GRAY
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INVESTIGATIVE REPORT TO JOINT COMMITTEE TO INVESTIGATE THE I-35W BRIDGE COLLAPSE

MAY 2008

INVESTIGATIVE REPORT

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Lives were shattered by the collapse of the I-35W Bridge. So, too, was confidence in the safety of Minnesota's bridges. The National Transportation Safety Board immediately began an investigation of the technical reason for the Bridge's collapse. Equally necessary, the Minnesota Legislature sought to determine whether the collapse might be related to a policy or practice that the Legislature could address and, by doing so, avert future tragedies.

The Legislature retained the law firm of Gray Plant Mooty to conduct an independent investigation on its behalf. Evidence was gathered through extensive document review and by interviewing current and former governors, transportation commissioners and Minnesota Department of Transportation ("MnDOT") employees as well as others with relevant knowledge. We drew six conclusions from our analysis of the evidence. Evidence illustrating these conclusions is presented in the form of nine Investigative Summaries.

We found that MnDOT sought to deal with its overall financial constraint in a generally responsible manner. However, on an operational level relating specifically to MnDOT's responsibility for the maintenance of the I-35W Bridge, we found that:

- MnDOT policies were not followed in critical respects;
- Decision-making responsibility was diffused and unclear;
- The flow of information was informal and incomplete;
- Expert advice was not effectively utilized;
- Financial consideration may have adversely influenced decision-making; and
- Organizational structure did not adequately address Bridge conditions and safety.

Our findings lay a basis for corrective action by the Legislature; particularly as it relates to bridges which are similar to the I-35W Bridge insofar as they are non-redundant and fracture critical, meaning that the entire bridge can collapse upon the failure of one critical element. The Report recommends various legislative avenues to address MnDOT's financial and organizational challenges; to strengthen the bridge inspection and maintenance process; and to ensure improved information flow regarding bridge deficiencies within the State and across the country.

BACKGROUND TO INVESTIGATION

A. The I-35W Bridge ("Bridge") Collapse.

The Bridge collapsed shortly after six p.m. on August 1, 2007. Thirteen people were killed. Another one hundred and forty-five were injured, many seriously. These casualties made it Minnesota's worst bridge accident, and one of the nation's as well.

The Bridge collapsed for no apparent reason. It had not been hit by a barge or other large object. The weather was clear and calm.[1] The Bridge was expected to stay in use for some number of years. A deck resurfacing project, underway when the Bridge collapsed, was intended to improve the Bridge's drivability. Yet one of Minnesota's busiest bridges, with 140,000 vehicles crossing it each day, had fallen into the Mississippi River within sight of downtown Minneapolis.

When a bridge collapses, so does public faith in government. It is therefore essential that the role of government in maintaining and replacing our infrastructure be subject to the most rigorous and objective scrutiny, not to ascribe blame but to proscribe future disasters. This is why the Minnesota Legislature chose Gray Plant Mooty ("GPM") to examine the condition, not of our roads and bridges, but of the Minnesota Department of Transportation ("MnDOT"), which oversaw the physical condition of the Bridge.

This is our report to the Legislature and to the public of what our investigation has found.

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[1] NTSB Interim Report, January 11, 2008, p. 15, *available at* http://www.dot.state.mn.us/i35wbridge/pdfs/ntsb_design_adequacy_report.pdf.

B. Legislative Response to Fulfill its Oversight Responsibility.

The Minnesota Legislature responded quickly to the public outcry. A Joint Committee to Investigate the Bridge Collapse ("Joint Committee") was appointed on August 14, 2007.[2] Its bipartisan membership consisted of sixteen legislators drawn equally from the Senate and House transportation committees. The Joint Committee's charge was to conduct a comprehensive review of all decisions made by MnDOT that might be relevant to the collapse of the Bridge. It was also charged with determining the extent to which other Minnesota bridges are on a course comparable to the Bridge and recommending improvements to the State's bridge maintenance and replacement program.

The Joint Committee concluded that it needed to hire special legal counsel to conduct a thorough and independent investigation. After a competitive process, the Committee retained the law firm of Gray Plant Mooty on December 19, 2007.[3] GPM was asked to report its findings to the Committee in May 2008.

C. Focus and Methodology of Gray Plant Mooty's Investigation.

A bridge does not plunge into the water beneath it for no reason. This is obviously true in light of engineering principles. But it may also be true in terms of public policy. Our investigation is concerned only about the latter; that is – as there are other bridges of a similar design and condition in Minnesota and across the country[4] – drawing from this horrific tragedy what the Minnesota Legislature might do to reduce the possibility of another bridge collapse. As

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[2] *See* Joint Committee homepage, *at* http://www.commissions.leg.state.mn.us/jbc/index.htm.
[3] December 19, 2007 contract between Gray Plant Mooty and the Joint Committee, *available at* http://www.commissions.leg.state.mn.us/jbc/Gray_Plant_Mooty_contract.pdf.
[4] March 12, 2008 National Transportation Board ("NTSB") Data Report re State-by-State Bridge Counts, *available at* http://www.ntsb.gov/dockets/highway/hwy07mh024/387871.pdf.

one former MnDOT Commissioner observed, the collapse of the Bridge should not be approached as an isolated event; rather, the collapse is more appropriately viewed as symptomatic of the problems of maintaining an aging infrastructure.

Gray Plant Mooty began its independent investigation in late December 2007 with the task to deliver a Report to the Joint Committee in May 2008. In January, we met informally with legislative staff, legislators, the Commissioner of Transportation and the Governor's staff. After these initial meetings, we began gathering and reviewing the information required for a complete Report. To that end, we made four separate written requests to MnDOT to produce documents, seeking with those requests over fifty different categories of information. In addition to these written requests, we made numerous verbal requests for documents during the interviews of MnDOT representatives. Our search for information was not confined to information from MnDOT; we also requested and received documents from consultants on the Bridge, the Office of the Governor, and many other third-party sources, including the Ohio Department of Transportation, and various engineering professionals. We also received a copy of the Office of the Legislative Auditor's ("OLA") public work file at the conclusion of the OLA investigation in February 2008. In total, we reviewed approximately 24,000 records, consisting of hundreds of thousands of pages.[5]

In addition to document review, Gray Plant Mooty attorneys interviewed many people with relevant knowledge. These interviews included thirty-three transcribed interviews of current MnDOT employees and representatives of the engineering firm, URS Corporation ("URS"), which had acted as a consultant to MnDOT in conducting a long term evaluation of the

[5] Accompanying our Report is a five volume Appendix ("App.") consisting of the complete transcripts of the recorded interviews as well as select relevant excerpts of the evidence we gathered.

Bridge.[6] We also conducted fourteen untranscribed interviews, including interviews of the current and former Governors and the current and former Commissioners of MnDOT, over the life of the Bridge, absent former Governor Ventura.[7]

Gray Plant Mooty focused its investigation on the following aspects of MnDOT's operations *relative to the Bridge collapse*:

- Information flow and decision-making;
- Organizational structure and staffing, including the use of consultants;
- Compliance with existing policies (and best practices) at critical junctures; and
- The influence of state and federal funding considerations.

The cause of the collapse of the Bridge is presently unknown. Although the National Traffic Safety Board ("NTSB") has issued an interim report, that investigation is not complete. Until it is, we do not know whether any of the concerns addressed in this Report are related to the actual cause of the collapse, or even a contributing cause. It should be clearly and explicitly understood: The Gray Plant Mooty investigation was **not** about determining the technical reason(s) for the Bridge's collapse. Nor was it about finding fault in any legal sense. And, it is only after the physical cause of the collapse is known that MnDOT's oversight of the Bridge can be completely evaluated.

Our investigation was also subject to a number of practical constraints. Although MnDOT was generally cooperative with our requests for production of documents, certain

[6] *See* MnDOT Interview Chart prepared by GPM, Addendum A to this Report. The transcribed interviews were taken before a certified court reporter. Transcripts were delivered to interviewees at the same time as provided to GPM. A number of interviewees thereafter submitted errata sheets. A MnDOT Data Practices lawyer sat in on each of the MnDOT interviews. In some instances, a MnDOT supervisor sat with an interviewee during the interviews. The transcripts are attached to this Report as Appendix ("App") Vol. I, Tabs 1-33.
[7] Former Governor Ventura was out of the country and not available for an interview until after the scheduled due date of this Report.

documents were withheld by MnDOT due to the Data Practices Act or other confidentiality concerns. It must be emphasized that despite MnDOT's production of thousands of documents, we are not at all certain that we received all the documents that MnDOT has relating to the Bridge. Indeed, MnDOT was still producing documents after the witness interviews were concluded.[8] Because of our need to finalize our report in anticipation of its presentation to the Joint Committee, we had only a limited ability to review documents that were produced after May 5, 2008. Further, due to the tight timelines and availability of witnesses, many of the interviews occurred prior to the production of relevant documents. For the same reasons, second or third interviews with relevant witnesses were not possible. Some MnDOT employees were not available due to death, illness or retirement. For a variety of reasons, we also were unable to conduct interviews with a number of other parties who might potentially possess relevant information, including Progressive Contractors, Inc., PB Americas, Inc. and Wiss, Janney, Elstner and Associates. Finally, due to the pending and confidential status of the NTSB investigation, we did not have access to certain MnDOT information that may have been informative on the issues addressed.

D. <u>Related Studies</u>.

As would be expected given the nature and magnitude of the Bridge collapse, other governmental bodies also took action. The NTSB had staff on the scene within hours. Charged with investigating bridge collapses across the country, the NTSB is now conducting the lengthy process of determining the technical reason or reasons for the Bridge's collapse. To date, its

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[8] For instance, in the afternoon of May 2, 2008, MnDOT produced a CD to GPM containing 3,500 e-mails relating to the Bridge. On May 9, 2008, MnDOT produced 2,274 pages of emails between MnDOT and URS and more than 500 internal MnDOT documents and emails. MnDOT produced additional documents on May 19, 2008.

investigation has led to an interim report detailing an apparent design flaw that was found in some of the gusset plates used on the Bridge.[9] The NTSB released the interim report to warn bridge owners across the country of a possible design flaw in the undersizing of gusset plates on bridges of a type similar to the Bridge. A final report is expected from the NTSB later this year.

In Minnesota, the Legislative Audit Commission requested that the OLA conduct an evaluation of the State highway and bridge program. The OLA's report evaluated the funding that is available and necessary in light of the condition of Minnesota bridges, but does not focus on the I-35W Bridge. This evaluation was completed and presented to the Legislature on February 19, 2008.[10]

MnDOT also sought explanations and assurances in the aftermath of the collapse. The engineering firm of Wiss, Janney, Elstner and Associates ("Wiss, Janney") was hired "to conduct an investigation to determine the cause of the collapse" and to participate in the NTSB investigation.[11] The Wiss Janney report will be issued after the NTSB's investigation is completed. MnDOT also retained PB Americas, Inc. ("PB Americas"), an engineering consulting firm, to assist in an emergency inspection of all bridges in the State.[12] The inspections were completed at the end of 2007. As a result of those inspections, MnDOT prepared a "critical deficiencies log" identifying seventeen Minnesota bridges with "critical

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[9] NTSB Interim Report, pp. 15-16.
[10] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, *available at* http://www.auditor.leg.state.mn.us/ped/pedrep/trunkhwy.pdf.
[11] September 13, 2007 contract between MnDOT and Wiss Janney, *available at* http://www.dot.state.mn.us/i35wbridge/contracts/wiss-janney/executed_contract.pdf.
[12] October 19, 2007 contract between MnDOT and PB Americas, *available at* http://www.dot.state.mn.us/i35wbridge/statewide_inspections/contracts/578617-v1.pdf.

deficiencies."[13] PB Americas is also studying MnDOT's bridge inspection program and will make recommendations for its improvement. This report is expected in May 2008.

MnDOT has already taken action on a number of other fronts since the Bridge collapse. These steps include revising its Bridge Design Manual to require independent peer review of major bridge designs, proposing increased staffing levels for its bridge inspection and maintenance responsibilities, and reviewing the adequacy of gusset plates on existing truss bridges.[14] In addition, in the last few months, MnDOT has closed the DeSoto Bridge in St. Cloud and closed lanes and placed weight restrictions on the Blatnik Bridge in Duluth.

Gray Plant Mooty's investigation is distinct from each of the studies mentioned above. The focus of our Report is unique in that it deals not with the physical conditions that caused the Bridge to collapse, but with MnDOT's oversight of that physical condition. Given that a number of the other studies are still ongoing, particularly the NTSB investigation, the findings in this report should be viewed as preliminary and subject to potential refinement once additional information is known.

CONTEXT FOR REPORT

The following detail provides basic information relating to MnDOT's organizational structure, transportation funding for major bridge repair and replacement, the fundamentals of bridge safety, and the history of the Bridge. This detail is intended to establish a framework for the Conclusions, Investigative Summaries and Recommendations which follow.

[13] MnDOT 2007 Inspections: Critical Findings, *available at* http://www.dot.state.mn.us/i35wbridge/statewide_inspections/2007cfreport_1.xls. Pursuant to MnDOT's policies, a "critical deficiency," in the context of a bridge inspection, refers to a defect that might cause severe damage to or collapse of a bridge. M. Pribula Transcript, pp. 16-17, App. Vol. I, Tab 25; T. Niemann Transcript, p. 16, App. Vol. I, Tab 18. GPM's investigation did not address whether any of the critical deficiencies had previously been noted by MnDOT.

[14] April 17, 2008 memorandum from D. Dorgan to Acting Commissioner Robert McFarlin, App. Vol. V, Tab 186.

A. MnDOT Organization and Operations.

1. History and Reputation.

MnDOT was created by the Legislature in 1976 to assume the responsibilities of the former Departments of Aeronautics and of Highways and the transportation-related responsibilities of the State Planning Agency and Public Service Department. In creating MnDOT, the Legislature determined that MnDOT would be the principal agency to develop, implement, administer, consolidate and coordinate state transportation policies, plans and programs.[15]

MnDOT is a large agency, with over 4,500 employees. The central administration, which encompasses the Offices of the Commissioner, the Deputy Commissioner and five Division Directors, is located in the Department of Transportation Building near the State Capitol.[16] Although the organizational structure at MnDOT has changed often, the centralized and regional components have remained relatively consistent. Currently, four of MnDOT's five divisions have a centralized nature and the fifth division, the Operations Division, operates through eight regional areas – seven Greater Minnesota district offices and the Minneapolis - St. Paul Metropolitan Area (the "Metro District"). Most of the day-to-day operations are managed at the district level, including maintenance, highway construction projects, and highway right-of-way issues.[17]

Historically, MnDOT has been recognized nationally and internationally as a leading Transportation Agency and a model for both the nation and other countries. MnDOT's work has

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[15] Minn. Stat. Ch. 174.
[16] Organization Chart for MnDOT as of August 1, 2007, Addendum B to this Report.
[17] *See* MnDOT website, *at* http://www.dot.state.mn.us/information/districts.html.

been recognized by numerous awards,[18] and, as reported by two former Commissioners, MnDOT was consulted by several European countries regarding best practices. With Minnesota's extreme and varying climate, the awards and recognition are significant accomplishments.

2. The Office of Bridges and Structures.

The Office of Bridges and Structures ("OBS," also referred to as "Central Bridge") operates within MnDOT's central administration under the Engineering Services Division, although the Central Bridge office is physically located in Oakdale, Minnesota.[19] Central Bridge considers itself, and is considered by the various districts to be, a service organization that provides technical expertise and assistance to the districts on bridge related issues.[20] The head of Central Bridge is the State Bridge Engineer.[21] Central Bridge is divided into four separate sections: bridge design, bridge planning and hydraulics, bridge construction and maintenance, and bridge standards, research and information resources. Central Bridge is in charge of retaining consultants to work on the design and study of the State's bridges, but construction contractors are usually retained through the individual districts.

3. Bridge Funding.

In order for work to occur on a bridge, there needs to be funding to do it. The availability of funding is a very complex matter. The following description touches on the bare essentials, relevant to the maintenance, repair and replacement of the Bridge.

[18] *See* List of 2006 Department of Transportation Awards, provided by Governor Pawlenty's office, App. Vol. V, Tab 187.
[19] Organization Chart for the Central Bridge Office as of August 1, 2007, Addendum B to this Report.
[20] D. Dorgan Transcript (February 29, 2008), p. 13, App. Vol. I, Tab 5.
[21] Daniel Dorgan has been the State Bridge Engineer from December 2000 to the present.

The Bridge was part of the Minnesota Trunk Highway System. For that reason, funds for its maintenance, repair or replacement needed to come from a limited number of revenue sources including various state taxes, federal highway aid and, in recent years, state bonding. Subject to both Minnesota constitutional and statutory provisions,[22] the Legislature appropriates this funding to MnDOT for two principal purposes: (1) maintenance of roads and bridges on the trunk highway system and (2) new construction, including expansion projects. MnDOT, in turn, allocates a certain share of the legislative appropriation to each of its eight districts, including the Metro District. The resultant transportation programming has been described as one of the most decentralized in the country.[23]

Within the Metro District, ordinary maintenance work on the Bridge (e.g., snowplowing and flushing) was done by MnDOT employees and paid for out of the District's annual maintenance budget. Larger or more involved projects were often out-sourced to private contractors who were paid through the District's Bridge Improvement Program ("BIP").[24] To become a part of the BIP, the project was by necessity of lower cost given an annual Metro District BIP budget of approximately $15 million.[25] Projects also needed to be identified four or five years in advance of the start date,[26] although there were exceptions made. For more costly repairs on the Bridge, the project needed to become a part of the Statewide Transportation Improvement Program ("STIP"), which meant it first needed to be proposed by the Metro District, then gain approval through the Metropolitan Council's review process and, finally, be submitted to MnDOT's central administration for further consideration before inclusion in the

[22] Minn. Const. Art. XIV, § 6; Minn. Stat. Ch. 161.04.
[23] A. McKenzie Transcript, p. 25, App. Vol. I, Tab 15.
[24] R. Schultz Transcript, pp. 27-29, App. Vol. I, Tab 27.
[25] R. Schultz Transcript, p. 31, App. Vol. I, Tab 27.
[26] R. Schultz Transcript, p. 29, App. Vol. I, Tab 27.

STIP.[27] The STIP operated over a three-year funding cycle until 2007; it is now a four-year cycle.[28]

The funding availability just described does not adequately provide for emergency repairs of a costly nature nor the major rehabilitation or replacement of what MnDOT refers to as the "Budget Buster" bridges, one of which was the I-35W Bridge.[29] All the "Budget Buster" bridges require replacement or major renovation because of "fracture critical issues and/or deterioration."[30] In each case, the costs involved exceed the district's funding capacity.

In response to this situation, MnDOT administrators began exploration of a new funding source for major bridge replacements. The result of their effort was a proposal for a Statewide Bridge Preservation Fund ("SBPF") which was given final approval by MnDOT's Transportation Program Committee in January 2006.[31] As approved, the SBPF provides 100% of the funds for replacing the bridge structure, with the MnDOT district paying all other costs associated with the project such as widening the approaches.[32] The SBPF was funded at $40 million per year.[33] The first bridge replacement contract under this program will be let in November 2009.[34] The SBPF, together with the Legislature's recent passage of a major transportation funding bill[35] will address many of the funding challenges associated with major bridge renovation and replacement, particularly to the extent that such projects can be safely

[27] A. McKenzie Transcript, pp. 24-25, App. Vol. I, Tab 15.
[28] A. McKenzie Transcript, p. 29, App. Vol. I, Tab 15.
[29] April 5, 2004 Report for Commissioner's Staff Meeting, App. Vol. V, Tab 213; A. McKenzie Transcript, pp. 73-74, App. Vol. I, Tab 15.
[30] April 5, 2004 Report for Commissioner's Staff Meeting, App. Vol. V, Tab 213.
[31] A. McKenzie Transcript, pp. 34, 42, App. Vol. I, Tab 15.
[32] A. McKenzie Transcript, pp. 48-52, App. Vol. I, Tab 15.
[33] K. Gray Transcript, p. 45, App. Vol. I, Tab 10.
[34] A. McKenzie Transcript. p. 37, App. Vol. I, Tab 15.
[35] L. Freese Transcript, pp. 46-49, Vol. I, Tab 8.

scheduled in advance. Large scale bridge renovation and replacement projects which need to be undertaken on an unscheduled, near-term basis still present a funding challenge.

Notwithstanding that the identified need for projects and services far exceed the level of available funding,[36] MnDOT staff were very clear that had there been an emergency requiring a bridge to be closed, they would have done so and found the money to repair or replace it.[37] They also asserted that the Department had consistently made the Governor and Legislature aware of its funding shortfall.[38]

B. Background to Bridge Safety.

A program of regular bridge inspections is critical to assuring the safety of bridges. Such a program necessarily includes inspections that are thorough and sufficiently frequent, performed by inspectors who are adequately trained and supervised. Inspection reports must be accurate and detailed, to allow decision makers who rely on the reports the ability to make appropriately informed decisions about bridge maintenance and replacement. There are various federal and state statutes and regulations, as well as MnDOT policies governing bridge inspection and inspection reports. As part of our investigation, we have surveyed the legal requirements and MnDOT policies, which are summarized below. However, as important is how those written requirements are implemented in practice. Certain aspects of MnDOT's actual practices will be discussed in further detail in connection with our Investigation Summaries below.

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[36] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, pp. 71-82.
[37] A. McKenzie Transcript, pp. 79-80, App. Vol. I, Tab 15.
[38] R. McFarlin Transcript, pp. 83-84, App. Vol. I, Tab 14.

1. Bridge Inspection Standards.

Inspection of bridges is governed both by federal and state law. The National Bridge Inspection Standards ("NBI Standards")[39] are a set of rules promulgated under federal law[40] that govern inspection and evaluation of all highway bridges in public roads.[41] The NBI Standards require, among other things, routine inspection of bridges at regular intervals not to exceed twenty-four months.[42] State transportation departments are directed to establish criteria for determining the level and frequency of inspection of fracture critical members of bridges,[43] taking into account such factors as age, traffic characteristics and known deficiencies.[44] The NBI Standards establish minimum qualifications for bridge inspection program managers and team leaders.[45] The NBI Standards also require states to assure that "systematic quality control (QC) and quality assurance (QA) procedures are used to maintain a high degree of accuracy and consistency in the inspection program."[46] Such procedures are required to "[i]nclude periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations."[47]

Minnesota law directs the Commissioner of Transportation to adopt rules prescribing standards for bridge inspection and inventory.[48] Rules adopted pursuant to this statutory requirement designate the Commissioner as the person with responsibility for inspection and

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[39] 23 C.F.R. Part 650, subp. C.
[40] *See* 23 U.S.C. § 151 (directing the Secretary of Transportation to "establish national bridge inspection standards for the proper safety inspection and evaluation of all highway bridges").
[41] 23 C.F.R. §§ 650.301 and 303.
[42] 23 C.F.R. § 650.311(a).
[43] A "fracture critical member" is a member of a bridge whose failure would result in the bridge's collapse. *See* Report Glossary, Addendum C to this Report.
[44] 23 C.F.R. § 650.311(c) (2).
[45] 23 C.F.R. § 650.309 (a) and (b).
[46] 23 C.F.R. § 650.313(g).
[47] 23 C.F.R. § 650.313(g).
[48] Minn. Stat. § 165.03, subd. 2(b).

inventory of bridges located within the right of way of a state trunk highway.[49] Those rules require that each bridge be inspected at least annually, unless a longer interval, not to exceed two years, is authorized by the Commissioner,[50] and further provide that "[t]he thoroughness of each inspection depends on such factors as age, traffic characteristics, state of maintenance, and known deficiencies. The evaluation of these factors is the responsibility of the engineer assigned the responsibility for the inspection."[51]

2. The Inspection Process.

The American Association of State Highway and Transportation Officials ("AASHTO") Manual for Condition Evaluation of Bridges (1994) ("AASHTO Bridge Inspection Manual") is incorporated by reference as part of the NBI Standards.[52] That Manual describes the purpose of bridge inspections:

> Bridge inspections are conducted to determine the physical and functional condition of the bridge, to form the basis for the evaluation and load rating of the bridge, as well as analysis of overload permit applications, to initiate maintenance actions, to provide a continuous record of bridge condition and rate of deterioration, and to establish priorities for repair and rehabilitation programs.[53]

MnDOT has adopted written policies and procedures that provide detail regarding bridge inspection requirements beyond the general prescriptions set out in the MnDOT rules. These include the MnDOT Bridge Inspection Manual,[54] Guidelines for In-Depth Inspection of Fracture

[49] Minn. R. part 8810.9300, subp. 1.
[50] Minn. R. part 8810.9400, subp. 1.
[51] Minn. R. part 8810.9400, supb. 1.
[52] 23 C.F.R. § 650.317.
[53] AASHTO Bridge Inspection Manual, p. 11.
[54] Minnesota Department of Transportation Bridge Inspection Manual)Version 1.3 – November 2006 ("MnDOT Bridge Inspection Manual"), App. Vol. II, Tab 43.

Critical Bridge and Underwater Inspections,[55] and policy regarding "critical deficiencies."[56] The MnDOT Bridge Inspection Manual describes the purposes of bridge inspection as follows:

> A bridge inspection includes examining the structure, evaluating the physical condition of the structure, and reporting the observations and evaluations on the bridge inspection report. Bridge inspection serve two purposes – to **ensure the safety** of the structure, and to **identify maintenance needs** for the structure.[57]

MnDOT Fracture Critical Inspection Guidelines apply to all bridges that have members determined to be fracture critical.[58] Those Guidelines make it the responsibility of OBS to, for all fracture critical bridges, maintain an in-depth inspection program, maintain information files on the bridges, and assure quality of third party or district inspections.[59] In-depth inspections of fracture critical bridges is the responsibility of OBS, although the responsibility for actually conducting those inspections is delegated to the MnDOT district office for bridges located in the Twin Cities metro and Rochester areas.[60] For inspections conducted by district personnel, Central Bridge inspectors provide assistance as requested by the districts, including assistance in performing nondestructive testing ("NDT") – specifically ultrasonic testing or "UT" – that the district inspectors are not qualified to perform.[61]

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[55] Minnesota Department of Transportation, Program Support Division, Technical Memorandum No. 02-22-0B-01 (September 23, 2002) ("MnDOT Fracture Critical Inspection Guidelines"), *superseded by* Technical Memorandum No. 07-10-B-02 (July 19, 2007), App. Vol. II, Tabs 42, 40.

