HIGHWAY CONSTRUCTION FACTORS FACTUAL REPORT

HWY-07-MH-024
Minneapolis, MN

(45 pages)

NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C. 20594

HIGHWAY FACTORS DRAFT FACTUAL INVESTIGATION REPORT

A. ACCIDENT

Type of Accident:	Bridge Collapse
Date and Time:	August 1, 2007 at 6:10 pm CDT
Location:	Interstate Highway 35W Bridge over the Mississippi River, Minneapolis, Hennepin County, MN
Fatalities:	13
Injuries:	145

B. HIGHWAY FACTORS GROUP

David S. Rayburn [redacted]
NTSB Senior Highway Accident Investigator
Group Chairman
624 Six Flags Drive, Suite 150 Arlington, Texas 76011
[redacted]

Dan Walsh, P.E. [redacted]
NTSB *Highway Accident Investigator* Group Member
624 Six Flags Drive, Suite #150, Arlington, Texas 76011 [redacted]

Tom Sloan
Vice President, Bridges and Structures
Progressive Contractors, Inc. (PCI)
14123 – 42ndSt. NE
P.O. Box 416
St. Michael. MN. 55376
(612) 497-6100

Kevin Gulden
Bridge Division Coordinator (PCI)
(763) 497-6100
[redacted]

[redacted]
Same Address

Gary Gulden

Project Manager (PCI)
Same Address and Phone Number

Bill Wright, P.E., Ph.D. [redacted]
Federal Highway Administration *Structures Laboratory Team Leader* Group Member
6300 Georgetown Pike McLean, Virginia 22101 [redacted]

Joseph L. Hartmann, P.E., Ph.D. [redacted]
Federal Highway Administration *Team Leader* Group Member
6300 Georgetown Pike McLean, Virginia 22101 [redacted]

Daniel L. Dorgan, P.E. [redacted]
Minnesota Department of Transportation
Bridge Office *State Bridge Engineer* Group Member
3485 Hadley Avenue North Oakdale, Minnesota 55128-3307 [redacted]

Ed Lutgen, P.E. [redacted]
Minnesota Department of Transportation
Bridge Office *Bridge Rating Engineer* Group Member
3485 Hadley Avenue North Oakdale, Minnesota 55128-3307 [redacted]

C. ACCIDENT SUMMARY

About 6:05 p.m. (CDT), on Wednesday, August 1, 2007, the 35W Interstate Highway Bridge over the Mississippi River, in Minneapolis, Minnesota experienced a catastrophic failure in the main span of the deck truss portion of the 1907-foot-long bridge. As a result, approximately 1,000 feet of the deck truss collapsed with about 456 feet of the main span falling into the river. An assessment of the gusset plates within the deck truss revealed that the connections at U10, U10 prime, L11 and L11 prime were under-designed. The bridge was comprised of eight traffic lanes, with four lanes in each direction. At the time of the collapse, a roadway construction project was underway that resulted in the closure of two northbound and two southbound traffic lanes causing traffic queues on the bridge. A total of 110 vehicles were documented as being on the portion of the bridge that collapsed. Of these, 17 vehicles were displaced from the bridge deck and entered into the water. As a result of the bridge collapse, 13 people died and 145 people were injured.

INTRODUCTION

This report contains general design information about the I-35 Bridge (MnDOT bridge structure 9340) reproduced from the Bridge Design Group report, general accident statistics, and detailed information about the current construction project on the bride deck at the time of the accident, including details about how aggregate materials and equipment were staged in preparation for use in re-paving operations. Additionally, information about permitted loads that have traveled across the bridge in the preceding 12 months is presented.

The information was obtained through a review of the design plans, construction plans for project 2783-107(T.H. 35W=394), the minutes of the pre-construction conference, weekly meeting minutes diaries of Mn/DOT construction personnel, and through interviews of 5 truck drivers and Twenty-one employees of the contractor, PCI. Also records of overweight loads permitted by the Mn/DOT and the Minneapolis Public Works Department were reviewed. Finally, records of overweight fire trucks use of the bridge were examined.