[56] Minnesota Department of Transportation, Engineering Services Division, Technical Memorandum No. 05-02-B-02 (July 20, 2005) ("MnDOT Critical Deficiencies Policy"), superseded by Technical Memorandum No. 08-02-B-02 (February 26, 2008), App. Vol. II, Tab 41, App. Vol. V, Tab 188. MnDOT adopted its first critical deficiency policy in 2005 in response to a mandate from the Federal Highway Administration. T. Niemann Transcript, pp. 17-18, App. Vol. I, Tab 18.

[57] MnDOT Bridge Inspection Manual, p. 3 (emphasis in original), App. Vol. II, Tab 43.

[58] MnDOT Fracture Critical Inspection Guidelines, p. 2, App. Vol. II, Tab 40.

[59] MnDOT Fracture Critical Inspection Guidelines, p. 2, App. Vol. II, Tab 40.

[60] MnDOT Fracture Critical Inspection Guidelines, p. 2, App. Vol. II, Tab 40; T. Niemann Transcript, pp. 10-11, App. Vol. I, Tab 18.

[61] MnDOT Fracture Critical Bridge Inspection Guidelines, pp. 2-3, App. Vol. II, Tab 40; M. Pribula Transcript, p. 29, App. Vol. I, Tab 25.

3. Inspection Reports.

Bridge inspectors prepare inspection reports as a record of their observations during their inspections. There are two general types of reports: annual inspection reports, which are prepared for all bridges, and fracture critical inspection reports, which are prepared only for fracture critical bridges. The annual inspection reports, which are relatively short documents – typically four to six pages in length – assign numeric values to elements of a bridge that correspond to the condition of those elements and also may include some brief comments regarding conditions noted by the inspector. In 1995, MnDOT began using a type of software, called Pontis, to maintain data regarding bridge conditions, produce annual inspection reports, and report information to the federal government.

The annual inspection reports are described as having two purposes: bridge safety and maintenance.[62] Annual inspection reports prepared for bridges in the Metro District went to a senior Metro District engineer, who was responsible for reviewing the reports to assure that the condition ratings were consistent with the written comments[63] and for having the data from the inspection report entered into the Pontis system.[64] Data from these annual inspections is transmitted electronically to the Bridge Management Unit at Central Bridge, which is responsible for maintaining this information in an electronic database and reporting required information to the Federal Highway Administration ("FHWA").[65]

For fracture critical bridges, including the I-35W Bridge, the inspectors would prepare a separate fracture critical inspection report, in addition to the annual inspection report. The

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[62] R. Schultz Transcript, pp. 18-19, App. Vol. I, Tab 27; *see also* MnDOT Bridge Inspection Manual, p. 3, App. Vol. II, Tab 43.
[63] R. Schultz Transcript, pp. 17-18, App. Vol. I, Tab 27.
[64] R. Shultz Transcript, pp. 17-18, App. Vol. I, Tab 27.
[65] J. Pierce Transcript, pp. 9-10, App. Vol. I, Tab 21.

Fracture Critical Inspection Guidelines require the preparation of inspection reports reflecting the observations of conditions by the bridge inspectors:

> Detailed and narrative reports including sketches and photographs shall be provided to the OBS and the District Bridge Engineer upon completion of the inspection. Reports shall include such items as:
>
> Identification of FCMs [i.e., fracture critical members]
>
> Identification of areas visually inspected
>
> Description of areas NDT [i.e., non-destructive testing] inspected
>
> Amount of corrosion and associated field measurements of loss of section
>
> Description of fatigue prone areas
>
> Length and extent of cracking present, and
>
> Extent of external damage due to impact on external factors[66]

After the report has been completed, an electronic copy is provided to Central Bridge and paper and electronic copies are also maintained in the files of the Metro District.[67] MnDOT's Fracture Critical Inspection Guidelines provide that "Due to safety concerns with bridge fatigue issues the OBS will review all in-depth inspection reports."[68] Pursuant to MnDOT's policies, the fracture critical inspection reports are required to be reviewed by the Central Bridge Office Bridge Inspection Engineer who is to provide written comments on the report within thirty days

[66] MnDOT Fracture Critical Inspection Guidelines, p. 3, App. Vol. II, Tab 40.
[67] M. Pribula Transcript, pp. 54-55, App. Vol. I, Tab 25.
[68] MnDOT Fracture Critical Inspection Guidelines, Quality Assurance Plan, September 23, 2002, p. 2, App. Vol. II, Tab 63.

of receiving it.[69] The reports are also provided to the Central Bridge Regional Construction Engineer.[70]

4. Maintenance Follow-up.

Bridge maintenance and repair issues that rise to the level of a "critical deficiency," which is defined as a condition that might result in severe damage or collapse of the bridge,[71] are required by MnDOT policy to be addressed on an expedited basis.[72] When a bridge inspector identifies a critical deficiency, the inspector is to take any action necessary to ensure public safety, including, potentially, closing, or restricting traffic on the bridge.[73] Pursuant to MnDOT's critical deficiencies policy, critical deficiencies are reported immediately to the "District Engineer" and the Central Bridge Office Bridge Inspection Engineer.[74] The District Engineer is responsible for immediately assessing the situation to either confirm or refute the critical deficiency finding, initiating traffic restrictions necessary for protecting the public, and promptly scheduling necessary repairs.[75] The Central Bridge Office Bridge Inspection Engineer is required to monitor the situation to assure that corrective action is taken.[76]

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[69] It should be noted that the job titles reflected in MnDOT's policies do not directly correspond to the job titles reflected on MnDOT's organizational chart. The head of the OBS Bridge Inspections Unit has been responsible for performing the functions assigned to the OBS Bridge Inspection Engineer under MnDOT's Fracture Critical Inspection Guidelines.
[70] MnDOT Fracture Critical Inspection Guidelines, Quality Assurance Plan, p. 2, App. Vol. II, Tab 63.
[71] M. Pribula Transcript, pp. 16-17, App. Vol. I, Tab 25; T. Niemann Transcript, p. 16, App. Vol. I, Tab 18.
[72] MnDOT Critical Deficiencies Policy, pp. 3-4, App. Vol. II, Tab 41.
[73] MnDOT Critical Deficiencies Policy, p. 3, App. Vol. II, Tab 41.
[74] MnDOT Critical Deficiencies Policy, p. 2-3, App. Vol. II, Tab 41. The Critical Deficiencies Policy identifies a number of positions that might fill the role of the District Engineer for purposes of reporting of critical deficiencies. In the Metro District, critical deficiencies were reported to the Metro District Maintenance Engineer. M. Pribula Transcript, p. 17, App. Vol. I, Tab 25. *See also* T. Niemann Transcript, pp. 17-18, App. Vol. I, Tab 18 (describing MnDOT's informal critical deficiencies policy, which predated the adoption of the written policy, and MnDOT's implementation of a written critical deficiencies policy pursuant to the directive of the FHWA).
[75] MnDOT Critical Deficiencies Policy, pp. 3-4, App. Vol. II, Tab 41.
[76] MnDOT Critical Deficiencies Policy, p. 4, App. Vol. II, Tab 41.

There is no written policy setting forth a timeline for follow-up on maintenance and repair to address conditions that are not determined to be critical deficiencies. Similarly, there do not appear to be any guidelines for what conditions may trigger non-critical maintenance activities, nor does there appear to be any written policy or guidelines with respect to the responsibility for maintenance decisions. Based on the information provided in the annual inspection report, a Metro District bridge engineer decides, based on his judgment, whether to refer issues to the maintenance crew supervisor or, in the case of conditions requiring more substantial repair, whether to seek input from Central Bridge.[77] Others who may also be involved in these decisions include the Metro District engineer responsible for fracture critical inspections, the Metro District maintenance supervisor, and the maintenance crew supervisor.[78] The role of Central Bridge is to provide consultation and technical expertise to assist the Metro District in determining whether repair is necessary and, if so, how to perform the repair.[79] The ultimate decision of whether, when and how to repair a bridge remains with the District.

Maintenance and repair of bridges in the Metro District may be performed either by the Metro District maintenance crews or by a private contractor. As a general matter, smaller maintenance projects are handled by the Metro District maintenance crews and larger projects are "out-sourced," although there is no clear standard for determining which projects will be performed "in house" and which projects will be performed under a contract.

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[77] R. Schultz Transcript, pp. 4, 18-19, 22-23, App. Vol. I, Tab 27.
[78] M. Pribula Transcript, pp. 55-57, App. Vol. I, Tab 25.
[79] R. Schultz Transcript, pp. 22-23, App. Vol. I, Tab 27; M. Pribula Transcript, pp. 58-59, App. Vol. I, Tab 25.

5. Bridge Performance and Measurement Data.

As set forth more fully in the OLA's February 2008 Report, Central Bridge sets performance targets for the State's overall bridge conditions and measures the results on an annual basis.[80] On a statewide basis, the performance targets relating to bridges of a certain size (including the Bridge) require at least 55 percent of those bridges in good condition, less than 16 percent to be in fair or poor condition, and less than 2 percent to be in poor condition. MnDOT was generally able to meet its performance targets for its bridge inventory in recent years on a statewide basis, but, in the Metro District, the percentage of bridges in poor condition exceeded 6% in 2005.[81] MnDOT's performance measurement data for its bridges compares favorably to national standards.[82]

C. <u>Major Events in the Bridge's History.</u>

1. Design and Construction.

The Bridge was designed in 1964 by Sverdrup & Parcel. Applicable design standards at the time were those published by the American Association of State Highway Officials ("AASHO," which is the predecessor organization of AASHTO).[83] Construction began shortly thereafter, and the Bridge opened to traffic in 1967. The Bridge opened with six operating lanes and was expected to carry approximately 66,000 cars per day. The Bridge was 1907 feet long and had fourteen spans. The Bridge's primary component parts were the deck, the superstructure and the substructure.[84] As designed, the Bridge was considered fracture critical and non-

[80] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, pp. 32-38.
[81] Report for Commissioner's Staff Meeting, February 2005, p. 6, App. Vol. V, Tab 214.
[82] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, p. 34.
[83] American Association of State Highway Officials.
[84] Simple illustrations and pictures of the Bridge and glossary of bridge terms, Addenda C and D to this Report.

redundant, meaning a failure in any one fracture critical member of the Bridge could cause its entire collapse. MnDOT has not constructed a fracture critical bridge in recent years and there are no plans pending to construct one in the future.

In its preliminary report, the NTSB found that certain gusset plates on the Bridge were under designed, such that gusset plates that should have been one inch in thickness were designed to be only one-half inch thick.[85]

2. Major Modifications to the Bridge.

In addition to maintenance activities undertaken by MnDOT personnel, major modifications were made to the Bridge pursuant to "out-sourced" contracts. First, in 1977, the thickness of the concrete deck overlay was increased from six to eight inches and work was performed on the southbound entrance. Two additional lanes were also opened to traffic. The purpose of the 1977 work was to improve drivability, extend the service life of the bridge and obtain the lowest possible cost per year maintenance.[86] In 1998, further modifications were made to the Bridge, including the addition of a concrete center median, side barriers, drain systems, bird guards and painting.[87]

In addition, in 1998, MnDOT discovered cracks in the approach spans of the Bridge.[88] To mitigate the growth of the cracks and to prevent new cracks from forming, MnDOT applied steel plates to reinforce the cracked area and made further structural modifications to increase the flexibility of the Bridge. Beginning in 1999, work began to furnish and install a fully-automated

[85] NTSB Preliminary Report, p. 16.
[86] MnDOT Project Development Report and Location/Design Study Report, February 7, 1977, p. 1, App. Vol. V, Tab 189.
[87] MnDOT Preliminary Recommendations for Bridge Improvement, November 6, 1996, pp. 3-4, App. Vol. V, Tab 190.
[88] September 16, 1998 MnDOT internal memorandum, App. Vol. V, Tab 191.

de-icer on both roadways of the Bridge. The work was completed in 2000 and the de-icer was in place at the time of the collapse.

3. Inspection History.

The Bridge was inspected every two years until 1993 and then annually, thereafter. Inspections of the Bridge were generally performed by two two-person teams, with a team starting at each end of the bridge and working their way toward the middle.[89] Inspectors would prepare to inspect the Bridge by reviewing the fracture critical inspection report for the previous year and would take that report with them during the inspection in order to note any changed conditions.[90] Because the Metro District only has three bridge inspectors, the Metro inspectors would often be accompanied by inspectors from Central Bridge or employees from the Metro District maintenance crews.[91] An effort was made to rotate teams from year to year, so that an inspector would not be working with the same person or looking at the same parts of the bridge every year.[92] Inspections of the Bridge were typically conducted over the course of five to six days.[93] Inspectors accessed the superstructure of the bridge using "snooper trucks." Inspections were classified as either "in-depth," with the inspector getting within twenty four inches, or, in some instances, within "arm's length," of the members inspected, or "annual," which took place at a somewhat greater distance.[94]

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[89] M. Pribula Transcript, p. 25, App. Vol. I, Tab 25.
[90] M. Pribula Transcript, pp. 24-25, App. Vol. I, Tab 25.
[91] M. Pribula Transcript, pp. 12-13, App. Vol. I, Tab 25.
[92] M. Pribula Transcript, pp. 25-26, App. Vol. I, Tab 25.
[93] M. Pribula Transcript, p. 26, App. Vol. I, Tab 25.
[94] MnDOT Fracture Critical Inspection Guidelines, p. 3 (September 23, 2002), App. Vol. II, Tab 40 ("In-depth inspections shall be conducted using under-bridge inspection units (snoopers), man-lifts, boats, ladders or means necessary to visually inspect all FC members from a distance not to exceed 600 mm (24 inches)."); M. Pribula Transcript, pp. 48-49, App. Vol. I, Tab 25; 23 C.F.R. § 650.305 (definition of "in-depth inspection," "hands-on" inspection may be necessary at some locations); *see also* MnDOT Fracture Critical Inspection Guidelines, Quality

The primary method of inspection was visual, with some limited use of NDT; specifically, the use of magnetic particle testing which was used to help locate cracks. In addition, a ground penetrating radar survey was completed on the Bridge in 1999 to assess the soundness of the deck.[95] UT, which is a type of NDT that can be used to determine the extent of section loss of a steel member[96] – was only used once on the Bridge, in connection with a special inspection of approximately one-half of the Bridge that was performed by inspection personnel from Central Bridge in May of 2007.

Fracture critical inspection reports were prepared for the Bridge beginning in 1994 and annually thereafter. The reports were generally prepared approximately six months or more after the inspection took place, typically in the calendar year following the inspection. In most years, the report was written or co-written by one or two inspectors. The report was then given to the Metro District engineer responsible for fracture critical bridge inspections, who reviewed and edited the report[97] and, when it was final, certified the report in his capacity as a Registered Licensed Professional Engineer.

As described in greater detail below, the Bridge had a partial, limited purpose inspection in May 2007. The 2007 annual fracture critical inspection of the Bridge was not scheduled to occur until September 2007.

Assurance Plan, p. 2 (July 19, 2007) ("Fracture critical members must be inspected from an arms length distance every 24 months."). App. Vol. II, Tab. 40.

[95] MnDOT Meeting Minutes, April 3, 2006, pp. 5-6, App. Vol. III, Tab 125.

[96] B. Nelson Transcript, pp. 13-14, App. Vol. I, Tab 17.

[97] The exception was the 2004 fracture critical inspection report, which was both written and reviewed by the Bridge Safety Inspection Engineer.

4. Outside Expert Analysis of the Bridge.

Fatigue, as well as the Bridge's non-redundant design, were issues of on-going concern and study. Outside experts were retained by MnDOT to evaluate fatigue and potential methods to add redundancy to the Bridge. "Fatigue" describes the tendency of a material to break when subjected to repeated loading.[98] "Redundancy" refers to the capacity of a bridge superstructure to continue to carry loads after the failure of one of its members.[99]

a. The University of Minnesota.

MnDOT retained the University of Minnesota (the "University") to perform a fatigue evaluation of the deck truss of the Bridge beginning in 1999. The purpose of the University study was to (1) characterize the actual statistical distribution of the stress ranges; (2) evaluate the potential for fatigue cracking in the deck truss, and estimate the remaining life if fatigue cracking was a potential and (3) recommend increased inspection or retrofitting, if necessary.[100] The University issued its Report to MnDOT in March 2001. The University Report concluded that fatigue cracking was not expected during the remaining useful life of the Bridge.[101] Notwithstanding this conclusion, the University recommended that certain members of the main truss and floor trusses have frequent inspection.[102]

b. HNTB Corporation.

In late 1998 or early 1999, Central Bridge began conversations with the HNTB Corporation ("HNTB"), a consultant with whom MnDOT had previously worked on other

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[98] *See* Report Glossary, Addendum C.
[99] *See* Report Glossary, Addendum C.
[100] University of Minnesota Fatigue Evaluation of The Deck Truss of Bridge 9340 Final Report, March 2001, p. 5, App. Vol. V, Tab 192.
[101] University of Minnesota Fatigue Evaluation of The Deck Truss of Bridge 9340 Final Report, March 2001, Executive Summary, p. xi, App. Vol. V, Tab 192.
[102] University of Minnesota Fatigue Evaluation of The Deck Truss of Bridge 9340 Final Report, March 2001, p. 79, App. Vol. V, Tab 192.

projects, about various alternatives that might be used to add redundancy to the Bridge.[103] Even with an infinite fatigue life, adding redundancy was identified by MnDOT's State Bridge Engineer, as an important safety factor for the Bridge.[104] By March 1999, HNTB had developed various conceptual scenarios for MnDOT, the purposes of which were to add redundancy features to the Bridge.[105] HNTB continued to discuss these scenarios with MnDOT, and in May 2000, HNTB delivered to MnDOT a set of proposed tasks to evaluate and increase the redundancy of the Bridge.[106] Although HNTB had not been hired by MnDOT for this project, HNTB continued to discuss these proposals with MnDOT, as discussed in more detail in connection with Investigative Summary No. 7, below. In October 2001, HNTB submitted a proposal to MnDOT for further study and work on the Bridge.[107] MnDOT chose not to proceed with HNTB. Instead, MnDOT prepared a Request for Interest ("RFI") which it sent to interested consultants in March 2003.[108] HNTB responded to the RFI, but was not chosen for the work.[109]

c. URS Corporation.

URS also responded to the RFI.[110] Don Flemming, MnDOT's State Bridge Engineer from 1986 to December 2000, and former head of Central Bridge, was, by then, working for URS and a primary contact for MnDOT. URS was chosen by MnDOT to do the tasks solicited in the RFI, the primary objectives of which were: (1) to identify the main superstructure

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[103] D. Flemming Transcript, p. 48, App. Vol. I, Tab 30; HNTB Schematics (March 1999), App. Vol. III, Tab 112; HNTB email (May 9, 2008), App. Vol. V, Tab 218.
[104] D. Flemming Transcript, p. 53, App. Vol. I, Tab 30.
[105] HNTB Schematics (March 1999), App. Vol. III, Tab 112; D. Dorgan Transcript (April 22, 2008), pp. 24-27, App. Vol. I, Tab 5; G. Peterson Transcript, pp. 38-40, App. Vol. I, Tab 20.
[106] HNTB Proposed Tasks Memorandum, May 2000, App. Vol. III, Tab 111; D. Dorgan Transcript (April 22, 2008), pp. 22-23, App. Vol. I, Tab 5; G. Peterson Transcript, pp. 35-37, App. Vol. I, Tab 20.
[107] HNTB Proposal, October 2001, App. Vol. III, Tab 114; D. Dorgan Transcript (April 22, 2008), p. 27, App. Vol. I, Tab 5; G. Peterson Transcript, pp. 41-43, App. Vol. I, Tab 20.
[108] MnDOT Request for Interest ("RFI"), March 7, 2003, App. Vol. V, Tab 193.
[109] HNTB Response to RFI, March 28, 2003, App. Vol. V, Tab 194.
[110] URS Response to RFI, March 28, 2003, App. Vol. V, Tab 195.

members of the truss-arch spans that were most susceptible to fatigue cracking and to evaluate the structural consequences should one of those members fail; (2) determine repair methods for fatigue cracks; and (3) identify preferred staging of deck replacement to minimize stresses in the Bridge.[111]

URS's work on the Bridge was covered by two separate contracts. First, in June 2003, URS accompanied the MnDOT inspection crew on their annual inspection of the Bridge "to assess the existing structural condition of key superstructure components."[112] At the conclusion of this exercise, URS produced a preliminary Inspection Report for MnDOT.[113] Next, in December 2003, URS and MnDOT signed the second contract, which covered the performance of the work contemplated by the RFI.[114]

URS began its work on the second, larger contract in January 2004. The contract contemplated that MnDOT would pay URS $486,722.72 for its work and that URS would have its final report to MnDOT by May 2005.[115] The project completion date was extended several times, arising in part from the unique complexity of the project.[116] As a result, numerous amendments were executed, and URS's compensation rose to $635,840.69.[117] URS issued its preliminary draft report to MnDOT in July 2006.[118] As set forth more fully in connection with Investigation Summary No. 7, URS and MnDOT discussed the draft report leading to additional

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[111] MnDOT RFI, March 7, 2003, App. Vol. V, Tab 193.
[112] Professional and Technical Services Contract, Mn/DOT Agreement No. 85169 (May 29, 2003), App. Vol. V, Tab 196; *see also* E. Zhou Transcript, pp. 12-13, Vol. I, Tab 33; D. Flemming Transcript pp. 63-64, App. Vol. I, Tab 30; D. Dorgan Transcript (April 22, 2008) at pp. 38-39, App. Vol. I, Tab 5.
[113] URS Initial Inspection Report For: Fatigue Evaluation Bridge 9340 35W Over Mississippi River, June 9-13, 2003, App. Vol. V, Tab 197.
[114] December 2003 contract between MnDOT and URS ("MnDOT/URS Contract"), App. Vol. V, Tab 198.
[115] MnDOT/URS Contract, App. Vol. V, Tab 198.
[116] B. McElwain Transcript, pp. 13-14, App. Vol. I, Tab 32; E. Zhou Transcript pp. 23-24, App. Vol. I, Tab 33.
[117] *See* July 12, 2004 amendment to MnDOT/URS Contract; November 4, 2005 amendment to MnDOT/URS Contract; April 13, 2006 amendment to MnDOT/URS Contract; October 9, 2006 amendment to MnDOT/URS Contract and April 5, 2007 amendment to MnDOT/URS Contract, App. Vol. V, Tab 199.
[118] URS Draft Report: Fatigue Evaluation and Redundancy Analysis Bridge No. 9340 I-35W Over Mississippi River, July 2006, App. Vol. V, Tab 200.

analysis by URS and a revised preliminary draft report in December 2006. URS never issued its final report to MnDOT. URS representatives were working on the final report up to and including the day of the Bridge collapse.[119]

5. Work on the Bridge in the Summer of 2007.

In June, 2007, MnDOT began work on the Bridge to remove and replace the two-inch concrete overlay on the Bridge deck (the "2007 Overlay Project"). The 2007 Overlay Project was part of a larger rehabilitation of a stretch of I-35W, running from I-94 to Stinson Boulevard in Minneapolis. The 2007 Overlay Project was a joint effort: Design for the roadway work emanated from the Metro design unit, located in Roseville; design for the Bridge Overlay Project emanated from the Central Bridge design unit, located in Oakdale; and the construction for the entire rehabilitation project, including the 2007 Overlay Project, was managed by a Metro District construction office located in Mendota Heights.[120] The actual work was performed by the outside contractor, PCI. The Overlay Project began in June 2007, and was on-going at the time of the Bridge collapse.

CONCLUSIONS AND INVESTIGATIVE SUMMARIES

Our investigation lead to six conclusions relating to bridge safety. Each conclusion is set out below with an explanatory comment. Next, Investigative Summaries are set out detailing situations that illustrate our six general conclusions.

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[119] August 1, 2007, 3:34 p.m. email from B. McElwain to E. Zhou, App. Vol. V, Tab 201.
[120] A. Ottman Transcript, pp. 25, 62-63 App. Vol. I, Tab 19; J. Adams Transcript, p. 30, App. Vol. I, Tab 1.

A. Conclusions.

1. MnDOT policies were not followed in critical respects.

Inspecting a bridge the size and complexity of the Bridge is a difficult assignment, one requiring much skill and dedication. It is also an assignment of the highest importance. Human lives are at stake. Two responsibilities are critical: an inspector must record his or her observations with specificity and, correspondingly, the action taken in response to the inspector's findings must be prompt, appropriate and documented. MnDOT now has these responsibilities under review. Our investigation uncovered reasons for MnDOT to conduct this review with a sense of urgency. *See* for example, Investigative Summaries 1, 2 and 5.

2. Decision-making responsibility within MnDOT was diffused and unclear.

Primary responsibility for inspecting, maintaining, repairing and replacing the Bridge rested with MnDOT's Metro District. Bridge expertise on the other hand, resided primarily within the Central Bridge Office. Responsibility for decision-making both within the Metro District and between Metro and the Central Bridge Office, was often unclear to the individuals involved. This was compounded by lack of clarity in the process to bring major projects forward in order to explore funding options. *See* for example, Investigative Summaries 3, 4 and 7.

3. Financial considerations may have adversely influenced decision-making.

Both current and former MnDOT employees universally expressed the view that the Department would not allow the condition of a bridge to jeopardize the safety of the public; when a high risk situation becomes known, MnDOT will remove that risk without regard to cost or other implications. We found no reason to challenge the veracity of this assertion with regard to a clear and immediate danger. We did find instances, however, where cost was a factor in determining courses of action with respect to the Bridge at points in time when immediate risk was not obvious. One reason for this is that the programming and funding process for MnDOT construction projects is one of the most decentralized in the nation. This may have certain advantages, but it substantially limits the amount of funding realistically available for a major project or significant, unexpected repairs. This limitation made orphans of the so-called "budget buster" bridges. *See* for example, Investigative Summaries 7 and 8.

4. The flow of information regarding the condition and safety of the Bridge was informal and incomplete.

MnDOT operates largely as an oral culture. As is true for many large institutions, it is also highly compartmentalized. The result is that written documentation is lacking in some critical areas and important information did not always reach consultants or the appropriate parties within MnDOT. This situation was exacerbated by the departure of professional staff, particularly senior engineers. When substantial loss of employees occurs in a primarily oral culture, institutional memory suffers. Insufficient attention was given to correcting incomplete information, even in instances where it was contrary to MnDOT policies. *See* for example, Investigative Summaries 1, 2, 6 and 9.

5. Expert advice regarding the condition and safety of the Bridge was not effectively utilized.

Consultants and private construction contractors play a large and important role in the Department's day-to-day operations. Properly utilizing their services is key to an effective and efficient MnDOT. To be successful, there needs to be clarity and consistency in the direction given – and advice taken. Our investigation found instances where improvement is both possible and desirable. *See* Investigative Summaries 3, 7 and 9.

6. Organizational structure did not adequately address bridge condition and safety.

MnDOT's organizational structure has evolved over time. For example, the relationship between MnDOT's central office and the Districts is different now than in the past. So, too, is the organizational hierarchy within the central office. Perhaps more than in any previous period, the Department has recently faced two immense challenges: rehabilitating or replacing the existing transportation infrastructure, including the budget buster bridges while responding to the intensely expressed need for new construction and expansion. MnDOT's organizational structure does not always measure up to these two competing challenges. For example, *see* Investigative Summaries 3, 7 and 8 and the Observations About MnDOT's Leadership and Organization.

B. Investigative Summaries.

The following nine Investigative Summaries describe the evidence we have found that requires improvements in procedures and practices bearing on bridge safety.

1. MnDOT did not follow its own policies with respect to documenting the deteriorating condition of the Bridge.

Regular inspection reports of fracture critical bridges are required by both federal and state law. Such reports are the primary source of information about the condition of a fracture critical bridge, which information forms the basis for important decisions regarding the need for maintenance, repair, and replacement of a bridge. For this reason, it is important that the persons responsible for making these decisions be able to rely on the inspection reports as a complete and accurate reflection of a bridge's condition. There is no question that steel bridges corrode and deteriorate over time. Although such deterioration typically occurs slowly, there were conditions on the Bridge, such as leaking joints, that may have accelerated this deterioration.[121] Further, if gradual deterioration contributes to the failure of a fracture critical member and, if that occurs, the ultimate deterioration happens instantaneously in the form of a sag or collapse.[122] For this reason, AASHTO standards require that bridge inspection reports accurately and adequately describe the existence of the deterioration observed so that the rate of deterioration can be determined.[123]

Corrosion can reduce the structural capacity of steel bridge members by reducing the thickness of the member (i.e., "section loss").[124] Corrosion may also be present in the form of "pack rust," which is rust that forms between two adjacent steel surfaces that causes those surfaces to push apart as the oxidized steel expands.[125] Pack rust typically indicates the presence of section loss.[126] Rust is a progressive condition, in that, unless arrested by cleaning and

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[121] V. Desens Transcript, pp. 44-46, App. Vol. I, Tab 3. Mr. Desens has been a bridge inspector for MNDOT since 1982, but is not an engineer.

[122] *See e.g.,* Arthur A. Huckelbridge Jr., Dean A. Palmer and Richard E. Snyder, *Grand Gusset Failure*, CIVIL ENGINEERING, September 1997, *available at* http://cedb.asce.org/cgi/WWWdisplay.cgi?9706002.

[123] AASHTO Bridge Inspection Manual, p. 11.

[124] T. Niemann Transcript, p. 39, App. Vol. I, Tab 18; K. Fuhrman Transcript, p. 86, App. Vol. I, Tab 9; *see also* Bridge Inspector's Reference Manual, Federal Highway Administration (October 2002, revised December 2006), p. 2.3.21, *available at* http://www.nhi.fhwa.dot.gov/downloads/freebees/10/RM%20Reference%20Manual%202006.pdf:

> Corrosion, which could reduce structural capacity through a decrease in member section and make the member less resistant to both repetitive and static stress conditions: since rust continually flakes off of a member, severity of corrosion cannot always be determined by the amount of rust; therefore, corroded members must be examined by physical as well as visual means.

[125] MnDOT Bridge Inspection Manual, p. 63, App. Vol. II, Tab 43; K. Fuhrman Transcript, pp. 55-56, App. Vol. I, Tab 9.

[126] MnDOT Bridge Inspection Manual, p. 63, App. Vol. II, Tab 43.

repainting, it can be expected to grow worse over time. This progression may be hastened if water drips through the deck to the steel superstructure elements below.[127]

The AASHTO Bridge Inspection Manual includes a discussion of inspection of a steel bridge for corrosion and section loss:

> Structural steel members should be inspected for loss of section due to rust. Where a build-up of rust scale is present, a visual observation usually is not sufficient to evaluate section loss. Hand scrape areas of rust scale to base metal and measure remaining section using calipers, ultrasonic thickness meters, or other appropriate method. Sufficient measurements should be taken to allow the evaluation of the effect of the losses on member capacity.[128]

MnDOT's policies relating to bridge inspections specifically require a quantification of corrosion and section loss. Thus, the Fracture Critical Inspection Guidelines provide that fracture critical inspection reports "shall include such items as . . . amount of corrosion and associated field measurements of loss of section."[129] The MnDOT Bridge Inspection Manual requires, when section loss is observed by an inspector, the assignment of a numeric value in the annual report based on the percentage of section loss.[130]

MnDOT did not follow its policies regarding the quantification of section loss in fracture critical bridge inspection reports for the Bridge. The 1993 annual report for the Bridge (the year before the first fracture critical report for the Bridge) did quantify section loss by noting that: "Downstream truss at L11 inside gusset plate has loss of section 18" long and up to 3/16" deep (Original thickness = ½")" and "Downstream truss at L13 the lower horiz. brace between the trusses has 3/16" section loss at rivited [sic] angle."[131] Although MnDOT bridge inspection personnel state that the inspection reports are intended to be a historical record of the condition

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[127] V. Desens Transcript, pp. 44-46, App. Vol. I, Tab 3.
[128] AASHTO Bridge Inspection Manual, p. 21.
[129] MnDOT Fracture Critical Inspection Guidelines, p. 3, App. Vol. II, Tab 40.
[130] MnDOT Bridge Inspection Manual, p. 70, App. Vol. II, Tab 43.
[131] Bridge 9340 Bridge Inspection Report, October 18, 1993, p. 5, App. Vol. IV, Tab 159.

of the Bridge, resulting in the same comments often appearing in reports from year to year,[132] this same quantification of section loss as appeared in the 1993 report, was not carried over to reports for subsequent years. Instead, the 1994 fracture critical report notes, at this same location, "Section loss at gusset plate, bottom chord, truss #2."[133] The report does not quantify the amount of section loss observed as required by MnDOT's policies. This same notation is found in fracture critical inspection reports in subsequent years.[134]

The fracture critical inspection reports prepared for the Bridge did not typically quantify corrosion and section loss. Thus, reports include the following notations of section loss, without any quantification of the extent of the loss:

- Panel Point 13: Section loss at gusset plate, bottom chord (1994, 1995, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006);[135]

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[132] V. Desens Transcript, pp. 59-60, App. Vol. I, Tab 3; *see also* OLA Report at p. 58.
[133] 1994 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 4, App. Vol. IV, Tab 161.
[134] 1995 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 5, App. Vol. IV, Tab 163; 1997 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 7, App. Vol. IV, Tab 167; 1998 Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 169; 1999 Annual and In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 14, App. Vol. IV, Tab 171; 2000 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 16, App. Vol. IV, Tab 173; 2001 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 17, App. Vol. IV, Tab 175; 2002 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 22, App. Vol. IV, Tab 177; 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 23, App. Vol. IV, Tab 179; 2004 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 22, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 21, App. Vol. IV, Tab 183; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 23, App. Vol. IV, Tab 185. The 1996 fracture critical report is in a format that is different from the other fracture critical inspection reports for the Bridge that does not provide the same level of detailed description of the condition of individual members.
[135] 1994 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 5, App. Vol. IV, Tab 161; 1995 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 163; 1997 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 7, App. Vol. IV, Tab 167; 1998 Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 168; 1999 Annual and In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 14, App. Vol. IV, Tab 171; 2000 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 17, App. Vol. IV, Tab 173; 2001 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 18, App. Vol. IV, Tab 175; 2002 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 22, App. Vol. IV, Tab 177; 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 23, App. Vol. IV, Tab 169; 2004 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 23, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 23, App. Vol. IV, Tab 182; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 24, App. Vol. IV, Tab 185.

- Panel Point 9': Section loss at truss bottom chord/sway frame connection (2003, 2004, 2005, 2006);[136]

- Panel Point 14: Stringer #11 has section loss, flaking rust near joint from gland pulled out above (2003, 2004, 2005, 2006);[137]

- Panel Point 14: Reversible diagonal member U14/L13 has section loss with severe flaking rust (2006);[138]

- Panel Point 8': Floorbeam truss has section loss, moderate flaking rust (2003),[139] truss bottom chord/sway frame connection (gusset plates) has section loss, heavy flaking rust (2004, 2005, 2006).[140]

The evidence regarding the extent of corrosion on the Bridge is not clear. Although the fracture critical inspection reports note section loss at a number of locations, the report from a limited field inspection performed by URS in June 2003 in preparation for its consulting work found that the truss members were in relatively good condition from a corrosion standpoint[141] and that there was no significant section loss due to corrosion.[142] It should be noted that this inspection was not intended to be a full-blown fracture critical inspection, but rather, was described as a limited inspection.

Although MnDOT's Fracture Critical Bridge Inspection Guidelines require that the inspection reports quantify section loss, two of the Metro District inspectors who wrote the

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[136] 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 30, App. Vol. IV, Tab 179; 2004 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 34, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 35, App. Vol. IV, Tab 183; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 37, App. Vol. IV, Tab 185.

[137] 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 31, App. Vol. IV, Tab 179; 2004 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 36, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 36, App. Vol. IV, Tab 183; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 35, App. Vol. IV, Tab 185. Although section loss is first noted at this location in the 2003 fracture critical report, the note itself indicates that the condition was first observed at this location in 1994.

[138] 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 35, App. Vol. IV, Tab 185.

[139] 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 23, App. Vol. IV, Tab 179.

[140] 2004 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 34, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 34, App. Vol. IV, Tab 183; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 37, App. Vol. IV, Tab 185.

[141] Initial Inspection Report for Fatigue Evaluation, Bridge 9340 at p. 1, App. Vol. II, Tab 68.

[142] E. Zhou Transcript, pp. 35-36, App. Vol. I, Tab 33.

inspection reports for the Bridge stated that they had not previously seen a written copy of these Guidelines.[143] A bridge inspector who has been involved in performing fracture critical inspections of the Bridge since 2001[144] stated that section loss might be measured using either ultrasonic testing or by placing a straight-edge on the member affected by the section loss, but that neither of these methods were, to his knowledge, ever used in inspecting the Bridge.[145] Although the fracture critical inspection reports were reviewed and approved by the inspectors' supervisor, the Metro Fracture Critical Bridge Inspection Engineer, this issue was never raised.[146] Further, although, pursuant to MnDOT's policies, the Central Bridge Office Bridge Inspection Engineer was to review and comment on these inspection reports, the Central Bridge Office Bridge Inspection Engineer stated that he did not understand that it was his responsibility to review the reports that were prepared by the Metro District[147] and that lines of responsibility and authority between the Metro District and Central Bridge were unclear.[148] The Central Bridge Office Bridge Inspection Engineer further states that he "assumes" that he would have read the executive summary for fracture critical reports for the Bridge but also states that he "probably" would not have read the whole report.[149] The Central Bridge Office Bridge Construction and Maintenance Engineer, who was responsible for supervising the Central Bridge Office Bridge Inspection Engineer, states that he did not know whether the Bridge Inspection Engineer was reviewing the inspection reports for the Bridge.[150]

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[143] K. Fuhrman Transcript, pp. 39-49, App. Vol. I, Tab 9; V. Desens Transcript, p. 9, App. Vol. I, Tab 3.
[144] V. Desens Transcript, p. 6, App. Vol. I, Tab 3.
[145] V. Desens Transcript. pp. 12-14, App. Vol. I, Tab 3.
[146] V. Desens Transcript, pp. 38-39, App. Vol. I, Tab 3.
[147] T. Niemann Transcript, pp. 14-15, 65-66, App. Vol. I, Tab 18.
[148] T. Niemann Transcript, pp. 65-66, App. Vol. I, Tab 18.
[149] T. Niemann Transcript, pp. 42-43, App. Vol. I, Tab 18.
[150] G. Peterson Transcript, p. 12, App. Vol. I, Tab 18.

There are conflicting views regarding the significance of the measurement of section loss reflected in the 1993 annual report for the Bridge. Although one of the non-engineer inspectors believed that the amount of section loss described in the 1993 report was a cause for concern,[151] the State Bridge Engineer, although stating that the location where the loss was identified was "significant,"[152] described the amount of section loss as "small, fairly insignificant amount" when taking into consideration the size of the gusset plate where the section loss was identified.[153] The State Bridge Engineer quantified the amount of section loss reflected in the 1993 inspection report as about 5% (subsequently stated by the State Bridge Engineer to be "something less than 6.6% at that time").[154] MnDOT's Bridge Inspection Manual describes section loss of 2% to 5% of the total cross-section area of a member as "moderate" and not sufficiently severe to warrant structural analysis.[155] Section loss of 5% to 10% is characterized by the Bridge Inspection Manual as significant.[156] In the case of section loss greater than 10% of the total cross-section area of a primary steel bridge element, the MnDOT Bridge Inspection Manual states that the load-carrying capacity of the member has been significantly reduced and that a structural analysis or immediate repairs may be required.[157]

Notwithstanding MnDOT's written policies regarding measurement of section loss, the State Bridge Engineer indicated that it was his view that whether to measure and quantify section loss was a matter of an individual inspectors' judgment about whether the extent of the loss was "significant."[158] The Central Bridge Office Bridge Construction and Maintenance Engineer

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[151] V. Desens Transcript, p. 28, App. Vol. I, Tab 18.
[152] D. Dorgan Transcript (April 22, 2008), p. 90, App. Vol. I, Tab 5.
[153] D. Dorgan Transcript (April 22, 2008), pp. 84-85, App. Vol. I, Tab 5.
[154] May 5, 2008 correspondence from D. Dorgan to R. Stein, App. Vol. V, Tab 202.
[155] MnDOT Bridge Inspection Manual, p. 70, App. Vol. II, Tab 43.
[156] MnDOT Bridge Inspection Manual, p. 70, App. Vol. II, Tab 43.
[157] MnDOT Bridge Inspection Manual, p. 66, App. Vol. II, Tab 43.
[158] D. Dorgan Transcript (April 22, 2008), pp. 16-18, App. Vol. I, Tab 5.

testified that he was unaware of any guidelines on when section loss becomes significant.[159] However, whether the amount of loss is considered to be significant or insignificant, there is no documentation of how that loss may have progressed if it progressed at all, in the more than 13 years since the 1993 report because subsequent reports do not provide any quantification.

There are other reasons to be concerned that the inspection reports may not have accurately reflected the condition of the Bridge at the time the report was prepared. Fracture critical reports for the Bridge would typically include pictures of certain of the conditions that are described in the narrative of the report. The 2006 fracture critical inspection report includes pictures that indicate that they were taken in 2004.[160] When asked about this situation, the State Bridge Engineer suggested that, although "one could" take new pictures at the time of an inspection, there might be no need if the condition remained unchanged.[161] Again, without current pictures, a person relying on this report would have little basis for concluding that the condition of the bridge had or had not changed and there is a lack of a complete documentary record regarding the current condition of the Bridge as of the time the inspection was performed. This is made even more problematic by the fact that there may be a lag of as many as six months between the inspection and the preparation of the inspection report, which raises concerns that fading memories may adversely affect the amount of detail that the report provides, particular in the absence of either specific measurements or current photographs.

While the fracture critical inspection reports reflect the advancing deterioration of the Bridge, they fail to quantify that deterioration in important respects.[162] In light of the important

[159] G. Peterson Transcript, p. 67, App. Vol. I, Tab 20.
[160] *See* 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 24, App. Vol. IV, Tab 185.
[161] D. Dorgan Transcript (April 22, 2008), pp. 110-111, App. Vol. I, Tab 5.
[162] *See e.g.*, 2006 In-Depth Fracture Critical Inspection Report for Bridge No. 9340, p. 25 (description of deteriorating conditions at Panel Point #14 and Panel Point #13'), p. 28 (description of deteriorating conditions at

role of the fracture critical inspection reports, it is important for MnDOT to have clear policies regarding the contents of those reports. It is just as important, however, for those policies to be followed. Recognizing that bridge inspectors properly exercise considerable professional judgment in performing their responsibilities, that judgment cannot be allowed to supersede MnDOT's written policies or the policies become meaningless. MnDOT's policies require quantification of deterioration in a manner consistent with standards issued by AASHTO. MnDOT's policies were not followed by the bridge inspectors, however, and that failure was not identified either by the inspectors' immediate supervisor or by the person at Central Bridge who was ultimately responsible for reviewing the reports to assure their completeness. *See* Conclusions 1 and 4.

2. MnDOT did not adequately document the timely follow-up on inspection report findings.

As discussed above, issues identified during an inspection that are determined to be "critical findings" are addressed pursuant to MnDOT's policies regarding critical findings.[163] Those policies call for documented follow-up to resolve such issues within specified timeframes.[164] There is, however, apparently no written policy governing follow-up on maintenance issues that do not rise to the level of critical findings.

The OLA noted the lack of standard processes at MnDOT for communicating maintenance recommendations from bridge inspectors and for documenting decisions on

Panel Point #2'), p. 34 (description of deteriorating conditions at Panel Point #13), p. 35 (description of deteriorating conditions at Panel Point #14), App. Vol. IV, Tab 185.
[163] MnDOT Critical Deficiencies Policy, pp. 2-3, App. Vol. II, Tab 41.
[164] MnDOT Critical Deficiencies Policy, pp. 3-4, App. Vol. II, Tab 41.

maintenance work to be performed.[165] Our investigation also found this to be the case. Although the bridge inspection reports are considered by MnDOT to be the basis for bridge maintenance decisions, there does not appear to have been any direct link between the observations reflected in the fracture critical inspection reports on the Bridge and maintenance and repair activities. The maintenance supervisor who was responsible for directing the maintenance performed on the Bridge by the Metro District maintenance crews did not typically receive copies of the fracture critical inspection reports for the Bridge.[166] Instead, maintenance needs were usually communicated verbally, sometimes in a telephone call, typically followed by a face to face meeting, with the maintenance supervisor for the crew responsible for the Bridge.[167] Based on those discussions, the maintenance supervisor would prepare his work plan.[168] When the work was completed, the maintenance supervisor would then prepare a completion report reflecting that work was done, however, these reports do not describe the specific type of work.[169] The Metro District Bridge inspectors state that the fracture critical inspection reports, prepared for the Bridge reflected maintenance and repairs that had been performed,[170] although the inspection reports themselves reflect very few indications of repair activities.

The fracture critical reports for the Bridge include a section entitled "Immediate Maintenance Recommendations."[171] One of the non-engineer inspectors stated that he used the

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[165] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, p. 58.
[166] D. Dombroske Transcript, p. 26, App. Vol. I, Tab 4.
[167] D. Dombroske Transcript, p. 26, App. Vol. I, Tab 4; M. Pribula Transcript, pp. 61-62, App. Vol. I, Tab 25.
[168] D. Dombroske Transcript, p. 26, App. Vol. I, Tab 4.
[169] D. Dombroske Transcript, p. 27, App. Vol. I, Tab 4.
[170] K. Fuhrman Transcript, pp. 72-73, App. Vol. I, Tab 9; V. Desens Transcript, p. 56, App. Vol. I, Tab 3.
[171] 2000 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 6, App. Vol. IV, Tab 173; 2001 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 6, App. Vol. IV, Tab 175; 2002 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 177; 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 179; 2004 Annual Fracture

"Immediate Maintenance Recommendations" section to indicate conditions that were causing damage to the Bridge.[172] However, the Metro District Fracture Critical Bridge Engineer stated that "immediate" in this context meant that the maintenance would be performed as the schedule allowed.[173] As a consequence, certain "immediate maintenance recommendations," including recommendations relating to broken bolts and leaking joints, were repeated verbatim, year after year.[174] The Metro District bridge inspectors specifically noted their lack of authority to direct that any repairs be performed and that their responsibility was limited to reporting their observations and recommendations and talking with their supervisor, the Metro District Fracture Critical Bridge Inspection Engineer, if they believed maintenance or repair needed to be performed.[175] One of the inspectors observed, with specific reference to the leaking joints, "These reports are written up, and everyone is allowed to read them. And, you know, everybody should have known about this."[176]

Although the fracture critical bridge inspection reports for the Bridge reflected items for follow up, the reports themselves were generally not reviewed by the Metro District personnel who performed maintenance on the Bridge. Further, owing to the oral culture that exists within MnDOT, decisions regarding maintenance were often communicated verbally, with sparse documentation reflecting that decision-making. It is our understanding that MnDOT is in the

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Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 183; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 185.

[172] V. Desens Transcript, p. 44, App. Vol. I, Tab 3.

[173] M. Pribula Transcript, p. 65, App. Vol. I, Tab 25; V. Desens Transcript, pp. 46-47, App. Vol. I, Tab 3.

[174] 2000 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 6, App. Vol. IV, Tab 173; 2001 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 6, App. Vol. IV, Tab 175; 2002 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 177; 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 179; 2004 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8, App. Vol. IV, Tab 183; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 8., App. Vol. IV, Tab 185.

[175] K. Fuhrman Transcript, pp. 23-25, App. Vol. I, Tab 9; V. Desens Transcript, pp. 44-46, App. Vol. I, Tab 3.

[176] V. Desens Transcript, p. 45, App. Vol. I, Tab 3.

process of reviewing its policies and practices in this regard and, based on our investigation, we believe that such review is necessary. *See* Conclusions 1 and 4.

3. The corrective action taken by MnDOT did not improve the "poor" rating of the Bridge superstructure.

The condition rating of a bridge pursuant to the NBI Standards provides a shorthand assessment of a bridge's general condition. At the time of the Bridge's collapse, the Bridge had been determined to be in "poor" condition for 17 consecutive years. The efforts MnDOT devoted to improving the Bridge condition were insufficient to improve this rating.

The NBI Standards provide a numeric rating system that rates sections of a bridge – including the deck, superstructure, and substructure – on a scale of 0 though 9, with a rating of 7 - 9 indicating "good" to "excellent" condition, a rating of 5 – 6 indicating "fair" to "satisfactory," a rating of 3 – 4 indicating "serious" to "poor" and 0 – 2 indicating "failed" to "critical." MnDOT has adopted a goal that no more than 2% of the State's bridges will be rated as "poor."[177] In the Metro District, slightly over 6% of the bridges had a "poor "rating in 2005.[178]

In the case of the I-35W Bridge, the rating of the Bridge's superstructure was lowered in 1990 from a 7 to 4.[179] A rating of 7 designates a bridge superstructure as being in "good condition," while a rating of 4 indicates "poor condition."[180] MnDOT's Bridge Inspection Manual describes the conditions associated with a superstructure rating of 4 as follows: "Superstructure has advanced deterioration. Members may be significantly bent or misaligned.

[177] MnDOT Bridge Inspection Manual, pp. 5-9, App. Vol. II, Tab 43.
[178] Report for Commissioner's Staff Meeting, February 2005, Vol. V, Tab 214.
[179] 1988-1990 Bridge Inspection Report, p. 1, App. Vol. IV, Tab 158.
[180] MnDOT Bridge Inspection Manual, p. 7, App. Vol. II, Tab 43.

Connection failure may be imminent. Bearings may be severely restricted."[181] With specific respect to steel superstructures, the Bridge Inspection Manual states that a rating of 4 is typified by "[S]ignificant section loss in critical stress areas. Un-arrested fatigue cracks exist that may likely propagate into critical stress areas."[182]

A bridge with an NBI condition rating of 4 or less for the superstructure is considered by the FHWA to be "structurally deficient."[183] In describing his understanding of designation of a bridge as structurally deficient, the Metro District Fracture Critical Bridge Inspection Engineer stated that such a designation would indicate, "[W]e got to start planning to fix it. This is a flag saying we have to repair the bridge."[184]

Numerous conditions contributed to the poor rating of the Bridge's superstructure. In the same year that the superstructure rating was lowered from a 7 to a 4, the rating for the bearings, which are considered part of the superstructure, was also lowered from a 7 to a 4.[185] The Metro District Fracture Critical Bridge Inspection Engineer stated that the "poor" rating of the superstructure was based primarily on the Bridge's restricted bearings and the inability to determine whether the main bearings were allowing the Bridge to move as it was designed.[186] Fracture critical inspection reports for the Bridge beginning with the first such report in 1994, note corrosion of the bearings. The 1999 fracture critical inspection report states that the bearings at Piers 3 and 8 were functioning properly, but that the bearing at Pier 6 showed no

[181] MnDOT Bridge Inspection Manual, p. 7, App. Vol. II, Tab 43.
[182] MnDOT Bridge Inspection Manual, p. 7, App. Vol. II, Tab 43.
[183] MnDOT Bridge Inspection Manual, p. 12, App. Vol. II, Tab 43.
[184] M. Pribula OLA Interview Transcript, p. 4, App. Vol. V, Tab 203.
[185] 1988-1990 Bridge Inspection Report, p. 1, App. Vol. IV, Tab 158.
[186] M. Pribula Transcript, pp. 42-44, App. Vol. I, Tab 25; V. Desens Transcript, pp. 18-19, App. Vol. I, Tab 3 (attributing superstructure rating to corroded and locked up bearings, cracked tack welds and stress cracks in the bridge approach spans). Although, the third Metro bridge inspector stated that the poor rating of the superstructure was because of the deterioration of the wearing course of the deck (K. Fuhrman Transcript, pp. 43-44, App. Vol. I, Tab 9), the Bridge deck was separately rated and received an NBI rating of 5 (fair condition) from 1999 through 2006 and an NBI rating of 6 from 1980 through 1998.

obvious signs of movement.[187] In addition, in connection with some repair work that was being planned in 1996, it was determined that bearings under the approach spans were not working properly, causing stresses and cracking in the floorbeams of the approach spans.[188]

Fatigue cracking of the Bridge was a matter of ongoing concern. The 1997 fracture critical inspection, which was performed in late July and early August of 1997, identified cracking likely related to inadequately functioning rocker bearings.[189] In December 1997, MnDOT entered into a contract for placement of strain gauges to monitor this cracking and the situation was determined to be a sufficient threat to public safety to warrant entering into the contract on an expedited basis outside of MnDOT's ordinary contracting processes.[190] The situation was subsequently resolved through a repair contract.