1. PREFATORY DATA

1.1ACCIDENT LOCATION

The collapsed portion of the bridge was located on I-35W, approximately 1 mile northeast of junction I-94. The bridge spanned over the Mississippi River, Minnesota Commercial Railroad Tracks, West River Parkway, and 2nd Street. Figure 1 illustrates the accident site was located in the City of Minneapolis, Hennepin County, Minnesota.

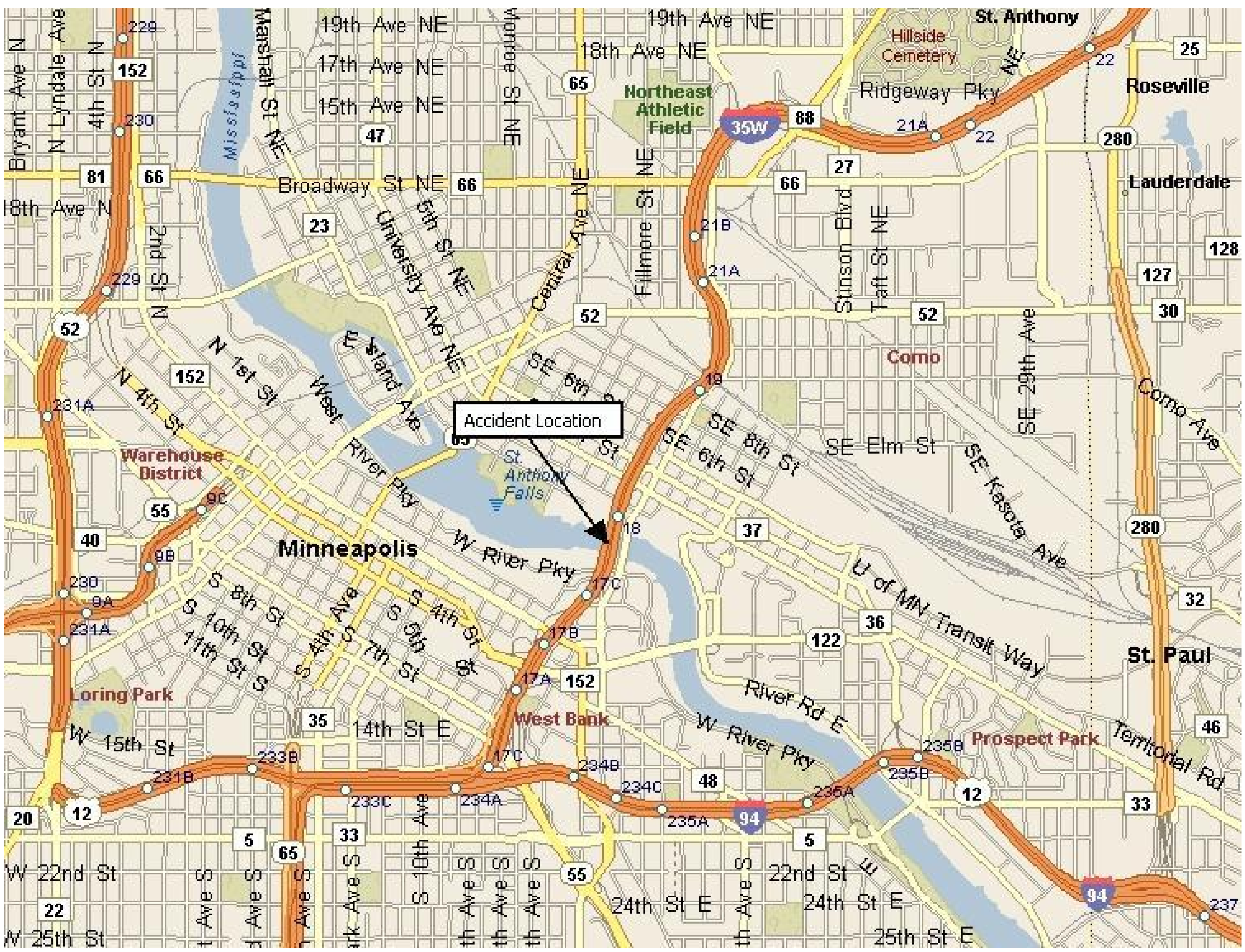


Figure 1 – Location Map

2. BRIDGE DESCRIPTION

2.1 GENERAL DESCRIPTION

Opened to traffic in 1967, the I-35W Bridge (Bridge #9340) had 13 piers and 14 spans, with a total length of 1,907 feet. The split deck had four lanes in the northbound direction of travel and four lanes in the southbound direction of travel. The bridge deck widened at the north end to accommodate on and off ramps, and curved slightly at the south end to accommodate the approach roadway alignment. Spans 6 through 8, the main river spans, were "fracture critical" steel deck trusses, approximately 988 feet long. They were comprised of welded "built-up" members. The truss was approximately 60 feet deep at piers 6 and 7. The two main trusses are connected laterally by welded floor beam trusses, which were cantilevered beyond the truss on both sides and supported the 27-inch-deep rolled beam roadway stringers. At each end of the main truss spans, the truss supported the adjacent approach spans with a unique crossbeam configuration. The approach span beams framed into a crossbeam, which was supported by rocker bearings on the cantilever truss ends. Spans 1 through 5 and 9 through 11, the approach spans, had 48-inch- deep, welded plate beams, which transitioned into 33-inch-deep welded and rolled steel beams. The connections are riveted. Span numbers 12 through 14, the far north spans, are cast-in-place concrete voided slabs.

2.2 STRUCTURE INVENTORY