In 1998, bridge inspectors discovered numerous cracks in beams supporting both the north and south approach spans.[191] The Metro Bridge Safety Engineer described the discovery of these cracks as a "critical finding," although not one that required closing of the Bridge.[192] Repairs were conducted by attaching steel plates to the beams to repair one large crack and drilling out the ends of the smaller cracks so that they would not spread.[193] Inspections were recommended to be increased in frequency, to every six months, and additional testing was also

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[187] 1999 In-Depth Fracture Critical Inspection Report, p. 7, App. Vol. IV, Tab 171.
[188] A. Ottman Transcript, pp. 51-52, App. Vol. I, Tab 19.
[189] 1997 In-Depth Fracture Critical Inspection Report, p. 1, App. Vol. IV, Tab 167.
[190] *See* March 27, 1998 contract between MnDOT and Maxim Technologies, Inc., App. Vol. V, Tab 205.
[191] 1998 Fracture Critical Inspection Report, p. 1, App. Vol. IV, Tab 169; October 23, 1998 memorandum from D. Flemming to G. Workman, App. Vol. V, Tab 206; October 14, 1998 memorandum from M. Pribula to J. Pirkl, App. Vol. V, Tab 207.
[192] M. Pribula Transcript, pp. 16-18, App. Vol. I, Tab 25.
[193] A. Ottman Transcript, p. 56, App. Vol. I, Tab 19; 1999 In-Depth Fracture Critical Inspection Report , p. 3, App. Vol. IV, Tab 171; November 3, 2000 memorandum from D. Flemming to G. Workman, App. Vol. V, Tab 208.

recommended.[194] The Bridge was then inspected every six months for two years after which annual inspections were reinstated when no new cracking was observed.

As a result of this discovery, MnDOT consulted with Dr. Robert Dexter at the University of Minnesota. Based on Dr. Dexter's recommendations, MnDOT lowered certain elements of the superstructure – called diaphragms – in order to reduce stresses on the floorbeams and increase flexibility.[195] Additionally, in May of 1999, MnDOT entered into a contract with the University of Minnesota to study the Bridge, particularly with respect to fatigue issues.[196] The University produced its final report pursuant to that contract on March 1, 2001.[197] That report concluded that, "The detailed fatigue assessment in this report shows that fatigue cracking of the deck truss is not likely. Therefore, replacement of this bridge, and the associated very high cost, may be deferred. This report further found that, "[F]atigue cracking is not expected during the remaining useful life of the bridge."[198] As is discussed below, however, MnDOT's continued concerns about fatigue cracking, as well as its desire to add redundancy to the Bridge, were key motivating factors in the decision to proceed with the consulting contract with URS.[199]

Although the work recommended by the University appears to have successfully addressed the issue of fatigue cracking in the approach spans, it did not improve the overall rating of the superstructure. Work done on the Bridge in 1998 related primarily to the Bridge deck and did not improve the superstructure rating. The 2007 Overlay Project, which was going on at the time the Bridge collapsed, was intended to extend the life of the Bridge as well as its

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[194] October 23, 1998 memorandum from D. Flemming to G. Workman, App. Vol. V, Tab 206.
[195] December 21, 1998 correspondence from University of Minnesota to D. Flemming, App. Vol. V, Tab 223.
[196] May 10, 1999 contract between MnDOT and the University of Minnesota, App. Vol. V, Tab 209.
[197] University of Minnesota Fatigue Evaluation of The Deck Truss of Bridge 9340 Final Report, March 2001, App. Vol. V, Tab 192.
[198] University of Minnesota Fatigue Evaluation of The Deck Truss of Bridge 9340 Final Report, March 2001, App. Vol. V, Tab 192.
[199] *See* Investigative Summary No. 7.

driveability, but would not have improved the superstructure rating. To that end, MnDOT's February 2006 Preliminary Bridge Preservation Recommendation relating to the 2007 Overlay Project observes, "This work does not address the poor rating of the superstructure. Prior to final recommendation a meeting will be scheduled to discuss future work needed to raise the condition rating above NBI 4."[200] The final Bridge Preservation Recommendation in September 2006 states:

> This work does not address the poor rating of the superstructure. URS has completed the draft final report on the Fatigue Evaluation and Redundancy Analysis of Br. #9340, and based on the recommendations in the draft report we recommend that Metro program truss member retrofit plating work within the next 4 years. Rehabilitation of the four rocker bearings on the transfer beams that support the approach spans on the cantilever truss spans should be programmed.[201]

There is evidence of a general recognition, reflected in MnDOT's performance measures as well as other MnDOT documents, that a bridge with a poor rating, although not requiring immediate action, is a condition to be avoided. Despite actions by MnDOT to improve the condition of the Bridge, the superstructure of one of the busiest bridges in the state, a bridge with a fracture critical, non-redundant design, continued to be rated in "poor" condition for seventeen years. *See* Conclusions 2, 5 and 6.

4. MnDOT did not conduct a load ratings analysis in response to the Bridge's deteriorating condition.

Central Bridge handles load rating requests for MnDOT. A re-rating of a bridge can arise due to either its modification or as a result of damage or deterioration.[202] In the latter case, the inspection engineer or inspection supervisor, presumably in conjunction with Central Bridge,

[200] Draft Preliminary Bridge Preservation Recommendations, App. Vol. V, Tab 211.
[201] September 2006 Bridge Preservation Recommendations, p. 4, App. Vol. V. Tab 210.
[202] In limited circumstances, a bridge might also be re-rated due to legislative changes regarding traffic restrictions.

will refer a bridge for re-rating. If a re-rating analysis concludes that a bridge cannot carry its previous live load, then the bridge is "posted" for weight restriction, typically either by prohibiting truck traffic or reducing the number of traffic lanes. Obviously, such a restriction can have significant consequences for the users of the Bridge.

A bridge's load rating must be updated to reflect any changes in condition identified during the bridge inspection. The AASHTO Manual for Condition Evaluation of Bridges states:

> Bridge load rating calculations are based on information in the bridge file including the results of a recent inspection. As part of every inspection cycle, bridge load ratings should be reviewed and updated to reflect any relevant changes in condition or dead load noted during the inspection.[203]

Re-rating may be necessary as the result of a bridge's deterioration. To that end, the AASHTO Manual observes:

> The rating of an older bridge for its load-carrying capacity should be based on a recent thorough filed investigation. All physical features of a bridge which have an effect on its structural integrity should be examined . . . . Note any damaged or deteriorated sections and obtain adequate data on these areas so that their effect can be properly evaluated in the analysis. Where steel is severely corroded, concrete deteriorated, or timber decayed, make a determination of the loss in cross-sectional area as closely as reasonably possible.[204]

The head of MnDOT's Central Bridge rating unit similarly described the relationship between deterioration of a bridge – specifically, deterioration resulting from section loss – and its rating:

> You have to look what member is being – or where the loss is in the member, what member it is, and whether the member is the critical member in the whole bridge, and what the overall rating is at that point. As little as 5 percent might mean if it was a critical member of the bridge and the bridge was that – would have been close to the posting level, as little as 5 percent would mean you'd have to redo it.[205]

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[203] AASHTO Manual for Condition Evaluation of Bridges (1994), p. 49.
[204] AASHTO Manual for Condition Evaluation of Bridges (1994), p. 51.
[205] L. Johnson Transcript, p. 27, App. Vol. I, Tab 11.

The Bridge was re-rated after the modifications in both 1977 and 1998.[206] These re-ratings were based solely on the Bridge plans and did not take into account the inspection reports or other information concerning the Bridge's condition. However, even had the inspection reports been considered, those reports lacked the detail and quantification necessary for use in the ratings analysis. Such an analysis is performed using a computer and, accordingly, the inspection report, to be of use in such an analysis, must include measurements that can be entered into the computer program.[207] Although the superstructure was given a NBI Code 4 for seventeen years, section loss of about 5% (subsequently stated by the State Bridge Engineer to be "something less than 6.6%") was reported in at least one critical location in 1993 and while MnDOT staff appropriately expressed concern about the non-redundant design of the Bridge, no one ever asked to have the Bridge re-rated due to its deteriorated condition.[208] In response, the State Bridge Engineer stated that he did not find the Bridge's condition to be atypical for a 40-year old steel truss structure and that, even if the Bridge had been referred for re-rating, there was no assurance that a load restriction would have been placed on the Bridge.[209]

Although AASHTO's standards, which are mandatory, require consideration for load re-rating as part of the annual bridge inspection cycle, we found no written documentation that consideration was given to reviewing and updating the Bridge's load ratings to reflect any changes to the Bridge's condition noted in the inspection reports.[210] Further, because the inspection reports lacked quantification of the extent of deterioration, the inspection reports themselves were not useful in making a re-rating decision. Further, we did not find

[206] The final report documenting the conclusions of the 1998 re-rating analysis was not filed and is not available. L. Johnson Transcript, p. 25, App. Vol. I, Tab 11.
[207] L. Johnson Transcript, pp. 10-11, App. Vol. I, Tab 11.
[208] L. Johnson Transcript, p. 27, App. Vol. I, Tab 11.
[209] D. Dorgan Transcript, pp. 114-115, App. Vol. I, Tab 5.
[210] AASHTO standards are mandatory because the NBI standards incorporate them by reference. 23 C.F.R. §650.317.

documentation of any formalized process by which bridge condition is taken into account in making re-rating decisions. *See* Conclusion 2.

5. MnDOT did not document the bowed gusset plate on the Bridge.

In March 2008, the Minneapolis Star Tribune published a photograph taken in 2003 by URS that appeared to show a bowed gusset plate.[211] Although this photograph was among a large number of photographs that were provided by URS to MnDOT in their report of their June 2003 limited inspection, no one at either MnDOT or URS noticed the bowing in connection with their review of the photographs. Nor is this bowing identified in any inspection report, either annual or fracture critical report, prepared by the Metro District bridge inspectors.[212]

The way a bridge inspector would check for bowing gusset plates would be to place a straight edge along the edge of the plate and visually observe any divergence.[213] There is varying testimony regarding whether the inspectors checked for bowed gusset plates. One of the inspectors states that this was not something the inspectors checked for.[214] Another of the inspectors states that he would sight down the plates to see whether they were aligned.[215] Both of these inspectors state that they did not notice any bowed gusset plates during their inspection

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[211] Tony Kennedy, *Old photos show flaws in steel of I-35W bridge*, STAR TRIBUNE, March 26, 2008, *available at* http://www.startribune.com/local/16927626.html.

[212] Handwritten notes produced by URS, dated September 6, 2005, include the comment, "Gusset Plate Buckling – If this occurs, it is not catastrophic." This comment has been reported in the news media as pertaining to the I-35W Bridge. URS states, however, that this was a hypothetical comment relating to a bridge that URS was studying in Cleveland and URS's conclusions that, if the gusset plate edge was too slender, this did not necessarily mean the gusset plate would fail. E. Zhou Transcript, p. 61, App. Vol. I, Tab 33.

[213] K. Fuhrman Transcript, p. 59, App. Vol. I, Tab 9.

[214] V. Desens Transcript, p. 69, App. Vol. I, Tab 3.

[215] K. Fuhrman Transcript, p. 60-61, App. Vol. I, Tab 9.

of the Bridge.[216] The Metro District Bridge Safety Inspection Engineer, however, states that he recalls observing bowing in a gusset plate during an inspection of the Bridge.[217]

While the Metro District Bridge Safety Inspection Engineer is unable to recall the specific year he observed this bowing or the exact location, he is able to describe the observations he made that he says allowed him and the inspector that he was working with (whose name he does not recall), to conclude that the bowing was attributable to original construction, rather than the result of stress on the gusset plate.[218] The Metro District Bridge Safety Inspection Engineer states that, because it was determined that the bowing of the gusset plate was something that occurred during the construction of the Bridge, it was not included in the inspection report.[219] Testimony on this point is at variance as well, because one of the bridge inspectors states that, although it is his view that the bowing was likely caused during construction, had he noticed the bowing during one of his inspections, he would have noted that in his inspection report.[220] However, conditions attributable to the original construction were noted in the fracture critical inspection reports, fracture critical inspection reports for 2002, 2003, 2004, 2005, and 2006, for example, where the bending of a diagonal brace from original construction is noted.[221] Finally, because the bowing was not measured and recorded in the

[216] K. Fuhrman Transcript, p. 60-61, App. Vol. I, Tab 9; V. Desens Transcript, p. 69, App. Vol. I, Tab 3.
[217] M. Pribula Transcript, p. 72, App. Vol. I, Tab 25.
[218] M. Pribula Transcript, pp. 72-74, App. Vol. I, Tab 25. The reasons given by Mr. Pribula for his conclusion that the gusset plate was bowed during construction were (1) gusset plates are over designed to include a "safety factor;" (2) there was no visual evidence of stress on the gusset plates; (3) the presence of "drift pins" at other locations on the Bridge, indicating difficulty in "fit up" during construction.
[219] M. Pribula Transcript, p. 75, App. Vol. I, Tab 25.
[220] K. Fuhrman Transcript, p. 61, App. Vol. I, Tab 9.
[221] 2002 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 30, App. Vol. IV, Tab 177; 2003 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 30 App. Vol. IV, Tab 179; 2004 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 34, App. Vol. IV, Tab 181; 2005 Annual Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 34, App. IV, Tab 183; 2006 In-Depth Fracture Critical Bridge Inspection Report for Bridge No. 9340, p. 37, App. Vol. IV, Tab 185 ("Below stringer #13, the diagonal brace between the top and bottom chord of the floorbeam truss is bent (from original construction).")

inspection report, there was no way to determine whether there was any change in this condition over time.

After the NTSB announced the preliminary results concerning the potential role of the gusset plates in the collapse of the Bridge, MnDOT began a systematic investigation of the gusset plates of certain bridges around the State, a process that is ongoing.[222] As part of this investigation, MnDOT undertook a reinspection of the DeSoto Bridge in St. Cloud for possible section loss of the gusset plates due to corrosion.[223] Although this reinspection did not identify any significant corrosion issues, the MnDOT inspectors did note bowing of four gusset plates, which led MnDOT to close the bridge.[224] A subsequent evaluation of the DeSoto Bridge performed by the engineering firm Wiss, Janney, concluded that the bowing of the gusset plates related to "fit up issues" during the bridge's construction and that the bowing had "not compromised the ability of the affected gusset plates to sustain required design loads."[225] The Wiss, Janney firm also noted that, while the DeSoto Bridge gusset plates and the I-35W Bridge gusset plates were similar in length and identical in thickness, the design loads for the DeSoto gusset plates were approximately one-half the loads that were carried by the I-35W Bridge gusset plates before the Bridge collapsed.[226]

In hindsight, we now know that the sizing and bowing of gusset plates were significant. However, there is no evidence to show that the inspectors should have understood that significance prior to the Bridge collapse. However, the failure to note an observed condition in

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[222] D. Dorgan Transcript (May 2, 2008), p. 7, App. Vol. I, Tab 5.
[223] G. Peterson Transcript, pp. 64, 66, App. Vol. I, Tab 20.
[224] G. Peterson Transcript pp. 64, 67, App. Vol. I, Tab 20; D. Dorgan Transcript (April 22, 2008), pp. 41, 43, App. Vol. I, Tab 5.
[225] March 31, 2008 correspondence from Wiss, Janney, Elstner to D. Dorgan summarizing DeSoto Bridge Gusset Plate Evaluation, p. 2, App. Vol. V, Tab 215.
[226] March 31, 2008 correspondence from Wiss, Janney, Elstner to D. Dorgan summarizing DeSoto Bridge Gusset Plate Evaluation, p. 2 (May 31, 2008), App. Vol. V, Tab 215.

the inspection report that was apparently out of the norm is troubling as is the lack of a consistent explanation of why this condition was not noted. As a result, the ability to monitor the condition was lost as was the ability to take that condition into account in planning maintenance activities on the Bridge. *See* Conclusion 1.

6. MnDOT was not advised by the Federal Highway Administration about the sagging of a similarly-designed Ohio bridge.

Following the collapse of the Bridge, the NTSB issued a bulletin that warned bridge owners across the country to check the gusset plates of truss bridges.[227] Had a similar warning been issued following the non-catastrophic failure in 1996 of a gusset plate on a similarly designed bridge in Ohio, MnDOT might have had information available to it that would have enabled it to avert the tragedy that occurred eleven years later.[228]

On May 24, 1996, structural failure forced the closure of twin 850-foot arched truss bridges, each carrying two lanes of Interstate 90 traffic over the Grand River, 30 miles east of Cleveland.[229] Gusset plates of both trusses on the eastbound bridge buckled, causing approximately 3 inches of downward and 3 inches of lateral displacement to the bridge members.[230] On the day of the failure, a bridge-painting contractor had parked a line of trucks and heavy equipment on the right-hand shoulder of the bridge.[231] A truck reportedly crossed the bridge in the left lane, causing the gusset plates to fail.[232]

[227] January 15, 2008 NTSB Safety Recommendation, *available at* http://www.dot.state.mn.us/i35wbridge/pdfs/ntsb_safety_recommendation.pdf.
[228] In a previous presentation to the JBC, we inadvertently used the word "collapse" rather than "sag" in describing the Grand River Bridge incident.
[229] Arthur A. Huckelbridge Jr., Dean A. Palmer and Richard E. Snyder, *Grand Gusset Failure*, CIVIL ENGINEERING, September 1997, p. 50.
[230] *Grand Gusset Failure*, p. 50.
[231] *Grand Gusset Failure*, p. 50.
[232] *Grand Gusset Failure*, p. 50.

The Ohio Department of Transportation hired engineering consultant, Richland Engineering, Ltd. ("REL"), to investigate the failure. REL prepared a report with its analysis dated October 21, 1996.[233] It concluded that the gusset plates, at the time of the failure, were not adequate to support the design loads of the structure.[234] The FHWA also analyzed the failure and concluded ". . . the design thickness of the original gusset plate was marginal, at best, and its load carrying capacity was further exacerbated by loss of thickness due to corrosion."[235] The FHWA analysis indicated the full design load on the truss members was just about equal to the load required to buckle the gusset plates, with no safety factor.[236] The REL report notes that the section loss in the gusset plates due to corrosion, increased the actual stresses in the remaining members and that the capacity to resist buckling in the deteriorated plates was also reduced.[237] REL also noted that at the time of the failure, the presence of the painting crews and equipment caused the applied loads to approach the full design load.[238] REL concluded that "The gusset plates failed because the applied loads of the contractor's equipment and a legal truck load exceeded the actual capacity of the gusset plates. The deterioration of the gusset plates, particularly the north truss gusset plates, contributed to the failure."[239] REL determined that non-contributing factors included fatigue and temperature expansion of the bridge against closed and pack-rust frozen expansion joints.[240] Following the failure, all gusset plates in the bridge were

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[233] REL report re: LAK-902342R over Grand River, Gusset Plate Failure ("REL Report"), pp. 1-4, App. Vol. V, Tab 216.
[234] REL Report, p. 1, App. Vol. V, Tab 216.
[235] REL Report, p. 2, App. Vol. V, Tab 216 (quoting FHWA report).
[236] REL Report, p. 2, App. Vol. V, Tab 216 (quoting FHWA report).
[237] REL Report, p. 2, App. Vol. V, Tab 216.
[238] REL Report, p. 3, App. Vol. V, Tab 216.
[239] REL Report, p. 3, App. Vol. V, Tab 216.
[240] REL Report, p. 3, App. Vol. V, Tab 216.

analyzed by REL to evaluate the effects of design thickness, free edge buckling, and corrosion damage.[241]

A long-time OhDOT bridge engineer interviewed in connection with our investigation stated that OhDOT made a variety of policy changes following the Grand River Bridge failure. Specifically, OhDOT revised its bridge engineer training program to emphasize the importance of inspecting compression members and especially gusset plates. OhDOT also began to clearly communicate to consultants hired to inspect bridges that careful inspection of gusset plates on truss bridges was required. The same bridge engineer indicated that since the Grand River Bridge failure, OhDOT has stayed well-informed regarding all bridge closures on any interstate in the country. Further, when OhDOT learns of a problem with a bridge in another state, it uses the FHWA bridge inventory of Ohio bridges to see which of Ohio's bridges have similar members and to determine if further inspections are necessary.

In September 1997, *Civil Engineering*, an American Society of Civil Engineers ("ASCE") publication, released an article titled "Grand Gusset Failure." The article explored the 1996 failure of the Grand River Bridge, focusing on the contribution of undersized and corroded gusset plates to the failure and OhDOT's subsequent repair measures. According to the article, these repairs included the installation of much thicker gusset plates at certain critical points on the bridge and the installation of stiffeners on gusset plates at other critical points on the bridge.[242] Although *Civil Engineering* was at that time one of the publications received in MnDOT's library, our investigation was unable to determine the extent to which it was circulated within MnDOT, if at all. MnDOT reports that none of its employees were aware of the failure of the Grand River Bridge, either through the *Civil Engineering* article or otherwise,

[241] REL Report, p. 3, App. Vol. V, Tab 216.
[242] *Grand Gusset Failure*, p. 52.

before the failure of the I-35W Bridge.[243] MnDOT's consultants, similarly, were not aware of this occurrence.[244]

Absent any broad dissemination of information by the FHWA or other governmental agency about the gusset plate failure on Grand River Bridge, we cannot conclude that MnDOT should have known about this occurrence. Of all of the issues we reviewed in our investigation, this one appears to have held the most promise for discovering the condition that the NTSB has determined on a preliminary basis played a significant role in the collapse of the Bridge. However, there is no evidence to support attributing the failure to become aware of this information to any action or inaction on the part of MnDOT. The FHWA, however, should take steps to ensure that information on bridge deficiencies is shared with MnDOT and other state departments of transportation in the future. *See* Conclusion 4.

7. MnDOT did not effectively follow through on the advice of its experts on the Bridge.

MnDOT has historically used a combination of consultants and in-house personnel to staff major projects. Indeed, all of the former Commissioners acknowledge that some combination of consultants and in-house expertise is preferred. While the percentages may change from Commissioner to Commissioner, it is clear that the use of consultants is a widely accepted practice.

MnDOT used consultants to address two primary concerns about the Bridge. First, MnDOT wanted to study the fatigue life of the critical members and determine whether fatigue cracking was a cause for concern. Second, MnDOT was developing plans to add redundancy to

[243] May 5, 2008 correspondence from D. Dorgan to R. Stein, App. Vol. V, Tab 202; K. Western Transcript, p. 67, App. Vol. I, Tab 28; M. Pribula Transcript, p. 71, App. Vol. I, Tab 25.
[244] B. McElwain Transcript, pp. 32-33, App. Vol. I, Tab 32; D. Flemming Transcript, pp. 51-52, App. Vol. I, Tab 30; E. Zhou Transcript, p. 58, App. Vol. I, Tab 33.

the Bridge to enhance the Bridge's safety against a total failure, whether from fatigue cracking or otherwise. That is, the pursuit of redundancy is an overall safety precaution—a plan to create alternate load paths in the event that a member fails for whatever reason.

MnDOT's use of experts to address these concerns is commendable. But, as the evidence shows, after eight years of expert evaluation, recommendations by the experts to add redundancy to the Bridge were not acted upon, even though MnDOT had strongly supported doing so early on.

MnDOT started its fatigue study of the Bridge with the University of Minnesota in 1999. The University's March 2001 fatigue evaluation produced some good news about the fatigue aspects of the Bridge.[245] As previously noted, the evaluation found that fatigue cracking was not expected during the remaining useful life of the Bridge.[246] Around the same time, MnDOT was involved in a dialogue with HNTB relating to various ways to add redundancy to the bridge. As stated by HNTB, in the proposed tasks for the Bridge given to MnDOT in May 2000:

> The redundancy of the deck truss portion of the Interstate 35W bridge over the Mississippi River is a continuing concern to the Minnesota Department of Transportation.[247]

Don Flemming, while the State Bridge Engineer, stated that although the fatigue life on the Bridge was good, the non-redundant aspect of the Bridge was an important factor that needed to be addressed.[248] Flemming's position was recalled by a MnDOT engineer who worked with him.

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[245] University of Minnesota Fatigue Evaluation of The Deck Truss of Bridge 9340 Final Report, March 2001, App. Vol. V, Tab 192.
[246] University of Minnesota Fatigue Evaluation of The Deck Truss of Bridge 9340 Final Report, March 2001, Executive Summary, p. xi, App. Vol. V, Tab 192.
[247] May 2000 HNTB Corporation Proposed Tasks, App. Vol. III, Tab 111.
[248] D. Flemming Transcript, pp. 48, 53, App. Vol. I, Tab 30.

> I think we were probably aware that Dexter's report wasn't finding necessarily that we had a fatigue problem, but like Flemming said, this was the most heavily traveled fracture critical bridge in our system and he wanted to be sure that we were looking at it from a fracture critical standpoint. He was looking for some additional ways to – if there was some way we could add redundancy to the bridge that wouldn't make it fracture critical anymore, he was interested in talking to people about that.[249]

Using original plans from MnDOT and in response to MnDOT's request, HNTB submitted a proposal to MnDOT to analyze the Bridge.[250] HNTB's proposal included a partnership with Dr. Dexter, the University professor who had conducted the fatigue evaluation on the Bridge. Importantly, HNTB advised MnDOT that the condition of the Bridge could affect the analysis because "several bridge components" were "not functioning as intended" including joints, connections, and bearings.[251] The combination of the two experts—the University and HNTB—addressed both the fatigue and redundancy concerns about the Bridge against the backdrop of a bridge that was "not functioning as intended."

In December 2001, MnDOT met to discuss the HNTB proposal. The State Bridge Engineer's notes reflect the conclusion of the meeting: "Proceed with study HNTB/Dexter proposed."[252] HNTB was not, however, formally retained on the project.[253] Instead, more than a year later, MnDOT issued an RFI on the Bridge.[254]

URS was the expert consultant selected in response to the RFI.[255] The contract describing the work to be performed by URS identifies thirteen separate tasks, including, among

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[249] G. Peterson Transcript, p. 40, App. Vol. I, Tab 20.
[250] October 2001 HNTB Proposal, App. Vol. V, Tab 217; May 9, 2008 email from J. Miranowski to K. Bergstrom, App. Vol. V, Tab 218.
[251] October 2001 HNTB Proposal, App. Vol. V, Tab 217.
[252] D. Dorgan hand-written notes, Vol. III, Tab 119.
[253] MnDOT stated that it could not "direct select" HNTB. D. Dorgan Transcript (April 22, 2008), p.34, App. Vol. I, Tab 5.
[254] When asked about the length of delay, MnDOT replied that it was busy with many projects due to an increase in funding from the Ventura administration. D. Dorgan Transcript, p. 35 (April 22, 2008) App. Vol. I, Tab 5.
[255] The amount of time available for this investigation did not allow GPM to explore MnDOT's process for selecting and retaining outside consultants and contractors, including the adequacy of MnDOT's conflict of interest policies.

others, tasks relating to: (1) repair plans for eight identified fracture critical members; (2) concepts for improving redundancy and minimizing truss stresses; (3) conceptual plans for deck removal, structural changes and deck replacement.[256] The specific activities to be completed in connection with these tasks included:

- Design and prepare conceptual plans for contingency repair of eight selected fracture critical members;
- Develop plans for adding structural redundancy, such as altering the floor system by making it continuous and composite with the trusses;
- Evaluate improvements in structural redundancy;
- Develop multiple staging and sequencing alternatives for deck removal and replacement in truss spans;
- Analyze critical stresses at various stages of deck removal and replacement for applicable loads;
- Compare and evaluate alternatives to determine the best solution considering cost and member stresses;
- Prepare conceptual plans for a procedure for deck removal, structural changes and deck replacement;
- Submit a report for review and comment by MnDOT and revise the report per MnDOT's comments.[257]

The activities described were, in many respects, similar to those proposed by HNTB. Importantly, however, the scope of work under the URS contract did not include the analysis of the gusset plates that had been proposed by HNTB.[258] Our investigation did not address whether including this analysis as part of the URS contract would have resulted in the discovery of any underdesigned gusset plates.

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[256] MnDOT/URS Contract, App. Vol. V, Tab 198.
[257] MnDOT/URS Contract, App. Vol. V, Tab 198.
[258] *See* May 9, 2008 HNTB email, App. Vol. V, Tab 218, confirming that HNTB's proposal included an analysis of gusset plates.

URS's preliminary final report to MnDOT was issued in July 2006 (the "Preliminary Report"). The Preliminary Report made three recommendations to MnDOT: (1) a proposal to redeck the Bridge to add structural redundancy; (2) a proposal to retrofit the Bridge to add member redundancy, and (3) continued inspection.[259] In their August 2006 comments to the Preliminary Report, MnDOT staff supported the recommendations, and made written comments about the need to strengthen the language. For instance:

> **Fatigue Evaluation Page 10:** The last paragraph states failure of five of the eight critical members would "cause instability of the structural system". For others in Mn/DOT that are not knowledgeable in structures this phrase may not be understood. If the conclusion is the instability would likely lead to collapse of the bridge, that should be state clearly.[260]

In addition, MnDOT requested advice on how to stage the redecking work:

> **Conceptual Plan for Deck Replacement Page 13:** The last sentence of the first paragraph notes if the unbalanced half deck procedure is considered, a detailed analysis should be performed during final design. This decision is critical to our future project planning. One of the outcomes expected from the study was an assessment of the redecking options and traffic maintenance. We need this key question answered at this time, how many lanes can be maintained and what should be the staging, either half at a time, middle rebuilt first, or outside redecked first? This same issue appears is [sic] Recommendation 4. Without this answer, the staging for the entire project and roadway is stalled. So it cannot wait for final design.[261]

Nonetheless, at a September 2006 meeting to discuss these preliminary recommendations, URS was told that the redecking option was going to be deferred for 14 – 16 years.[262] And, instead, MnDOT authorized URS to undertake a fracture mechanics study, to determine the size that a

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[259] D. Flemming Transcript, pp. 76-77, App. Vol. I, Tab 30; URS Draft Preliminary Report, p. 5, App. Vol. V, Tab 200.

[260] D. Dorgan comments to URS Draft Preliminary Report Executive Summary, App. Vol. V, Tab 200.

[261] D. Dorgan comments to URS Draft Preliminary Report Executive Summary, App. Vol. V, Tab 200.

[262] E. Zhou Transcript, pp. 37-38, App. Vol. I, Tab 33; D. Flemming Transcript (April 22, 2008), p. 78, App. Vol. I, Tab 30.

fatigue crack needed to be before it would propagate and cause the loss of a critical member, resulting in collapse of the Bridge.[263]

URS's continued study resulted in it making revised recommendations to MnDOT in December 2006.[264] Specifically, URS determined that high level testing—either acoustical or magnetic—was sufficient to detect fatigue cracks of a size necessary to give cause for concern. URS recommended that MnDOT: (1) pursue the retrofit to add member redundancy and (2) conduct the recommended testing, or (3) implement a combination of both those recommendations. URS obtained bids from testing companies for MnDOT's use, noting in an e-mail that "MaTech's EFS appears to be the most advanced NDE procedure at this time, and their quote is under $200,000 for doing a complete examination . . . ."[265]

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[263] E. Zhou Transcript, pp. 38-40, App. Vol. I, Tab 33. In its comments to URS's Preliminary Report, MnDOT also raised a question regarding the toughness of the steel used to construct the Bridge and how that might affect the rate of crack growth. G. Peterson comments to URS Draft Preliminary Report Executive Summary, App. Vol. V, Tab 200. The issue of steel toughness was also discussed at the September 6, 2006, meeting between MnDOT and URS, with MnDOT advising URS that it would review its records to attempt to determine the source of the steel used. *See* September 6, 2006 Meeting Minutes, App. Vol. V, Tab 212. In URS's response to MnDOT's comments to URS Draft Preliminary Report, URS notes the potential relationship between steel toughness and fracture of bridge members:

> However, there is a factor of uncertainty in the change of material toughness with aging. For example, why did the Hoan Bridge fracture occurred thirty years after its opening in a day that was not the coldest and the loading that was not the heaviest in its service history? We also observed two other girder fractures (unstable crack growth) from fatigue susceptible details in two other bridges, one in Pennsylvania and one in Maryland. These fractures also occurred under normal traffic load decades after the bridge began to carry traffic. One can explain why the fractures occurred where they occurred because there are poor details that cause stress concentration. However, so far no one can explain why some fractures happened after so many years of service without visible signs of fatigue on the fracture surface. As we learned from probability and statistics, a zero-probability event may still happen.

September 2006 response to Mn/DOT comments on URS Draft Preliminary Report, p. 13, App. Vol. V, Tab 212. We did not have sufficient time available to determine how, or whether, this issue was ultimately resolved.

[264] E. Zhou Transcript, pp. 46-48, App. Vol. I, Tab 33; D. Dorgan Transcript (April 22, 2008), pp. 56-57, App. Vol. I, Tab 5; URS Draft Preliminary Report, Executive Summary, App. Vol. V, Tab 224.

[265] E. Zhou e-mail to D. Flemming, December 13, 2006, App. Vol. III, Tab 104.

URS and MnDOT met on January 17, 2007, to discuss the revised recommendations.[266] At that meeting, MnDOT came up with and decided to implement a different testing option than the two (acoustical or magnetic) recommended by URS: to have the Central Bridge inspection unit use its equipment to perform non-destructive testing, consisting primarily of visual inspection and ultrasound, if necessary, to determine whether the critical-sized fatigue cracks existed.[267] Once that testing was complete, then MnDOT would make a determination whether to pursue the retrofit recommendation.[268]

URS left the January 17, 2007, meeting with the understanding that its principal engineer on the project would accompany the MnDOT team during the testing in the Spring of 2007.[269] MnDOT decided not to have URS participate in the testing. An internal MnDOT e-mail stated that URS's participation in the testing would not add value.[270] So, in May 2007, the MnDOT team proceeded without URS to do a visual inspection, with some limited ultrasonic testing, of approximately half the Bridge[271]

MnDOT employees out on the Bridge in May 2007 had different understandings of the purpose for their work. For instance, the Central Bridge Inspection Engineer thought that the MnDOT crew was only on the Bridge to determine whether they had the capacity to do the testing.[272] Inspectors participating from the Metro District, however, thought they were on the Bridge to locate certain diaphragms for the retrofit recommendation.[273] No one from the

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[266] D. Dorgan Transcript (April 22, 2008), pp. 48-52, App. Vol. I, Tab 5.
[267] D. Dorgan Transcript (April 22, 2008), pp. 60-62, App. Vol. I, Tab 5.
[268] D. Dorgan Transcript (April 22, 2008), pp. 61-62, App. Vol. I, Tab 5.
[269] E. Zhuo Transcript, pp. 54-55, App. Vol. I, Tab 33; D. Flemming Transcript, pp. 92-93, App. Vol. I, Tab 34.
[270] February 9, 2007 email from G. Peterson to R. Miller, App. Vol. V, Tab 225.
[271] B. Nelson Transcript, pp. 23-24, App. Vol. I, Tab 17; T. Niemann Transcript, pp. 59-61, App. Vol. I, Tab 18.
[272] T. Niemann Transcript, pp. 60-61, App. Vol I, Tab 18.
[273] M. Pribula Transcript, pp. 30-31, App. Vol. I, Tab 25.

MnDOT inspection team consulted with URS prior to completing the partial inspection in May 2007.

In the summer 2007, MnDOT scheduled a meeting with URS for August 20, 2007, to discuss the partial results of the testing. URS's final report, and that August meeting, never took place due to the collapse of the Bridge.

MnDOT worked with experts almost continuously for eight years on the Bridge. From 1999 to the time of its collapse, the University of Minnesota, HNTB and URS worked with MnDOT to make recommendations about the Bridge, not only about the Bridge's fatigue life but also about adding redundancy to enhance the safety of the Bridge. MnDOT initially recognized the need for redundancy but later focused on the fatigue analysis. Ultimately, the Bridge did not receive any materially different treatment than it had historically and redundancy was not added to the Bridge. A MnDOT inspection crew completed a partial test on the Bridge in May 2007 that was different than the one recommended by its consultant and a construction crew scheduled the Bridge for an overlay project. Action to enhance redundancy, and add any benefits that redundancy could have brought to the Bridge, were deferred or dropped. *See* Conclusions 2, 3, 5 and 6.

8. Funding considerations influenced decisions about the Bridge.

Funding considerations were a part of everyday life at MnDOT. Finding money, striking the proper balance among competing projects and living within their budget were constant challenges for MnDOT administrators and staff. The following statements are illustrative:

> "[W]e have safety issues; we have capacity issues; we have aging pavement issues; we have bridge issues; we have traffic signal issues; I'm going to balance

> all those things out to say here's what we think are the most important projects that need to move forward . . . ."[274]
>
> "[I]t would be meaningless for me to contact CO [Central Office] and tell them how frequently I need more money because everybody could tell everybody how much more money we need."[275]
>
> "From an emergency response standpoint, we essentially have to live within our means. We are given appropriative authority, and that's the budget we have to work with, if you will."[276]

In April 2004 and 2005, the I-35W Bridge was identified as one of the "Budget Buster" bridges needing "replacement or renovation in the next 10 years" with action to occur by 2012 in the case of the Bridge.[277] However, as a major fracture critical bridge, the renovation or replacement of the I-35W Bridge presented a daunting financial challenge. This was fully acknowledged in a February 8, 2005, *Report for Commissioner's Staff Meeting* where it was noted that "major fracture critical bridge projects continue to be postponed due to funding."[278] The following description illustrates the effect of funding considerations on the renovation and replacement of the Bridge.

A portion of the work undertaken by URS was to study and make recommendations on a deck replacement for the Bridge as discussed in the preceding Investigative Summary. While URS was working on this at the end of February 2006, the Central Bridge construction unit was preparing a Preliminary Recommendation worksheet to approve a previously budgeted two-inch thick deck overlay project on the Bridge. Shortly thereafter, the Central Bridge engineer who would need to approve the Preliminary Recommendation called URS to express concern that MnDOT was, as paraphrased by URS, "planning for deck and joint repairs without considering

[274] R. Arnebeck Transcript, p. 54, App. Vol. I, Tab 2.
[275] B. Farraher Transcript, p. 46, App. Vol. I, Tab 7.
[276] K. Gray Transcript, p. 60, App. Vol. I, Tab 10.
[277] April 5, 2004 Report for Commissioner's Staff Meeting, App. Vol. V, Tabs 213 and 214.
[278] February 8, 2005 Report for Commissioner's Staff Meeting, App. Vol. V, Tab 214.

recommendations for a more permanent repair."[279] The URS representative responded that "personally, I would defer the proposed deck work and plan for a deck replacement and strengthening project."[280] URS followed up on the conversation with a March 24, 2006 letter informing MnDOT that URS had determined that replacing the existing deck with one that was continuous throughout would decrease live stress loads by 20% in some of the critical fatigue-prone members and improve the structural redundancy of the Bridge.[281]

On April 3, 2006, MnDOT met to discuss three investment strategies for the Bridge. They were: (1) a deck overlay scenario; (2) a deck replacement scenario; and (3) a Bridge replacement-only scenario.[282] Replacement of the Bridge was immediately ruled out given that "MnDOT has not committed to funding this project in the next 20 years" and the $75 million or more estimated cost of a new bridge was "cost prohibitive."[283] Concern was expressed, however, that if the Bridge needed to be closed for safety reasons in the future, the high cost of the replacement "will result in delaying many other projects to maintain our budget."[284]

Each of the two remaining options had several components. The first option, the deck overlay scenario, involved (1) replacing the top two inches of the Bridge's deck in 2007 for $3.5 million; (2) replacing the entire deck and strengthening the steel between 2017 and 2022 for $15 million; and (3) replacing the Bridge between 2057 and 2062 for more than $75 million.[285] Two of the "Pros" identified for the overlay scenario were that it "delays bridge replacement the most" and "allows time to acquire the funds needed for the deck replacement and the bridge

[279] February 27, 2006 email from D. Flemming to E. Zhou, App. Vol. III, Tab 148.
[280] February 27, 2006 email from D. Flemming to E. Zhou, App. Vol. III, Tab 148.
[281] March 24, 2006 letter from D. Flemming to MnDOT, App. Vol. III, Tab 133.
[282] MnDOT Meeting Minutes, April 3, 2006, App. Vol. III, Tab. 125.
[283] MnDOT Meeting Minutes, April 3, 2006, App. Vol. III, Tab 125.
[284] MnDOT Meeting Minutes, April 3, 2006, App. Vol. III, Tab 125
[285] MnDOT Meeting Minutes, April 3, 2006, App. Vol. III, Tab 125.

replacement."[286] As noted previously, funding was already in the BIP budget for the proposed 2007 Deck Overlay Project.[287]

The deck replacement scenario, the second option, involved (1) patching the existing deck as needed until 2012 for $15,000/year; (2) replacing the entire deck and strengthening the steel in 2012 for $15 million; and (3) replacing the Bridge in 2052 for more than $75 million.[288] Two of the "Pros" cited for the deck replacement scenario were that the deck replacement and steel strengthening would occur 5 to 10 years sooner than in the deck overlay scenario and it allowed time to acquire the funds to replace the Bridge.[289] Funding for the deck replacement work was not budgeted at the time of the April 3 meeting.

Shortly after the April 3 meeting, MnDOT e-mailed URS saying "it looks like we have two improvement options that are being considered that should be addressed in your final report."[290] The two options were the deck replacement and the deck overlay, with the e-mail acknowledging that although replacing the deck and adding deck continuity had been on track to be completed in the near future, the deck overlay option would put deck replacement on hold until 2017.[291]

To choose between these two options, a ground penetrating radar survey was needed to determine the actual integrity of the deck, which was "in question."[292] The results of the survey were to be compared with a similar survey in 1999 to establish the rate at which the deck was

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[286] MnDOT Meeting Minutes, April 3, 2006, App. Vol. III, Tab 125.
[287] Metro Division Bridge Investment Program FY 2007 Final Draft Revised, p. 2, priority sequence # 31, App. Vol. V, Tab 219.
[288] MnDOT Meeting Minutes, April 3, 2006, App. Vol. III, Tab 125.
[289] MnDOT Meeting Minutes, April 3, 2006, App. Vol. III, Tab 125.
[290] April 14, 2006 email from G. Peterson to D. Flemming, App. Vol. V, Tab 220.
[291] April 14, 2006 email from G. Peterson to D. Flemming, App. Vol. V, Tab 220.
[292] MnDOT Meeting Minutes, April 3, 2006, pp. 5-6, App. Vol. III, Tab 125.

deteriorating. The earlier survey found that 6% of the deck was "unsound."[293] The 2006 survey was to be completed no later than August 15th in order to have the results in hand when deciding between the deck overlay and the deck replacement options.[294] The cost to have a private firm perform the radar survey was estimated at $40,000.[295] It was noted that if MnDOT "could not conduct the ground penetrating radar survey," there was an opportunity to substitute a chain survey (commonly referred to as a "chain drag.")[296] However, the chain drag was considered "a last resort" since "the information from chaining is very inferior to the ground penetrating radar survey."[297]

Subsequently, the ground penetrating radar survey was called off. The explanation was given in an internal MnDOT email on June 16, 2006: "The Ground Penetrating Radar Survey (GPR) was not completed due to funding."[298] The inferior chain drag was conducted instead. Based on the information obtained from the chain drag showing little, if any, additional decomposition since the 1999 radar survey, the email states that the "preliminary recommendation" was to proceed with the deck overlay option.[299]

At a MnDOT meeting on July 12, 2006, a modified version of the deck overlay scenario was identified as the "Base 15 Year Bridge Investment Strategy."[300] Pursuant to this strategy, the deck overlay project would occur in 2007, with the full re-decking to occur in 2022 unless

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[293] 2006 Annual Bridge Inspection Report, p. 1, App. Vol. III, Tab 185; MnDOT Bridge Preservation Recommendations, p. 3, App. Vol. V, Tab 210. The Bridge Preservation Recommendations further note "There are more than 3000 linear feet of transverse cracks in the deck."

[294] MnDOT Meeting Minutes, April 3, 2006, p. 6 para. 5.4.5, App. Vol. III, Tab 125.

[295] MnDOT Meeting Minutes, April 3, 2006, p. 6, App. Vol. III, Tab 125.

[296] MnDOT Meeting Minutes, April 3, 2006, p. 6, para. 6, App. Vol. III, Tab 125.

[297] MnDOT Meeting Minutes, April 3, 2006, p. 6 para. 6, App. Vol. III, Tab 125.

[298] June 16, 2006 email re: Br. 9340 TH 35W over the Mississippi River investment strategy, App. Vol. V, Tab 221.

[299] June 16, 2006 email re: Br. 9340 TH 35W over the Mississippi River investment strategy, App. Vol. V, Tab 221.

[300] MnDOT Meeting Minutes, July 12, 2006, para 2.1, App. Vol. V, Tab 222.

there was an earlier decision to replace the Bridge.[301] The replacement decision needed to be made in 2012 to allow ten years to program funds and develop the project for construction in 2022.[302] If in 2012 it was decided not to replace the Bridge, the re-decking decision would need to be made in 2017 to allow five years to program funds and develop the project for construction in 2022.

The decision to proceed with the deck overlay -- in reliance on the chain drag results -- had at least two consequences. First, the full extent of the deck's sub-surface deterioration was not determined until the top two inches of concrete were removed from the deck at the start of the 2007 Overlay Project. Once this occurred, the inner portion of the deck was observed to be so deteriorated that an engineer from the Central Bridge Office was asked to make a visual inspection.[303] This led to a determination to remove more than the planned two inches of the concrete deck in several locations.[304] The ground penetrating radar survey was intended to detect the deeper concrete deterioration that was uncovered, but which went undetected by the chain drag.

Second, the decision to proceed with the 2007 Overlay Project deferred the redecking of the Bridge.[305] Unlike the 2007 Overlay Project which was considered to be a typical rehab project,[306] the redecking option recommended by URS served another purpose: It was designed to add redundancy to the Bridge.[307] The addition of a continuous composite deck was intended

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[301] MnDOT Meeting Minutes, July 12, 2006, para. 2.4, App. Vol. V, Tab 222.
[302] MnDOT Meeting Minutes, July 12, 2006, App. Vol. V, Tab 222.
[303] P. Kivisto Transcript, p. 62, App. Vol. I, Tab 12.
[304] B. Nelson Transcript, pp. 15-16, App. Vol. I, Tab 16.
[305] It should be noted that MnDOT continued to pursue the steel strengthening concept subsequent to deferring the deck replacement even though the two had been joined in the deck replacement scenario as originally proposed. $1.5 million had been allocated for the steel strengthening in the fiscal year 2008 BIP budget. The steel strengthening (retrofit) recommendation of URS is further discussed in Investigative Summary 7.
[306] E. Embacher Transcript, p. 47, App. Vol. I, Tab 6.
[307] D. Fleming Transcript, p. 77, App. Vol. I, Tab 30; E. Zhou Transcript, p. 32, App. Vol. I, Tab 33.

to improve the integrity of the bridge and reduce stresses.[308] The cost of the redecking (approximately $13 million) was, however, substantially greater than the overlay cost ($3.5 million).[309] While the $3.5 million was available in the Metro District's BIP budget, the $13 million needed for the deck replacement was not. That amount of money would take time to acquire. In the Fall 2006, when MnDOT definitively told URS that the redecking option "was not going to happen until 2020 or 2022 or something,"[310] URS expressed their preference for "replacing the bridge deck versus repairing it."[311] URS then accepted as "a given" that the deck replacement was not going to occur in the near future.[312] With this decision, an opportunity to strengthen the structural integrity by redecking the Bridge was lost, at least for the next fifteen years.

The availability of funding is almost always a factor in decision-making. Given limited funding, MnDOT sought to develop strategies for major rehabilitation work on the Bridge, and for its ultimate replacement. MnDOT is to be credited for doing so. Unfortunately, funding considerations deferred work on the Bridge that would have improved its structural integrity, not just maintain its drivability. *See* Conclusions 3 and 6.

9. MnDOT did not sufficiently consider the impact of the 2007 construction activities.

The 2007 Overlay Project included replacing expansion joints on the truss and approach spans as well as removing and replacing the top two inches of deteriorating concrete on the

[308] E. Zhou Transcript, pp. 31-32, App. Vol. I, Tab 33.
[309] MnDOT Meeting Minutes, July 24, 2006, paragraphs 2.3 and 2.1, App. Vol. II, Tab 37.
[310] D. Fleming Transcript, p. 78, App. Vol. I, Tab 30; E. Zhou Transcript, p. 38, Vol I, Tab 33.
[311] D. Fleming Transcript, p. 96, App. Vol. I, Tab 30.
[312] D. Fleming Transcript, p. 115, App. Vol. I, Tab 30.

bridge deck.[313] MnDOT contracted with PCI to do the work, which began in May 2007 and was ongoing at the time of the Bridge's collapse.[314] When the collapse occurred, construction vehicles and materials associated with the resurfacing were located in the two southbound lanes on the main span of the Bridge.[315] In total, four loads of coarse aggregate (gravel) and four loads of fine aggregate (sand) were located in the leftmost southbound lane just north of pier 6.[316] Construction workers further indicated that the aggregate piles had been pushed up against the center Bridge barrier sometime after 3:48 p.m. on the afternoon of the collapse.[317]

The NTSB has reconstructed the placement of every vehicle on the Bridge, as well as the placement of the construction equipment and materials.[318] The schematics developed by the NTSB show the placement of vehicles on the entire Bridge (along with the construction equipment and materials) and an enlargement showing just the main span of the Bridge.[319] The following a chart was also developed by the NTSB:[320]

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313 A. Ottman Transcript, pp. 58-59, App. Vol. I, Tab 19.
314 *Available at* http://www.dot.state.mn.us/i35wbridge/2007work/pci-award/1-100.pdf.
315 11/8/07 NTSB Modeling Group Study, Report No. 07-115, p. 2, Addendum E to this Report.
316 *Available at* http://www.ntsb.gov/dockets/Highway/HWY07MH024/default.htm.
317 *Id.*
318 *Id.*, Figures 1 and 1d.
319 Addendum E to this Report.
320 Addendum E, p. 13.

Summary of weight distribution on various parts of the bridge at the time of the collapse (lbs).				
	South of Pier 6	Center span between Pier 6 and Pier 7	North of Pier 7	TOTAL
Southbound Traffic	112,200	64,650	98,050	274,900
Southbound Closed lanes	41,900	578,735	91,691	712,326
Northbound Traffic	66,300	57,100	44,950	168,350
Northbound Closed lanes	104,750	0	0	104,750
TOTAL	325,150	700,485	234,691	1,260,326

This chart sets out the NTSB's calculation of the weight distribution on the Bridge when it collapsed. It shows that the total weight of the aggregate and construction equipment in the closed southbound lanes (578,735 lbs.) represented approximately 82% of the total weight (700,485 lbs.) on the center (main) span of the Bridge. The role that this weight concentration played in the Bridge's collapse, if any, has yet to be determined by the NTSB.

The URS study for MnDOT, discussed in preceding Investigative Summaries, included an analysis of the potential for unbalancing the loads on the Bridge during the deck replacement process.[321] Several scenarios were explored for avoiding placement of too great a weight load on one side of the Bridge which could potentially cause it to collapse.[322] The URS analysis may, or may not, have been relevant to the Bridge 2007 Overlay Project. The State Bridge Engineer did

[321] D. Dorgan comments to URS Draft Preliminary Report Executive Summary, App. Vol. V, Tab 200.
[322] URS Draft Preliminary Report, pp. 12-13, App. Vol. V, Tab 200.

not see it as germane.[323] In any event, the potential unbalancing of the Bridge was not taken into account in the design of the 2007 Overlay Project.