The Minnesota Department of Transportation (Mn/DOT) provided the structure inventory for the I-35W Bridge over the Mississippi River.

Table 1 – Mn/DOT Structure Inventory Report for I-35W Bridge (Bridge #9340)

General	
Maintenance Crew	7627
District	Metro
Maintenance Area	Metro
County	27 – Hennepin
City	Minneapolis
Description Location	1 MI NE of JCT 94
Latitude	44d 58m 50.89s
Longitude	93d 14m 40.09s
Custodian	Mn/DOT
Owner	Mn/DOT
Inspection By	Mn/DOT – Metro District
Year Built	1967
Structure	
Main Span Type	Continuous Steel Deck Truss
Main Span Detail (Type of Truss)	Warren with Vertical
Approach Span Type	Continuous Steel Beam Span
Number of Spans	Main: 3, Approach: 11, Total: 14
Main Span Length	456 feet

Structure Length (Total Length of Bridge)	1,907 feet
Deck Width	113.3 feet and varies
Deck Material	Cast-In-Place Concrete
Wear Surface Type	Low Slump Concrete
Wear Surface Install Year	1978
Wear Course/Fill Depth	2 inches
Structure Area	219,086 square feet
Roadway Area	201,511 square feet
Roadway	
Lanes	8 lanes on bridge
Average Daily Traffic (ADT)	141,000 (2004)
Heavy Commercial ADT	5,640
Functional Classification	Urban Principal Arterial Interstate Highway
Roadway Dimensions	
Roadway Width	52 feet northbound, 52 feet southbound
Median Width	4 feet
Miscellaneous Bridge Data	
Field Connections	Riveted
Cantilever	Friction
Abutment Foundation	Concrete Footing Pile
Pier Foundation	Concrete Spreading Rock
Paint	
Year Painted	1968
Percent Unsound	15%
Painted Area	490,200 square feet
Primer Type	Lead
Bridge Signs	
Posted Load	Not Required
Traffic	Not Required
Horizontal	Not Required
Vertical	Not Applicable
Inspection	
Deficient Status	Structurally Deficient
Sufficiency Rating	50
Last Inspection Date	June 15, 2006
Inspection Frequency	12 months
Inspector Name	Metro
Condition Codes	
Deck (6% Unsound)	5
Superstructure	4
Substructure	6
Channel	7
Appraisal Ratings	
Structure Evaluation	4
Deck Geometry	4