Design work relating to the Project was performed by MnDOT's design unit in 2005.[324] The design work plans were based on written recommendations prepared by the Regional Construction Engineer.[325] The bridge design unit leader did not analyze the impact of the construction activities on the Bridge, noting that because the work primarily involved removing and replacing the same amount of concrete, the project did not involve adding any weight to the Bridge.[326] Nor did the bridge design unit leader review where construction equipment and materials would be placed during the construction.[327] As a result, there were no "special provisions" written into the design plans pertaining to the placement of construction material and equipment during construction.[328] When the plans were completed, they were given to the Central Bridge Regional Construction Engineer and the State Bridge Engineer for their review and approval.[329] Once approved, the plans were included in the design package for the entire project, to go out to contractors for bids.[330]

If the construction plans for the Bridge Overlay Project had, in fact, contained "special provisions" from Central Bridge that dealt with how PCI should place materials on the Bridge, compliance with those special provisions would have been the responsibility of a Metro District senior engineering specialist.[331] Instead, the Metro District senior engineering specialist

[323] D. Dorgan Transcript (April 22, 2008), p. 70, App. Vol. I, Tab 5.
[324] A. Ottman Transcript, pp. 58-59, App. Vol. I, Tab 19.
[325] A. Ottman Transcript, p. 62, App. Vol. I, Tab 19.
[326] A. Ottman Transcript, p. 59, App. Vol. I, Tab 19.
[327] A. Ottman Transcript, pp. 59-60, App. Vol. I, Tab 19.
[328] B. Nelson Transcript, p. 19, App. Vol. I, Tab 16.
[329] A. Ottman Transcript, p. 63, App. Vol. I, Tab 19.
[330] A. Ottman Transcript, p. 63, App. Vol. I, Tab 19.
[331] Statement of L. Benjamin in B. Nelson Transcript, p. 21, App. Vol. I, Tab. 16.

assigned to the Overlay Project did not have any discussions with PCI about where they should place their construction materials on the Bridge.[332]

Once construction plans are turned over to a contractor, with or without special provisions, the specifications manual requires the contractor to "comply with legal load restrictions, and with any special restrictions imposed by the Contract."[333] More specifically, the specifications manual provides that "special restrictions may be imposed by the contract with respect to speed, load distribution, surface protection, and other precautions considered necessary."[334] With respect to the Overlay Project, no restrictions were incorporated into MnDOT's contract with PCI that restricted the placement of construction equipment or materials on the Bridge during construction.[335]

The construction for the 2007 Overlay Project was coordinated out of the Metro District's Mendota Heights construction office.[336] Prior to putting the Project out to bid, the construction office conducted a constructability review with various contractors to determine how the 2007 Overlay Project might proceed. The purpose of a constructability review is to learn from contractors how they would approach a project. The construction office does not recall whether Central Bridge was invited, but proceeded with the constructability review without the presence of Central Bridge, despite its years of specialized study of the Bridge.[337]

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[332] B. Nelson Transcript, p. 23, App. Vol. I, Tab 16.
[333] MnDOT's Standard Specifications, Section 1513, App. Vol. V, Tab 231.
[334] *Id.*
[335] B. Nelson Transcript, p. 19, App. Vol. I, Tab 16.
[336] E. Embacher Transcript, pp. 10-11, App. Vol. I, Tab 6.
[337] E. Embacher Transcript, pp. 44-45, App. Vol. I, Tab 6.

Once the 2007 Overlay Project contractor was chosen, the Mendota Heights construction office held a kick-off meeting for the contractors and others involved in the project. Central Bridge staff were invited to this meeting, but did not attend.[338]

While both URS and Central Bridge had extensive knowledge about the need to keep the truss load on the Bridge in balance, URS was not involved in the Overlay Project[339] and OBS had limited involvement once the design plans were completed. *See* Conclusions 4 and 5.

[338] Pre-con Invite List with attached Attendance Record, App. Vol. 5, Tab 226.
[339] D. Dorgan Transcript (April 22, 2008), p. 70, App. Vol. I, Tab 5; E. Embacher Transcript, p. 34, App. Vol. I., Tab 6; B. Nelson Transcript, pp.18-19, App. Vol. I, Tab 16.

OBSERVATIONS ABOUT MnDOT'S LEADERSHIP AND ORGANIZATION

A. Introduction.

As part of our investigation, we interviewed Governor Tim Pawlenty (2003 - present), and former Governors Arne Carlson (1991 - 1999), Al Quie (1979 - 1983), and Wendell Anderson 1971 - 1976). They represent four of the five surviving Governors whose administrations occurred during the life of the Bridge. We attempted to interview Governor Jesse Ventura (1999 - 2003), but he was out of the country and unavailable for interview prior to the time we completed the interview stage of our investigation.

Gray Plant Mooty also interviewed the recently appointed Commissioner of Transportation, Thomas Sorel; then acting Commissioner Robert J. McFarlin (2008) and five former Commissioners of Transportation who served during the life of the bridge: Lieutenant Governor Carol Molnau (2003 - 2008), Elwin Tinklenberg (1999 - 2003), James Denn (1991 - 1999), Len Levine (1987 - 1991), and Richard Braun (1977 - 1987).

B. Leadership.

The former Governors and Commissioners of Transportation offered opinions regarding issues that have been raised about the structure and leadership of MnDOT. They were unanimous in the view that the Commissioner did not have to be an engineer. The most important qualities, they said, are that the Commissioner be a good leader, manager and advocate for the Department. If the Commissioner was a good leader and manager who also happened to be an engineer, that would be a plus. But an engineering background, in their opinion, was not a necessary requirement for the position. We agree with that conclusion.

All of the former Commissioners of Transportation, prior to Lieutenant Governor Molnau, were in agreement that engineering expertise was essential in one of the top three positions in the Department--Commissioner, Deputy Commissioner or Assistant to the Commissioner. They felt that it was essential that engineering expertise at that level be available to the Commissioner in making management and operational decisions in the Department. Lieutenant Governor Molnau did not agree with that view, and she noted that she did not have an engineer in the Deputy or Assistant to the Commissioner positions after Doug Differt left the Department in late 2006. In explaining why she replaced Doug Differt with a nonengineer, Lt. Governor Molnau said she considered the Deputy position as primarily a communications and management position that did not necessarily have to be filled by an engineer. She noted that she had three engineers among the five heads of her operating divisions and that they worked collegially and acted as the senior management team for the Department.

Governor Pawlenty agreed with the view that technical engineering expertise should be available in the executive management of the Department, and he felt it need not be reflected in one of the top three positions. He noted that the original leadership of the Department during his administration was constituted by Lt. Governor Molnau as Commissioner and Doug Differt, an engineer, as Deputy Commissioner. After Mr. Differt's departure from the Department in late 2006, the Deputy Commissioner position was filled by a nonengineer, but the Governor believed that was appropriate if the engineering expertise was otherwise available to the Commissioner in the executive management of the Department.

We agree with the four former Commissioners of Transportation who believe that it is essential to have one of three top positions in the Department held by an engineer. Not only would that ensure that the Commissioner has ready access to that expertise in making day-to-day operational decisions, but it would also assure the engineers in the Department that their professional judgments are considered in the decisions made at the most senior level of the

Department. That assurance is important to encourage the engineers to advance their professional judgments even if they are in conflict with current Administration policy. During the last few weeks, there have been significant leadership changes in the Department. Currently, the Commissioner and Deputy Commissioner are engineers and the Deputy Commissioner has been appointed the Chief Engineer.

All the Governors and Commissioners were of the view that if the Department has a qualified leadership team with competent engineering expertise, very rarely should decisions involving bridge safety require involvement by the Governor. We agree.

The two former Governors interviewed who served after the Department of Transportation was established in 1976 and all former Commissioners of Transportation (prior to Lieutenant Governor Molnau) unanimously agreed that it is inappropriate for a statewide elected official to serve as Commissioner of Transportation. The view was expressed in varying but consistent language:

- As a huge mistake that would be expected to cause the professional staff to hunker down and be reluctant to express professional judgment at variance with the political position of the State official;
- As sending the wrong message to the MnDOT professional staff;
- As inhibiting in the MnDOT staff in the exercise of their professional judgment, out of concern for their careers if they were to speak out

One former Governor believed the legislature shared in the responsibility for allowing a political office holder to serve as Commissioner. That former Governor said that ultimately the Senate has the responsibility through its power of confirmation to determine who serves as Commissioner. He felt that the Senate should insist that there be a confirmation hearing within a specified time after an appointment. In his view, that would further professionalize the appointment process.

We make no conclusions on whether or not a statewide elected official should concurrently serve as Commissioner of Transportation, because the subject involves political judgments which are incompatible with the scope and intent of this Report. We do note that the subject could be debated in future Senate confirmation proceedings, along with whether any potential conflict of interest issues could arise if a Commissioner were also a statewide elected official.

C. **Review of Department Organization.**

The Department has had various organizational structures during the years since its creation in 1976. The changes in Department organization have often been occasioned by the resignation or retirement of a senior staff person, and the need to determine where the employees formerly reporting to the departed head should now report. Optimal organizational structure is impacted by the number of employees in the Department, and from fiscal year 2001 to 2007, the number of Department staff declined by 19%.[340] The number of Department professional and paraprofessional engineering staff declined by about 16% between fiscal years 2002 and 2007.[341] In part this is due to the fact that the number of engineers nationally has declined and the competition for hiring and retaining engineers is increasing. The Department and other similar departments around the country have lost engineers to more lucrative or interesting positions in the private sector. In the course of our interviews, MnDOT personnel reported anecdotally and

[340] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, p. 20.
[341] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, p. 21.

off-the-record that the agency has lost substantial administrative infrastructure support, which has placed a greater burden on the professional staff to perform administrative and clerical tasks.

How the Department is structured also affects the amount of work the Department needs to out-source. Over time, the Department has out-sourced more of its design and construction projects to the private sector and some of the attraction of being a Department engineer and actively involved in large construction projects has been diminished. One of the former Commissioner's cautioned about the need to find the right balance between the amount and type of work that is retained by the Department and what is out-sourced. That former Commissioner believed the Department must have in-house strength and expertise to do its own work and review the selection and work of outside consultants. One former Commissioner noted that some states went to a policy of outsourcing a majority of work during the time he was commissioner and that was a mistake. That former Commissioner later was invited to Scandinavia to advise them on how to extricate themselves from an over reliance on consultants.

It has been many years since an organizational review of the Department has occurred and given the foregoing developments and the appointment of a new Commissioner this year, we believe this is an appropriate time for a fresh look at the Department organization to determine how it might most effectively carry out its general responsibilities, including the specific responsibility to maintain and repair the bridge infrastructure in the State. We make several specific recommendations regarding an organizational review that provides, at least in part, an active role for the Legislature. We also recommend MnDOT develop a plan to ensure the continued recruitment and retention of expert senior management for the Department and that an adequate number of engineers are employed by the Department to carry out its mission. We note that many people have commented on the low morale that currently exists in the Department and that issue also should be examined.[342]

Such a review should address issues such as whether a formal policy should be established to make safety concerns with respect to certain critical bridges subject to greater scrutiny by identified senior Department officials, and whether a policy should be established on the use of outside consultants by the Department in proving advice regarding bridge safety and in the maintenance and repair of bridges.

In his report earlier this year, the Legislative Auditor commented on the need for better communication between the Department and the Legislature and we would recommend an annual progress report from the Department to the Legislature on matters identified in the Legislative Auditor's report and on other matters identified by the organizational review. The Legislature should consider requesting the annual progress report to: (1) list all of the fracture critical bridges that have received a NBI condition rating of 4 or less during that year; (2) a specific written plan to improve or replace all fracture critical bridges that have received a NBI condition rating of 4 or less for two or more consecutive years; and (3) a summary of reports and recommendations from consultants who have provided significant services on bridge safety matters including a status report on the Department's implementation of the recommendations.

D. Centralization of Fracture Critical Bridge Inspections.

As discussed above, although fracture critical inspections are, as a matter of policy, the responsibility of Central Bridge, fracture critical inspections performed in the Metro District and District 6 (Rochester) are performed by fracture critical bridge inspectors who work out of those Districts. As a matter of Central Bridge policy, fracture critical bridge inspection reports are

[342] B. Farraher Transcript, p. 64, App. Vol. I, Tab 7.

required to be reviewed by Central Bridge for adequacy and completeness, but we found that this policy was not always followed for Metro District fracture critical bridges.

Bridge inspections are identified as a top priority of the Department and Central Bridge would prefer to retain its practice of establishing centralized expertise for fracture critical inspections.[343] The quality and accuracy of bridge inspections are critical components to ensuring the safety of bridges. Central Bridge contains staff that is trained in specialized "nondestructive" inspection techniques used on fracture critical bridges, including ultrasonic testing, dye penetration, and magnetic particle testing.[344] All but one of the District Offices do not have staff with such specialized "nondestructive" inspection techniques and the Metro District is not staffed to use all of these techniques.[345]

As part of the recommendation that the legislature review the Department's organizational structure relative to bridge inspection, maintenance and replacement, we encourage the Department to consider further centralization of fracture critical inspections in Central Bridge, by requiring all fracture critical bridge inspectors be under the authority of and report to Central Bridge. The potential benefits of this approach are: (1) build and maintain specialized inspection expertise; (2) clarify that the inspection function is to be conducted as objectively as possible and the findings and conclusions are not to be influenced by District operations and funding; (3) increase the consistency of inspections; (4) provide better information flow and oversight of inspections and less confusion on responsibilities and authority between Central Bridge and the District Offices; (5) more available inspectors which increases the ability to expedite the inspection process and reduces the time that traffic

[343] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, p. 53.
[344] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, p. 53.
[345] Office of the Legislative Auditor Evaluation Report of State Highways and Bridges, February 2008, p. 53.

restrictions are needed; (6) planned rotation of inspectors for each bridge allows greater ability to have inspection teams that combine team members with historical knowledge of the particular bridge with team members who have haven't inspected that bridge each year and bring "fresh eyes" to the inspection process; (7) better opportunities for formal and informal training of all inspection team members; (8) increased accountability by having all fracture critical inspectors reviewed by individuals with specialized expertise in this area; (9) direct access of all inspectors to individuals trained in specialized "nondestructive" inspection techniques; (10) enhanced opportunities for recruitment and hiring of quality inspectors; (11) given the oral culture of the Department, improved sharing of information and ideas; and (12) less disruption caused by the departure of experienced inspectors.

RECOMMENDATIONS

1. **The Minnesota Legislature should consider enacting the following laws:**

    a. Amending Minn. Stat. 174.02, subd. 2 to require that at least one of the four unclassified positions appointed by the Commissioner of Transportation be a registered professional engineer.

    b. Amending Minn. Stat. 174.01, subd. 2 (9) to include as a goal of the state transportation system "to provide funding for transportation that, at a minimum, preserves the transportation infrastructure <u>with highest priority given to the repair or replacement of fracture critical bridges rated in "poor" condition</u>.

    c. Amending Minn. Stat. 165.03 to require:

        i. Annual in-depth inspections of all fracture critical bridges; and

        ii. Inclusion of a repair or replacement plan for all bridges with fracture critical numbers that are rated in "poor" condition for two or more consecutive years in the annual bridge report prepared by county and municipal governments.

2. **The Minnesota Legislature should consider the following appropriation measures:**

    a. Developing a centralized emergency funding source for major bridge rehabilitation and replacement projects (such as by providing advance authorization for the issuance of state bonds upon the closure of a major trunk highway bridge).

    b. Funding for MnDOT to develop a plan for successful recruitment and retention of an adequate number of experienced senior management and professional engineers, with particular emphasis on fracture critical bridge inspection engineers.

    c. Funding for MnDOT to retain a qualified consulting firm to audit compliance with the provisions of the Department's Quality Control/Quality Assurance Plan relating to the inspection, maintenance, rehabilitation and replacement of fracture critical bridges.

3. **The Minnesota Legislature should ensure that it is fully informed about:**

    a. The Legislature's role in communicating and maintaining bridge safety as a top infrastructure preservation priority at a time when there is high demand for other transportation services and projects, including new construction.

b. The adequacy of MnDOT's Quality Control/Quality Assurance Plan, particularly the manner in which the Plan sets out decision-making responsibility and provides for the training and oversight of inspectors and their supervisors.

c. The relationship between MnDOT's central administration and the Metro District's bridge inspection, reporting, maintenance and repair functions, particularly with respect to:

   i.. Whether the inspection function for fracture critical bridges should become the sole responsibility of the Office of Bridges and Structures for all MnDOT districts;

   ii. Whether a specific person within MnDOT should have sole responsibility for ensuring that all maintenance and repair issues identified in inspection reports for fracture critical bridges are appropriately and timely addressed and, if so, whom; and

   iii. Whether fracture critical bridges rated in "poor" condition should be subject to greater scrutiny by a senior MnDOT official and, if so, by whom.

4. The Minnesota Legislature should request:

a. The Federal Highway Administration to gather information on all major bridge deficiencies, as they become known, and to share the information with all state departments of transportation to assure systematic and timely incorporation of newly discovered safety concerns into state bridge inspection practices.

b. MnDOT to review the procedures it follows in disseminating information regarding new developments on bridge safety, including the internal dissemination of its own polices and practice manuals.

c. MnDOT to submit an annual report to the Governor and Legislature (i) identifying all fracture critical bridges in the state rated in "poor" condition along with a specific plan for repairing or replacing each bridge; (ii) summarizing the recommendations from consultants who have provided significant services on bridge safety and inspection matters during the year, with a status report on the Department's implementation of the recommendations; and (iii) summarizing implementation of the recommendations identified in the Legislative Auditor's report.

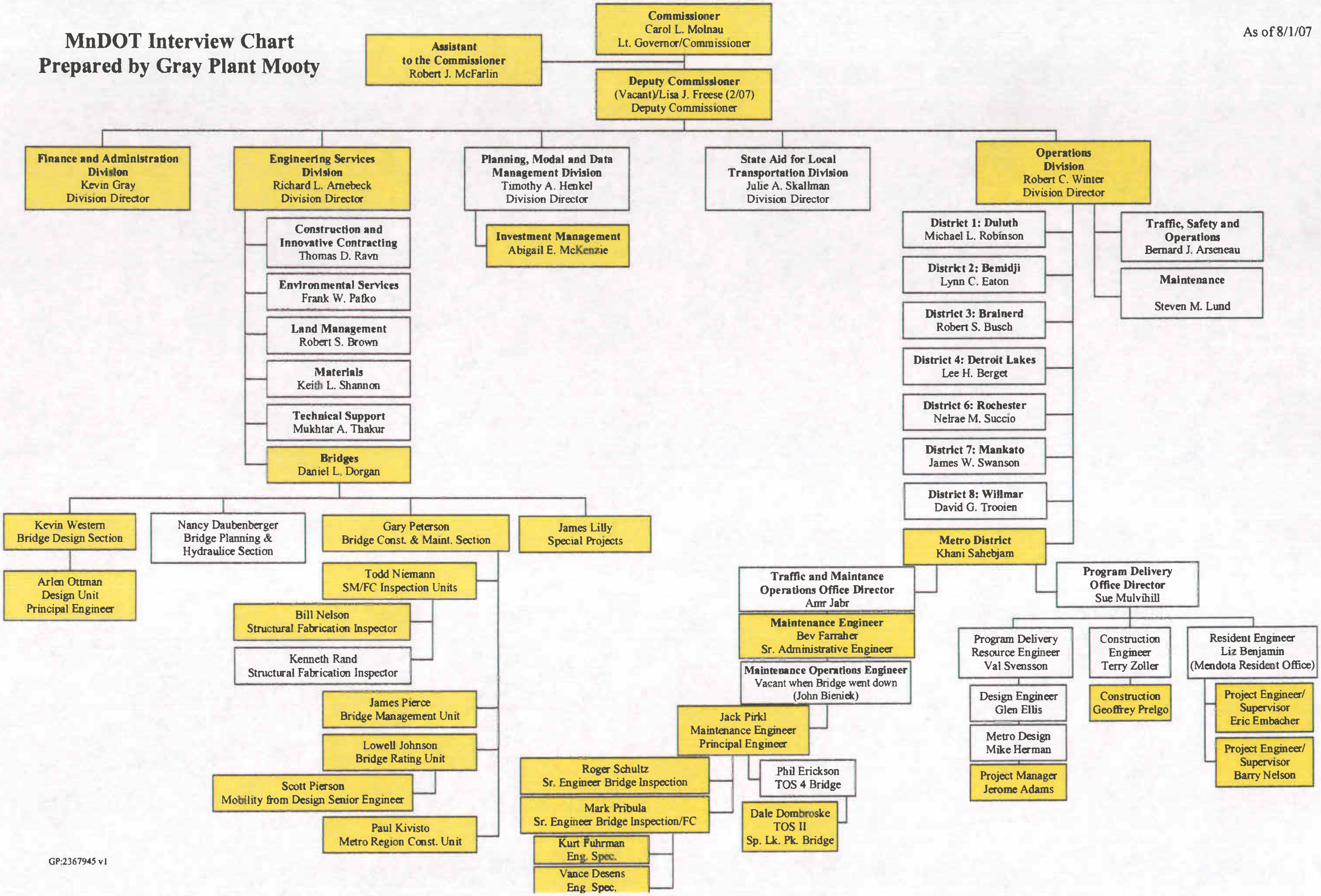
d. MnDOT to review its criteria for initiating load re-rating analyses on fracture critical bridges and its use of bridge inspection findings in such analyses.

ADDENDUM

A

MnDOT Interview Chart
Prepared by Gray Plant Mooty

As of 8/1/07



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B

Minnesota Department of Transportation

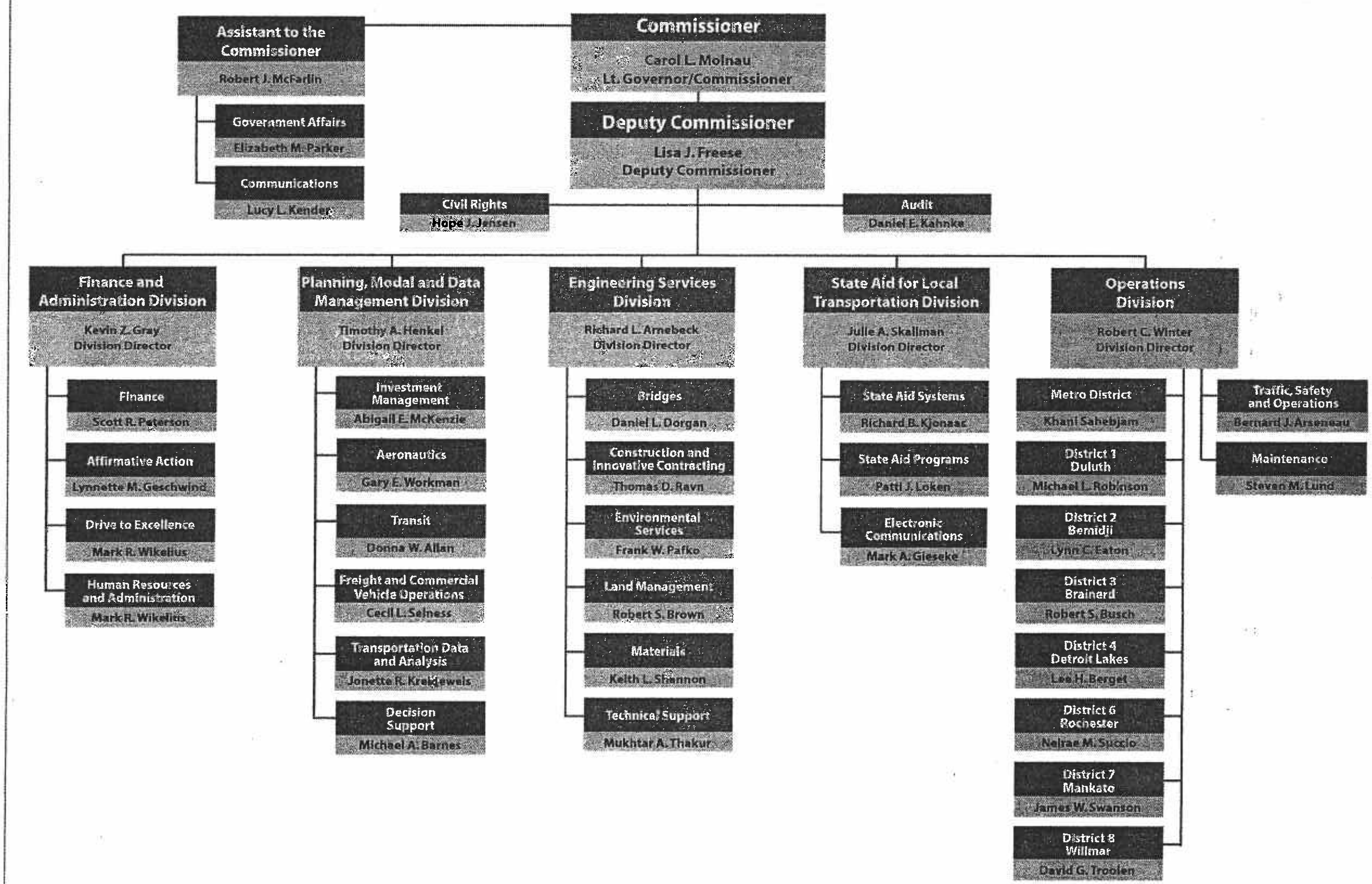


EXHIBIT NO. 3
Date: 3-27-08

BRIDGE OFFICE

Management	APSCNE
MnSEC	
MAPE	Commissioner's Plan

- **Daniel Dorgan (00195130)** — STATE BRIDGE ENGINEER, Princ. Admin. Engr. Mgmt., 451040
  - Lisa Gaughan — Administrative Secretary Supervisor
    - Georgia Herce (00112719) — Transportation Generalist Sr., 419880
    - Pat Harvell (00452548) — Office & Admin. Specialist, 1003872
    - Khatija Khan (01093907) — Office Specialist, 1068697
  - **Kevin Western (00049147)** — BRIDGE DESIGN SECTION, Sr. Admin. Engineer Mgmt., 451000
    - Duane Green (01021632) — DESIGN UNIT, Principal Engineer
    - Keith Molnau (00546387) — DESIGN UNIT, Principal Engineer, 450800
    - Manjula Louis (00669912) — DESIGN UNIT, Principal Engineer
    - Khalvya Lin (01016889) — SPECIAL ASSIGNMENTS, Principal Engineer, 450540
    - Arlen Ottman — DESIGN UNIT, Principal Engineer, 450950
    - Dave Dahlberg (00504760) — LRFD IMPLEMENTATION, Principal Engineer, 450960
    - Steve Ellis — DESIGN UNIT, Principal Engineer, 450910
    - David Conkel (01008103) — STATE AID BRIDGE UNIT, Principal Engineer, 450890
  - **Nancy Daubenberger (01030179)** — BRIDGE PLANNING & HYDRAULICS SECTION, Sr. Admin. Engineer Mgmt., 451030
    - Robert Miller (00334631) — AGREEMENTS, PERMITS, PROGRAM & ESTIMATES UNIT, Principal Engineer, 451010
      - Jeff Southward (00273180) — Detailing Unit, Senior Engineering Specialist, 450470
    - Tom Styrbicki — PRELIMINARY PLANS UNIT, Administrative Engineer Professional
    - Andrea Hendrickson — HYDRAULIC UNIT, Administrative Engineer Professional, 448850
      - Petra DeWeese — BRIDGE WATERWAY UNIT, Principal Engineer, 449540
  - **Gary Peterson** — BRIDGE CONST. & MAINT. SECTION, Sr. Admin. Engineer Mgmt., 451020
    - Thomas Merritt (00417668) — FABRICATION METHODS UNIT, Principal Engineer, 450980
    - Todd Niemann — INSPECTION UNIT, Administrative Engineer Professional
    - James Herce (00433828) — BRIDGE MANAGEMENT UNIT, Principal Engineer
    - Lowell Johnson (00188816) — BRIDGE RATING UNIT, Principal Engineer, 450710
    - Paul Rowekamp (00203327) — NORTH REGION CONST. UNIT, Administrative Engineer Professional
    - Bruce Irish — SOUTH REGION CONST. UNIT, Principal Engineer, 403350
    - Paul Kivisto (00352674) — METRO REGION CONST. UNIT, Principal Engineer, 449280
  - **James Lilly (00065191)** — SPECIAL PROJECTS, Sr. Admin. Engineer Mgmt., 424840
    - Erik Wolhowe — BRIDGE STANDARDS UNIT, Principal Engineer
    - Vacant () — INFO RES MGMT. UNIT, ITS 4

Page 1 of 5
April 17, 2007

BRIDGE OFFICE
Bridge Design Section

- **Kevin Western (00049147)** – BRIDGE DESIGN SECTION – St. Admin. Engineer Mgmt. (451000)
- **Jihshya Lin (01016889)** – SPECIAL PROJECTS – Principal Engineer (450840)
- **Joseph Campbell (01057197)** – Mobility to OCIC – Senior Engineer (270890)

Duane Green (01021632) – DESIGN UNIT – Principal Engineer (450900)
- Paul Stenberg (01029744) – Senior Engineer (450730)
- Shalini Chandra (01097088) – Grad Engineer 2 (00944720)
- Dave Houghton (00430439) – Engineering Specialist (452150)
- Jeanne Brown (00283348) – Architectural Drafting Tech 3 (450560)
- Cary Gries (01021332) – Architectural Drafting Tech 3 (450300)
- James Rohleder (01083356) – Transportation Generalist (1015345)

Keith Molnau (00546387) – DESIGN UNIT – Principal Engineer (450800)
- Paul Kettleson (01095607) – Senior Engineer (01017816)
- Moises Dimaculangan (01035495) – Grad Engineer 2 (01060338)
- Jerome Jilk (00200259) – Engineering Specialist (450530)
- Kenneth South (00524533) – Architectural Drafting Tech 3 (450040)
- Pedro Fonseca (01062030) – Architectural Drafting Tech 3 (450360)
- Bereket Merzi (01094916) – Architectural Drafting Tech 2 (1009838)

Manjula Louis (00669912) – DESIGN UNIT – Principal Engineer (01012034)
- Dustin Thomas (01035408) – Senior Engineer (1064028)
- Amber Blanchard (01026525) – Senior Engineer (983730)
- Marilyn Kleser (00376346) – Engineering Specialist (450480)
- Leonard Bames (00684744) – Architectural Drafting Tech 3 (211330)
- Craig Slavik (01029762) – Architectural Drafting Tech 2 (199140)
- Besrat Negatu (01041802) – Architectural Drafting Tech 3 (211320)
- Noushin Armanfar (01093781) – Architectural Drafting Tech 2 (452130)

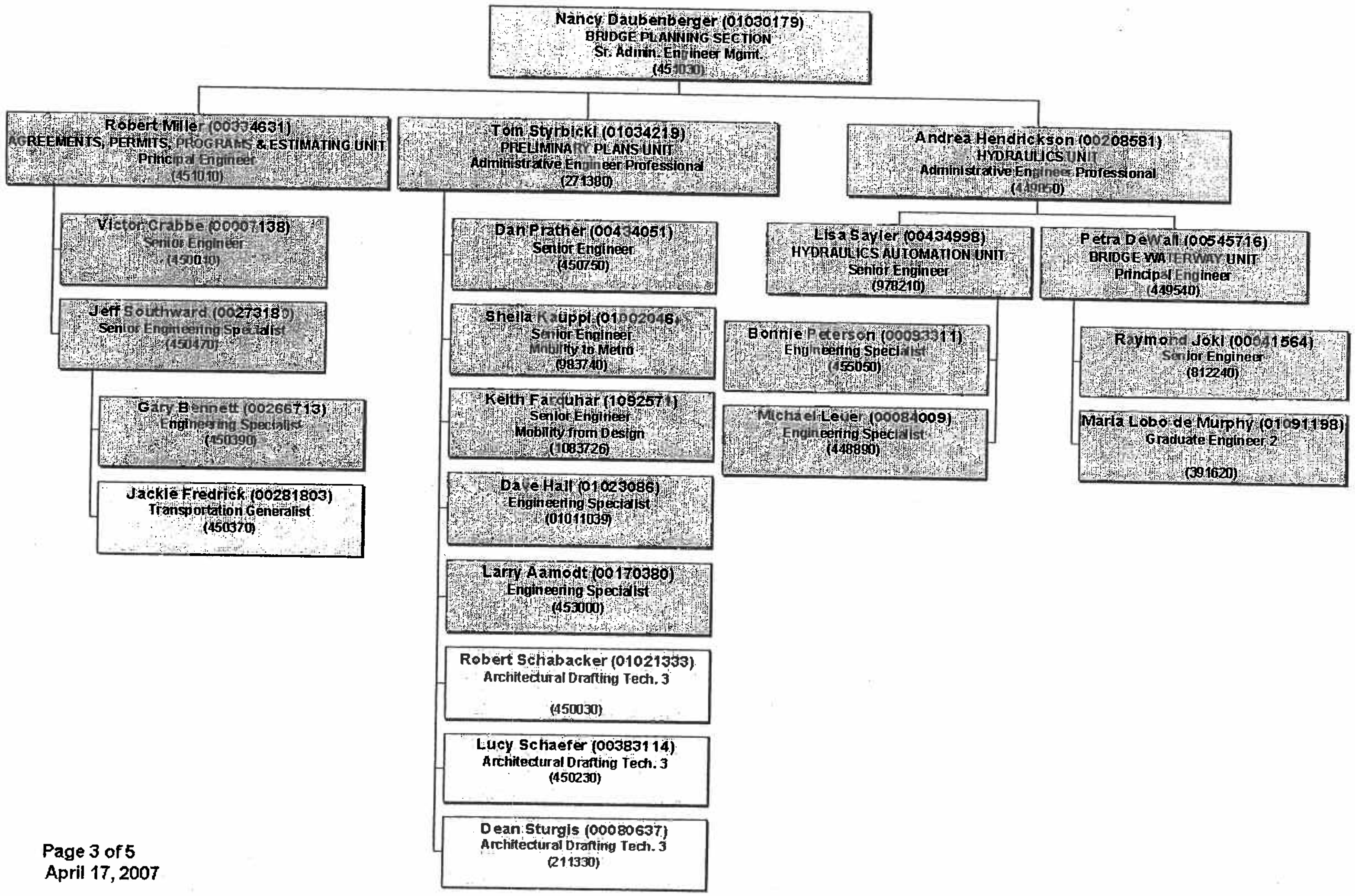
Steve Ellis (00045310) – DESIGN UNIT – Principal Engineer (450910)
- Erik Rustad (01003581) – Senior Engineer (365300)
- Joe Fishbein (01063136) – Senior Engineer (450600)
- Nancy Levine (00041760) – Engineering Specialist (450420)
- Richard Buettner (00266973) – Architectural Drafting Tech 3 (450320)
- L. Karen Land (01005217) – Architectural Drafting Tech 3 (211370)
- Trumaine Lindsey Sr. (01041286) – Transportation Generalist (450270)

Arlen Ottman (00470788) – DESIGN UNIT – Principal Engineer (450950)
- Angel Staples (01002621) – Senior Engineer (01005452)
- Paochen Mma (00351862) – Senior Engineer (450860)
- Robert Hawkinson (00299153) – Engineering Specialist (450220)
- Bee Thao (01025446) – Architectural Drafting Tech 3 (450020)
- Allen Drexler (01024144) – Architectural Drafting Tech 3 (211350)
- Dave Kilian (01061389) – Architectural Drafting Tech 2 (450460)

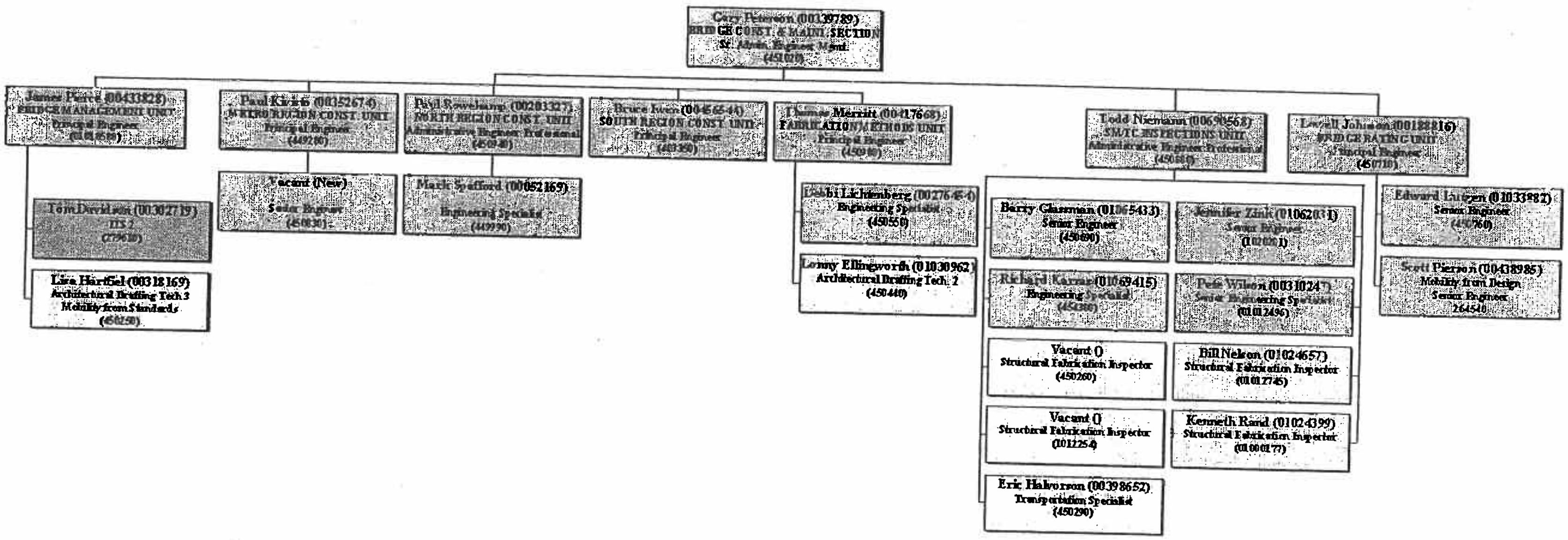
Dave Conkel (01008103) – STATE AID BRIDGE UNIT – Principal Engineer (450890)
- Brian Homan (00706383) – Senior Engineer (450820)
- Steve Brown (00137453) – Engineering Specialist (1082247)

David Dahlberg (00504760) – LRFD Implementation – Principal Engineer (450960)
- Yihong Gao (01040833) – Mobility from Research – Senior Engineer (450680)

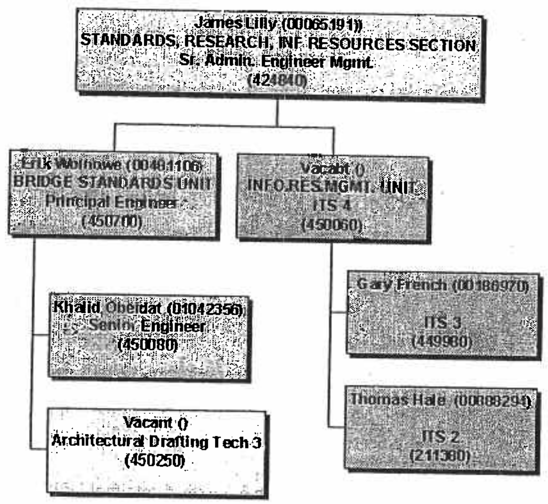
BRIDGE OFFICE
Bridge Planning & Hydraulics Section



BRIDGE OFFICE
Bridge Construction & Maintenance Section



BRIDGE OFFICE
Bridge Standards, Research, Information Resources Section



April 17, 2007

C

Glossary of Significant Bridge Terms

Bearing - a support element transferring loads from superstructure to substructure while permitting limited movement capability

Critical deficiencies - in the context of a bridge inspection, refers to a defect that might cause severe damage to or collapse of a bridge

Deck - that portion of a bridge which provides direct support for vehicular and pedestrian traffic

Diaphragm - a member placed within a member or superstructure system to distribute stresses and improve strength and rigidity

Expansion joints - a joint designed to provide means for expansion and contraction movements produced primarily by temperature changes

Fatigue - a material response that describes the tendency of a material to break when subjected to repeated loading; fatigue failure occurs after a certain number and magnitude of stress cycles have been applied; each material has a hypothetical maximum stress level to which it can be loaded and unloaded an infinite number of times

Fracture critical member - a member in tension or with a tension element whose failure would probably cause a portion of or the entire bridge to collapse

Girder - A girder is a support beam used in construction

Gusset - a plate which connects the members of a structure and holds them in correct position at a joint

Joint - a device connecting two or more adjacent parts of a structure

Load - the weight carried by a structure, including its live load (vehicular and pedestrian traffic) and its dead load

Load rating - an office exercise to determine the ability of a bridge to carry load based on the conditions reported by an inspector

Member - an individual angle, beam, plate, or built piece intended ultimately to become an integral part of an assembled frame or structure

Nondestructive testing "NDT" - comprising those test methods used to examine an object, material or system without impairing its future usefulness, e.g. magnetic particle testing and ultrasonic testing

Redundancy - redundancy of a bridge substructure is defined as the capability of the substructure system to continue to carry loads (vertical and lateral) after the failure of any of its components

Section loss - loss of a member's cross sectional area usually by corrosion or decay

Span - section of superstructure between supports; the span is the length between supports

Substructure - the abutments, piers, or other constructions built to support the span of a bridge superstructure

Superstructure - the entire portion of a bridge structure which primarily receives and supports traffic loads and in turn transfers these loads to the bridge substructure

Truss - a jointed structure made up of individual members arranged and connected usually in a triangular pattern, so as to support longer spans

Truss bridge - a bridge having a pair of trusses for a superstructure

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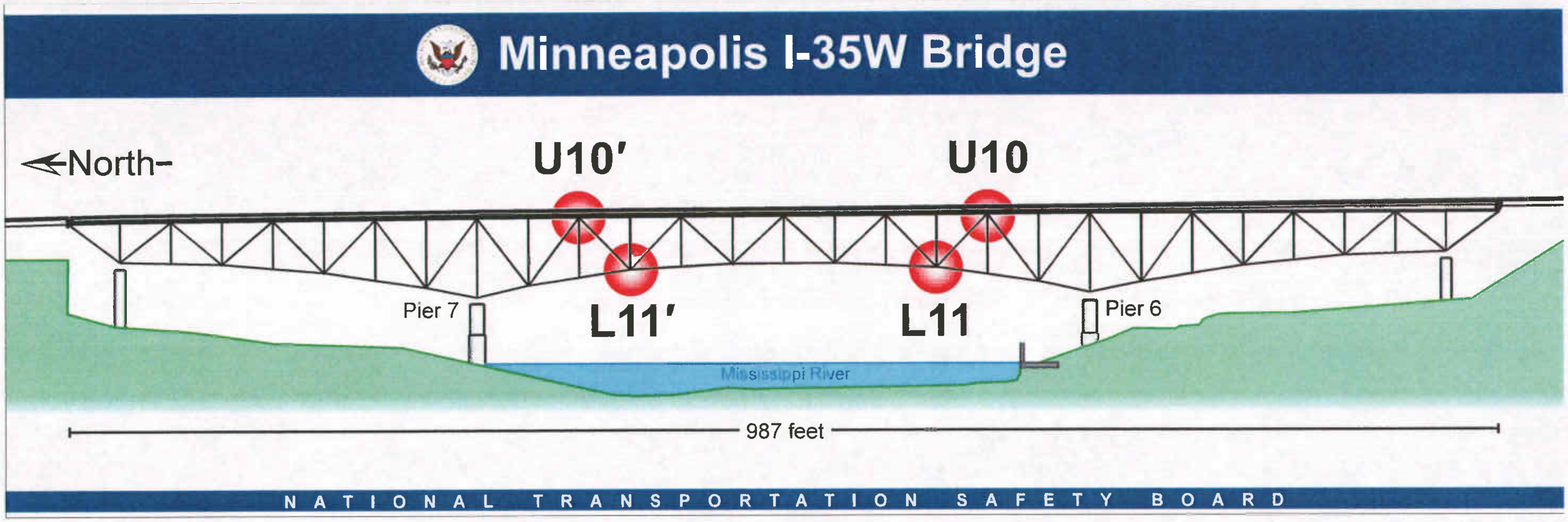
Sources:

- http://www.dot.state.mn.us/i35wbridge/pdfs/bridgenspectiondefs.pdf;
- http://projects.dot.state.mn.us/35wbridge/pdfs/GlossaryOfBridgeTerms.pdf;
- http://www.pbs.org/wgbh/buildingbig/glossary_head.html
- http://www.dot.state.mn.us/bridge/Manuals/Construction/Chapter700.pdf

D

NTSB Diagram and Pictures, available at
http://www.ntsb.gov/dockets/Highway/HWY07MH024/default.htm



A view of the west side of the deck truss portion of the bridge, looking northeast.

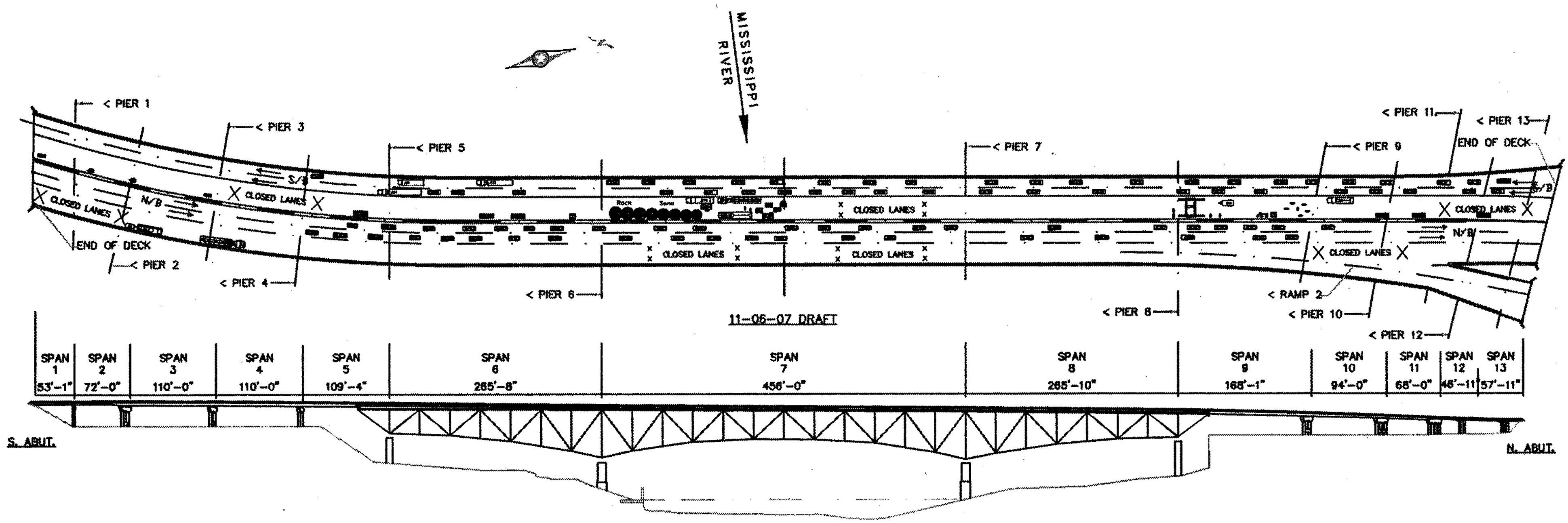
A view of the east side of the deck truss portion of the bridge, looking northwest.

Overhead view to the northeast on the day of the accident.

Overhead view to the east on the day of the accident.

E

Figure 1a - Scale Diagram of Pre-Collapse Bridge



NTSB Diagram and Pictures, available at
http://www.ntsb.gov/dockets/Highway/HWY07MH024/default.htm

Figure 2 – Construction Staging Area

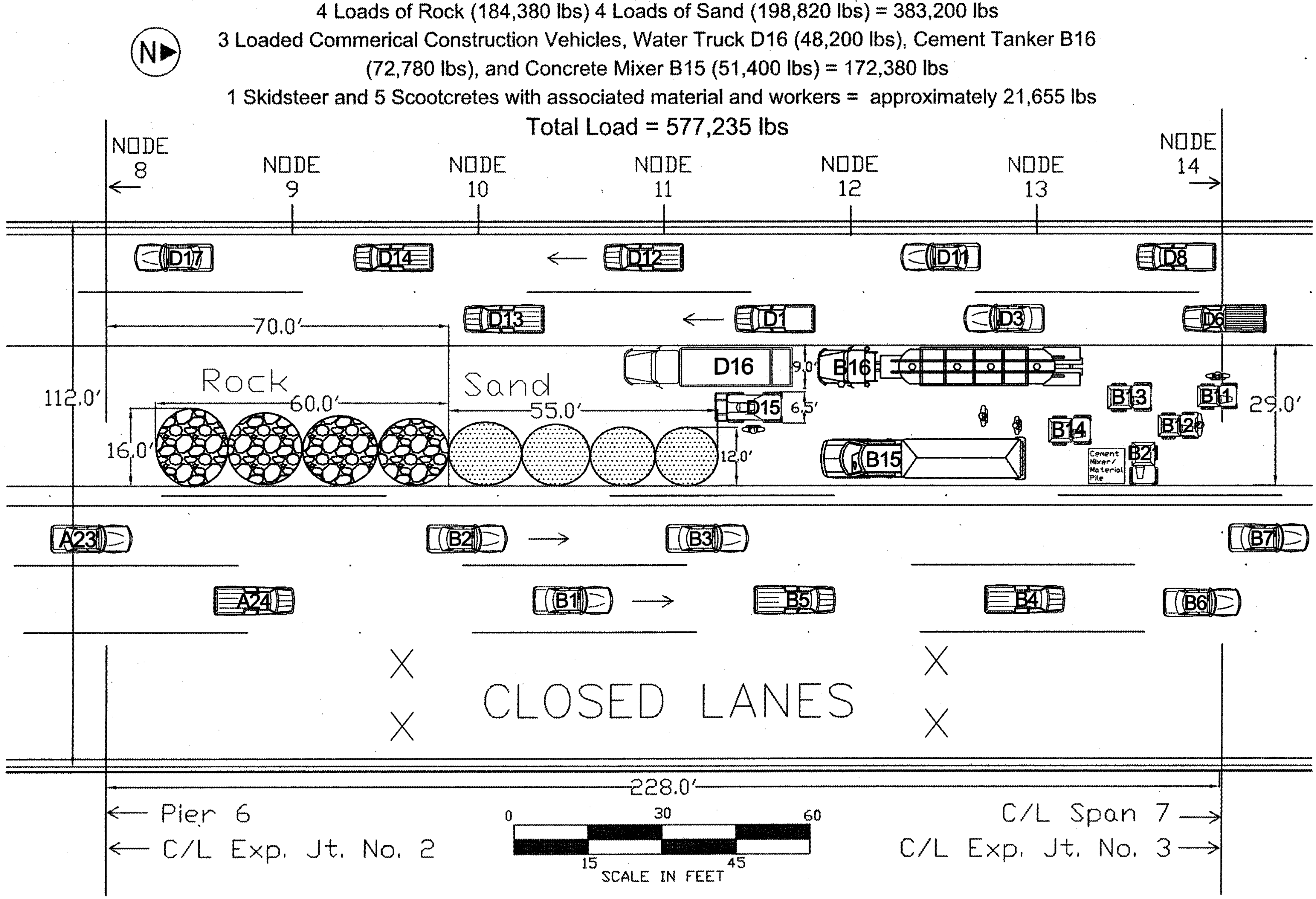
Construction Material Staging on Center Span Truss

4 Loads of Rock (184,380 lbs) 4 Loads of Sand (198,820 lbs) = 383,200 lbs

3 Loaded Commerical Construction Vehicles, Water Truck D16 (48,200 lbs), Cement Tanker B16 (72,780 lbs), and Concrete Mixer B15 (51,400 lbs) = 172,380 lbs

1 Skidsteer and 5 Scootcretes with associated material and workers = approximately 21,655 lbs

Total Load = 577,235 lbs



F

INDICES FOR APPENDIX VOLUMES I-V

APPENDIX Volume I

Recorded Interviews by Special Counsel

Tab Number	*Recorded Interviews*	*Date of Interview*
1	Adams, Jerome (MN/DOT)	3/21/2008
2	Arnebeck, Richard (MN/DOT)	3/20/2008
3	Desens, Vance (MN/DOT)	4/18/2008
4	Dombroske, Dale (MN/DOT)	3/20/2008
5	Dorgan, Daniel (MN/DOT)	2/29/2008; 4/22/2008; 5/2/2008
6	Embacher, Eric (MN/DOT)	4/14/2008
7	Farraher, Beverly (MN/DOT)	3/24/2008
8	Freese, Lisa (MN/DOT)	4/21/2008
9	Fuhrman, Kurt (MN/DOT)	3/24/2008
10	Gray, Kevin (MN/DOT)	4/10/2008
11	Johnson, Lowell (MN/DOT)	4/21/2008
12	Kivisto, Paul (MN/DOT)	3/27/2008
13	Lilly, James (MN/DOT)	3/28/2008
14	McFarlin, Robert (MN/DOT)	4/18/2008
15	McKenzie, Abigail (MN/DOT)	5/2/2008
16	Nelson, Barry (MN/DOT)	4/14/2008
17	Nelson, Bill (MN/DOT)	4/21/2008
18	Niemann, Todd (MN/DOT)	3/31/2008
19	Ottman, Arlen (MN/DOT)	3/26/2008
20	Peterson, Gary (MN/DOT)	4/2/2008
21	Pierce, James (MN/DOT)	4/25/2008
22	Pierson, Scott (MN/DOT)	4/15/2008
23	Pirkl, Jack (MN/DOT)	3/25/2008
24	Prelgo, Geoffrey (MN/DOT)	4/15/2008
25	Pribula, Mark (MN/DOT)	3/28/2008
26	Sahebjam, Khani (MN/DOT)	3/14/2008
27	Schultz, Roger (MN/DOT)	3/21/2008
28	Western, Kevin (MN/DOT)	3/28/2008
29	Winter, Robert (MN/DOT)	4/3/2008
30	Flemming, Donald J. (URS)	4/30/3008
31	Long, David (URS)	4/30/2008
32	McElwain, Brett (URS)	4/29/2008
33	Zhou, Edward (URS)	4/29/2008

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Appendix Volumes II and III

Interview Exhibits From Recorded Interviews

Tab Number	Transcript Exhibit Number	Description of Exhibit
34	1 – All interviews	Witness Protocol for Interviews
35	2 – Jerome Adams; 2 & 3 Richard Arnebeck; 2 – Dale Dombroske; 3 – Daniel Dorgan (vol 1); 2 – Beverly Farraher; 2 – Kevin Gray; 2 – Abigail McKenzie; 2 – Khani Sahebjam; 2 – Roger Schultz; 2 – Kevin Western; 2 – Robert Winter	Organization charts for Minnesota Department of Transportation, Mn/DOT Metro District and Metro Bridge
36	3 – Jerome Adams	12/3/02 J. Adams email regarding Rescheduled SP 2783-draft I-35W at Mississippi Bridge Replacement
37	4 – Jerome Adams; 15 – Gary Peterson	7/24/06 Mn/DOT minutes regarding Br. 9340 TH 35W over the Mississippi River Investment Strategy
38	5 – Jerome Adams	1/22/07 J. Adams email regarding SP 2783-116 TH 35W Br. 9340 Plating Project Changes with attached URS Bridge 9340 Study
39	6 – Jerome Adams	6/15/07 Mn/DOT Project Management Schedules and project documentation
40	4 – Richard Arnebeck; 3 – Vance Desens; 4 – Kurt Fuhrman; 3 – Bill Nelson	7/19/07 memorandum regarding Guidelines for In-Depth Inspection of Fracture Critical and other Non-Redundant Bridges and for Underwater Inspections with attached 7/10/07 Quality Assurance Plan, Bridge Office

Tab Number	Transcript Exhibit Number	Description of Exhibit
41	5 – Richard Arnebeck; 3 – Mark Pribula; 3 – Khani Sahebjam	7/20/05 memorandum regarding "Critical Deficiencies" found during bridge inspections
42	2 – Vance Desens; 3 – Kurt Fuhrman; 2 – Bill Nelson; 2 – Mark Pribula	9/23/02 memorandum regarding Guidelines for In-Depth Inspection of Fracture Critical Bridges and Underwater Inspections with attached 9/23/02 Quality Assurance Plan
43	4 – Vance Desens	Minnesota Department of Transportation Bridge Inspections Manual (Version 1.3 – November, 2006)
44	5 – Vance Desens; 14 – Daniel Dorgan (vol 2); 5 – Todd Niemann; 4 – James Pierce	10/18/93 Bridge Inspection Report
45	6 – Vance Desens	4/3/00 Bridge Inspection Report
46	7 – Vance Desens	5/17/02 Bridge Inspection Report
47	8 – Vance Desens	6/13/03 Bridge Inspection Report
48	9 – Vance Desens; 9 – Kurt Fuhrman; 5 – Mark Pribula	9/2001 Fracture Critical Bridge Inspection Report
49	10 – Vance Desens; 10 – Kurt Fuhrman; 6 – Todd Niemann	6/2003 Fracture Critical Bridge Inspection
50	11 – Vance Desens; 16 – Daniel Dorgan (vol 2); 12 – Kurt Fuhrman; 3 – James Pierce	6/2006 Fracture Critical Bridge Inspection (In-Depth)
51	12 – Vance Desens	5/2007 Fracture Critical Bridge Inspection (Annual Report) (Draft – cover and signature pages only)
52	13 – Vance Desens	12/19/06 G. Peterson email regarding Bridge #9340
53	3 – Dale Dombroske	6/2005 Fracture Critical Bridge Inspection (Annual

Tab Number	Transcript Exhibit Number	Description of Exhibit
		Report)
54	2 – Eric Embacher; 2 – Barry Nelson	6/6/07 Minutes of Preconstruction Meeting, Attendance Record and Agenda, regarding 35W Bridge 9340
55	3 – Eric Embacher; 3 – Barry Nelson	6/14/07 Construction Project Schedule materials
56	4 – Eric Embacher; 4 – Barry Nelson	7/31/07 Weekly Meeting Attendance Sheet
57	5 – Eric Embacher; 5 – Barry Nelson	9/7/06 E. Embacher memorandum regarding I-35W Bridge Rehabilitation and Concrete Pavement Rehabilitation
58	6 – Eric Embacher; 6 – Barry Nelson	6/29/07 E. Embacher letter regarding Shop Drawings
59	7 – Eric Embacher; 7 – Barry Nelson	Chart regarding Southeast (Mendota Heights) Resident Office – 2008
60	8 – Eric Embacher; 8 – Barry Nelson	Organization chart for Mendota Resident Office
61	3 – Beverly Farraher; 2 – Jack Pirkl	Organizational chart of Maintenance Operations
62	4 – Beverly Farraher; 3 – Jack Pirkl	Organization charts of Maintenance Operations and Metro Bridge
63	2 – Kurt Fuhrman	9/23/02 Quality Assurance Plan, Office of Bridges and Structures
64	5 – Kurt Fuhrman	1982 – 1985 Bridge Inspection Report
65	6 – Kurt Fuhrman; 15 – Daniel Dorgan (vol 2)	9/28 – 29/94 Report of the 1994 Annual Fracture Critical Inspection for Bridge No. 9340
66	7 – Kurt Fuhrman	7/12/96 Bridge Inspection Report
67	8 – Kurt Fuhrman	8/4/97 Bridge Inspection Report

Tab Number	Transcript Exhibit Number	Description of Exhibit
68	11 – Kurt Fuhrman; 7 – Arlen Ottman; 1 – Daniel Dorgan (vol 2); 4 – Don Flemming; 4 – David Long; 4 – Brett McElwain; 4 – Ed Zhou	6/9 – 13/2003 Fatigue Evaluation, Bridge 9340
69	3 – Kevin Gray; 4 – Abigail McKenzie	Chart of Transportation Funding Sources
70	3 – Abigail McKenzie	Organization chart of Planning, Modal and Data Management Division, Office of Investment Management
71	5 – Abigail McKenzie	Chart of Mn/DOT's Planning & Programming Process
72	6 – Abigail McKenzie	Mn/DOT Revenue Forecast: 2009 - 2028
73	4 – Kevin Gray	FY 2006 HSOP – Bridge
74	5 – Kevin Gray; 3 – Roger Schultz	4/17/06 Technical Memorandum regarding Bridge Preservation, Improvement and Replacement Guidelines for Fiscal Year 2006 through 2008
75	6 – Kevin Gray; 5 – Robert McFarlin	11/2/05 Transportation Program Committee (TPC) Meeting Minutes with attachments
76	7 – Kevin Gray	1/5/06 Transportation Program Committee (TPC) Meeting Minutes with attachments
77	8 – Kevin Gray; 6 – Robert McFarlin	1/5/06 List - Statewide Bridge Preservation Fund
78	9 – Kevin Gray	Presentation: "Future Trends in Condition and Investment Needs"
79	10 – Kevin Gray; 7 – Robert McFarlin	2/27/06 Bridge Report for Commissioner's Staff Meeting
80	11 – Kevin Gray; 8 – Robert McFarlin	5/4/83 Mn/DOT Policy Position Statement and Guideline regarding Trunk Highways Bonds, Criteria for Issuance

Tab Number	Transcript Exhibit Number	Description of Exhibit
81	12 – Kevin Gray; 9 – Robert McFarlin	Mn/DOT Draft Policy Position Statement and Guideline regarding Debt Management
82	13 – Kevin Gray; 10 – Robert McFarlin	7/06 Mn/DOT Draft Position Statement and Guideline regarding Trunk Highway Fund Balance
83	14 – Kevin Gray; 11 – Robert McFarlin	7/06 Mn/DOT Draft Policy Position Statement and Guideline regarding Federal Advance Construction
84	2 – Lowell Johnson	Special Counsel's Second Request for Production of Documents to the Minnesota Department of Transportation, Request 17
85	3 – Lowell Johnson	9/17/79 Bridge Rating and Load Posting Report
86	4 – Lowell Johnson	12/14/95 Bridge Rating and Load Posting Report
87	5 – Lowell Johnson	Input data from Bars report
88	6 – Lowell Johnson	8/17/97 Summary of Rating Calculations – Structure Member Inventory and/or Operating Analysis for Structure 9340
89	7 – Lowell Johnson	12/11/95 Summary of Rating Calculations – Structure Member Inventory and/or Operating Analysis
90	8 – Lowell Johnson	10/17/02 L. Johnson email regarding Br. 4654 Stillwater
91	9 – Lowell Johnson	8/16/05 L. Johnson email regarding Br. 4654 Stillwater
92	2 – Paul Kivisto	5/4/01 D. Dorgan memorandum regarding Metro Region Fracture Critical Bridge Repair Recommendations with attached 5/4/01 D. Dorgan memorandum re: Br #9600 Repair of Water Leakage Inside the Box Tie Girder

Tab Number	Transcript Exhibit Number	Description of Exhibit
93	3 – Paul Kivisto; 2 – James Lilly; 2 – Todd Niemann; 2 – Gary Peterson; 3 – Kevin Western; 2 – Daniel Dorgan (vol 1)	Organization charts of Bridge Office
94	4 – Paul Kivisto; 2 – Todd Niemann	10/23/98 D. Flemming memorandum regarding 9340 Cracks In Approach Span Girders, North End of Bridge Near Pier 9
95	5 – Paul Kivisto	11/23/98 Meeting Minutes regarding Bridge #9340
96	6 – Paul Kivisto	11/28/01 S. Hunt email regarding Discussion of Possible Additional Fatigue Investigation Work on Br. 9340
97	7 – Paul Kivisto	11/25/02 R. Cekalla memorandum regarding Rescheduled SP 2783 draft I-35W at Mississippi Bridge Replacement
98	8 – Paul Kivisto	12/3/02 P. Kivisto memorandum regarding Draft RFI for Consultant Study on Br. #9340
99	3 – James Lilly	2003 Graph: Age Profile by Area of Structures, Trunk Highways Only, Structures 10 Ft and Over
100	4 – James Lilly	James A. Lilly, P. E. resume
101	2 – Robert McFarlin	2/28/2008 Organization chart – R. McFarlin Commissioner of Transportation
102	3 – Robert McFarlin	8/1/06 Organization chart – C. Molnau Commissioner of Transportation
103	4 – Robert McFarlin	2/93 Organization chart – J. Denn Commissioner of Transportation

Tab Number	Transcript Exhibit Number	Description of Exhibit
104	4 – Bill Nelson; 6 – Don Flemming; 6 – David Long; 6 - Brett McElwain; 6 – Ed Zhou	12/13/06 E. Zhou email regarding Recommended Actions for Br. 9340
105	3 – Todd Niemann; 4 – Arlen Ottman; 4 – Gary Peterson; 6 – Mark Pribula	12/1/97 G. Peterson memorandum regarding Installation of Strain Gauges to Measure Stress in Floorbeam Connections
106	4 – Todd Niemann; 3 – Arlen Ottman; 3 – Gary Peterson; 7 – Mark Pribula	12/17/97 B. Miller memorandum regarding Installation of Strain Gauges to Measure Stress in Floorbeam Connection
107	2 – Arlen Ottman	A. Ottman relevant experience summary
108	5 – Arlen Ottman	10/14/98 M. Pribula memorandum regarding Cracked Welds in Approach Spans & Diaphragms at Pier #9
109	6 – Arlen Ottman	11/5/98 P. Kivisto email regarding Br 9340, TH 35W over Mississippi, Short and Long Range Plan
110	8 – Arlen Ottman	8/13/06 DLD – Comments on Executive Summary – Bridge 9340 Study with attached 7/06 Draft Report Table of Contents and 6/06 Executive Summary
111	5 – Gary Peterson; 2 – Daniel Dorgan (vol 2)	5/2000 HNTB report – Proposed tasks to evaluate and increase the redundancy of Mn/DOT Bridge No. 9340
112	6 – Gary Peterson; 3 – Daniel Dorgan (vol 2)	Handwritten note regarding attached 9/5/00 S. Olson letter of transmittal and drawings
113	7 – Gary Peterson; 4 – Daniel Dorgan (vol 2)	List of Bridge 9340 Outstanding Issues
114	8 – Gary Peterson; 5 – Daniel Dorgan (vol 2)	10/2001 HNTB Proposal for Structural Evaluation of Bridge 9340

Tab Number	Transcript Exhibit Number	Description of Exhibit
115	9 – Gary Peterson; 6 – Daniel Dorgan (vol 2)	11/8/01 Handwritten notes
116	10 – Gary Peterson	11/28/01 S. Hunt email regarding Discussion of Possible Additional Fatigue Investigation Work on Br 9340, with handwritten notes
117	11 – Gary Peterson; 7 – Daniel Dorgan (vol 2)	11/28/01 Discussion Points, I-35W over Mississippi River Bridge (from R. Johnson)
118	8 – Daniel Dorgan (vol 2);	12/3/01 J. Fredrick email regarding Br. 9340 35W/Mississippi River in downtown Mpls.
119	12 – Gary Peterson; 9 – Daniel Dorgan (vol 2)	12/14/01 Handwritten notes from meeting at Waters Edge
120	10 – Daniel Dorgan (vol 2); 15 – Don Flemming	11/7/06 G. Peterson email regarding RFP for a monitoring system, with handwritten notes
121	11 – Daniel Dorgan (vol 2)	1/10/07 G. Peterson email regarding Bridge 9340 plating contract scope of work
122	12 – Daniel Dorgan (vol 2)	1/17/07 G. Peterson email regarding 9340 plating scope, with handwritten notes
123	13 – Daniel Dorgan (vol 2)	Mn/DOT In-Depth Fracture Critical Bridge Inspection, Quality Assurance of Inspections Performed by Mn/DOT Districts, with attached 7/30/02 D. Weiszhaar Technical Memorandum regarding Guidelines for In-Depth Inspection of Fracture Critical Bridges and Underwater Inspections

Tab Number	Transcript Exhibit Number	Description of Exhibit
124	13 – Gary Peterson	5/9 Office Information Memo to Bob from S. Pierson, with attached 4/18/05 D. Flemming letter attaching 4/18/05 URS Meeting Minutes for Evaluation of Bridge 9340 – Progress Meeting 4
125	14 – Gary Peterson	4/3/06 Mn/DOT Meeting Minutes regarding Bridge Preservation Recommendations for Bridge Number 9340
126	16 – Gary Peterson	11/1/06 Mn/DOT Minutes regarding Br. 9340 TH 35W over the Mississippi River Investment Strategy
127	2 – James Pierce	6/15/06 Bridge Inspection Report
128	2 – Scott Pierson	8/4/04 D. Flemming email regarding attached meeting Minutes of Evaluation of Bridge 9340 – Progress Meeting 1
129	3 – Scott Pierson	11/17/04 URS Meeting Minutes of Evaluation of Bridge 9340 – Progress Meeting 2
130	4 – Scott Pierson	1/10/05 URS Meeting Minutes of Evaluation of Bridge 9340 – Progress Meeting 3
131	5 – Scott Pierson	2/7/05 E. Zhou email regarding Request for Information with attached S. Pierson memorandum regarding Request for Information Verification with Mn/DOT (revised 1/24/05)
132	6 – Scott Pierson	4/4/05 URS Meeting Minutes of Evaluation of Bridge 9340 – Progress Meeting 4

Tab Number	Transcript Exhibit Number	Description of Exhibit
133	7 – Scott Pierson	3/24/06 D. Flemming letter regarding Preliminary Recommendations for Bridge 9340
134	2 – Geoffrey Prelgo	8/16/06 Preliminary Meeting Minutes – Staging of 35W Rehab Project, Traffic Detours and Timing Issues
135	3 – Geoffrey Prelgo	8/24/05 Meeting Minutes - Staging of 35W Rehab Project, Construction Issues, Clarification of Job Scope and Guard Rail
136	4 – Mark Pribula	9/26/01 Bridge Inspection Report
137	2 – Don Flemming; 2 – David Long; 2 – Brett McElwain; 2 – Ed Zhou	3/28/03 URS Report – Fatigue Evaluation Bridge 9340, 35W Over Mississippi River
138	3 – Don Flemming; 3 – David Long; 3 – Brett McElwain; 3 – Ed Zhou	5/21/03 E. Zhou fax regarding Inspection Check List for Bridge 9340 with attached Inspection List for 6/9 – 13/03 and drawings
139	5 – Don Flemming; 5 – David Long; 5 – Brett McElwain; 5 – Ed Zhou	11/17/04 E. Zhou email regarding Final Minutes
140	7 – Don Flemming; 7 – David Long; 7 – Brett McElwain; 7 – Ed Zhou	12/18/06 E. Zhou email regarding Retrofit Recommendations
141	8 – Don Flemming; 8 – David Long; 8 – Brett McElwain; 8 – Ed Zhou	2/1/07 B. McElwain email regarding MnDOT Bridge 9340 Retrofit Design
142	9 – Don Flemming; 9 – David Long; 9 – Brett McElwain; 9 – Ed Zhou	7/19/07 D. Flemming email regarding 9340

Tab Number	Transcript Exhibit Number	Description of Exhibit
143	10 – Don Flemming; 10 – David Long; 10 – Brett McElwain; 10 – Ed Zhou	9/6/05 handwritten notes – Evaluation of I-35W Bridge, Notes from Meeting
144	11 – Don Flemming; 11 – David Long; 11 – Brett McElwain	6/23/06 B. McElwain email regarding Br. 9340 TH 35W over the Mississippi River investment strategy
145	12 – Don Flemming; 12 – David Long	5/17/05 D. Long email regarding Bridge 9340
146	13 – Don Flemming	11/30/98 E. Power letter regarding working relationship with HDR Engineering, Inc., and attaching report on Allegheny River bridge
147	14 – Don Flemming	9/1/06 D. Flemming email regarding Response to MnDOT comments
148	16 – Don Flemming	2/27/06 E. Zhou email regarding Bridge 9340 Preliminary Recommendation

GP:2370953 v1

APPENDIX Volume IV

Bridge Inspection Reports

Tab Number	Description of Bridge Inspection Report
149	8/27/1971 Bridge Inspection Report (Special Inspection)
150	11/29/1972 Bridge Inspection Report (Annual Inspection)
151	3/28/1973 Bridge Inspection Report (Special Inspection) and 12/27/1973 Bridge Inspection Report (Annual Inspection)
152	6/27/1974; 12/22/1975 and 6/28/1976 Bridge Inspection Report
153	5/24/1977 Bridge Inspection Report
154	1978; 1979; 1980 and 1981 Bridge Inspection Report
155	6/14/1982; 5/17/1983; 5/17/1984 and 11/7/1985 Bridge Inspection Report
156	11/4/1986 and 7/7/1987 Bridge Inspection Report
157	7/7/1987; 6/19/1988; 8/5/1989 and 1/31/1989 Bridge Inspection Report
158	1988; 1989 and 8/5/1990 Bridge Inspection Report
159	1991; 1992 and 10/18/1993 Bridge Inspection Report
160	9/26/1994 Bridge Inspection Report
161	9/28 - 29/1994 Report of the 1994 Annual Fracture Critical Inspection for the Bridge No. 9340
162	10/13/1995 Bridge Inspection Report
163	10/13/1995 Report of the 1995 Annual Fracture Critical Inspection for the Bridge No. 9340
164	7/12/1996 Bridge Inspection Report
165	7/9 - 12/1996 Fracture Critical Inspection Report
166	8/4/1997 Bridge Inspection Report
167	7/28 - 8/4/1997 Fracture Critical Bridge Inspection Report (*In-Depth*)
168	9/11/1998 Bridge Inspection Report
169	9/8 - 11/1998 Fracture Critical Bridge Inspection Report
170	4/5/1999 Bridge Inspection Report
171	3/22 - 24 and 4/5 - 9/1999 Fracture Critical Bridge Inspection Report (*Annual & In-Depth*)
172	4/3/2000 Bridge Inspection Report
173	3/28 - 29; 4/3 - 6; 7/5 - 7 and 10/30 - 31/2000 Fracture Critical Bridge Inspection Report (*Annual*)
174	9/26/2001 Bridge Inspection Report
175	6/11 and 9/24 - 26/2001 Fracture Critical Bridge Inspection Report (*Annual*)
176	5/17/2002 Bridge Inspection Report
177	5/13 - 17/2002 Fracture Critical Bridge Inspection Report (*In-Depth*)

Tab Number	Description of Bridge Inspection Report
178	6/13/2003 Bridge Inspection Report
179	6/9 - 13/2003 Fracture Critical Bridge Inspection Report (*In-Depth*)
180	6/16/2004 Bridge Inspection Report
181	6/7 - 11 & 14 - 18/2004 Fracture Critical Bridge Inspection Report (*Annual*)
182	6/10/2005 Bridge Inspection Report
183	6/6 & 8 - 10/2005 Fracture Critical Bridge Inspection Report (*Annual*)
184	6/15/2006 Bridge Inspection Report
185	6/5 - 9 & 12 - 15/2006 Fracture Critical Bridge Inspection Report (*In-Depth*)

GP:2370950 v1

APPENDIX Volume V

Additional Documents Cited

Tab Number	Description of Document
186	4/17/2008 D. Dorgan memorandum re: Recent Mn/DOT Actions Affecting Bridge Design, Maintenance and Inspection
187	List of 2006 Department of Transportation Awards, provided by Governor Pawlenty's office
188	2/26/08 R. Arnebeck memorandum re "Critical Deficiencies" found during bridge inspections
189	2/7/77 Mn/DOT Project Development Report and Location/Design Study Report
190	11/26/96 MnDOT, Office of Bridges and Structures Preliminary Recommendations for Bridge Improvement, with attached 2/12/97 Minutes on meeting regarding scope of remedial repair to Bridge 9340
191	9/16/98 D. Flemming memorandum re: BR 9340 – Cracks in Approach Span Girders with attached drawing
192	3/2001 University of Minnesota Report: Fatigue Evaluation of the Deck Truss of Bridge 9340
193	3/7/03 R. Miller memorandum re: Mn/DOT Request for Interest ("RFI")
194	3/28/03 HNTB Response to RFI
195	3/28/03 URS Response to RFI
196	5/29/03 Mn/DOT Contract with URS
197	6/2003 URS Initial Inspection Report For: Fatigue Evaluation, Bridge 9340 35W Over Mississippi River
198	12/23/03 MnDOT/URS Contract
199	7/12/04 amendment to MnDOT/URS Contract; 11/4/05 amendment to MnDOT/URS Contract; 4/13/06 amendment to MnDOT/URS Contract; 10/9/06 amendment to MnDOT/URS Contract and 4/5/07 amendment to MnDOT/URS Contract
200	7/2006 URS Draft Report: Fatigue Evaluation and Redundancy Analysis Bridge No. 9340 I – 35W Over Mississippi River
201	8/1/07 B. McElwain email to E. Zhou re: Section 4.3.1
202	5/5/08 D. Dorgan letter to R. Stein
203	1/7/08 M. Pribula OLA Interview Transcript
204	1/12/04 G. Peterson email to B. Iwen, P. Kivisto and P. Rowekamp re: Paint sort final
205	12/1997 contract between MnDOT and Maxim Technologies, Inc.
206	10/23/98 D. Flemming memo to G. Workman re: BR 9340 –

	Cracks in Approach Span Girders, North End of Bridge Near Pier 9
207	10/14/98 M. Pribula memo to J. Pirkl re: Cracked Welds in Approach Spans & Diaphragms at Pier #9
208	11/3/00 D. Flemming memo to G. Workman re: Inspection Frequency on Br. #9330 and Br. #9340
209	5/12/99 University of Minnesota / Mn/DOT Contract
210	10/1/06 MnDOT Bridge Preservation Recommendation
211	2/24/06 R. Schultz email re: Br. #9340 meeting with attached Preliminary Bridge Preservation Recommendations document
212	9/2006 URS Br. 9340 Draft Report Comments and Responses
213	4/5/04 Report for Commissioner's Staff Meeting
214	2/8/05 Report for Commissioner's Staff Meeting
215	3/31/08 Wiss, Janey, Elstner Associates, Inc. DeSoto Bridge Gusset Plate Evaluation
216	10/21/96 Richland Engineering Limited report re: LAK-902342 R over Grand River, Gusset Plate Failure ("REL Report")
217	10/2001 HNTB Proposal for Structural Evaluation of Bridge No. 9340
218	5/9/08 HNTB email
219	Metro Division Bridge Improvement Program FY 2007 – 2013
220	4/14/06 G. Peterson email re: Bridge 9030 Final Report
221	6/19/06 E. Zhou email re: Br. 9340 TH 35W over the Mississippi River investment strategy
222	7/12/06 Mn/DOT Meeting Minutes re: Br. 9340 TH 35W over the Mississippi River investment strategy
223	12/21/98 University of Minnesota letter to D. Flemming re: Bridge No. 9340 – Load Test Results
224	1/2007 URS Bridge 9340 Study – Recommendations on Truss Members Retrofit
225	2/9/07 G. Peterson email re: URS proposal to assist on 9340
226	2783-107 Precon Invite List with attached 6/6/07Attendance Record
227	2/27/06 D. Flemming email re Bridge 9340 Preliminary Recommendations
228	11/7/06 G. Peterson email re: RFP for a monitoring system
229	3/24/06 D. Flemming letter attaching Preliminary Recommendations for Bridge 9340 with attached
230	5/2008 letters from K. Janisch and R. Winter
231	Mn/DOT's Standard Specifications, Section 1513
232	4/14/06 G. Peterson email re: Bridge 9030 Final Report

GP:2378669 v2