Underclearances	7
Waterway Adequacy	9
Approach Alignment	8
In Depth Inspection	
Fracture Critical	June 2006
Underwater	February 2005
Waterway	
Waterway Opening	50,000 square feet
Navigational Control	Permit Required
Pier Protection	Not Required
Navigational Vertical / Horizontal Clearance	64 feet / 400 feet
MN Scour Code	Low Risk
Scour Evaluation Year	1993
Capacity Ratings	
Design Load	HS20MOD
Operating Rating	HS 33.0
Inventory Rating	HS 20.0
Rating Date	December 1, 1995
Mn/DOT Permit Codes	A: 1, B: 1, C: 1

3. TRUSS DIAGRAMS

Figure 2 shows the tension and compression members of the continuous steel deck truss. Tension members are shown in red, compression members are shown in blue, and reversal members are shown in green. Four piers supported the truss (5, 6, 7, and 8).

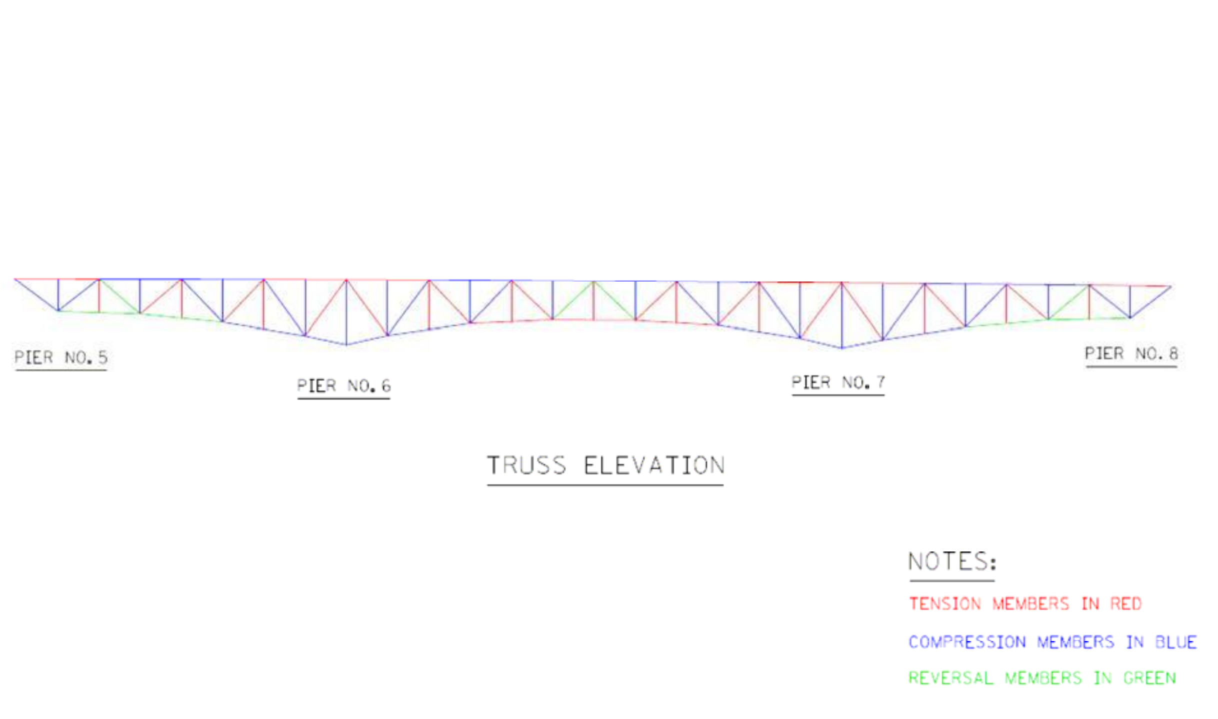


Figure 2 – Tension and compression members of the continuous steel deck truss

Figure 3 shows the entire length of the bridge from the south abutment to the north abutment. Figure 3 shows the approach slabs on either side of the continuous steel deck truss. Four piers supported the south approach spans (1, 2, 3, and 4) and five piers supported the north approach spans (9, 10, 11, 12, and 13).

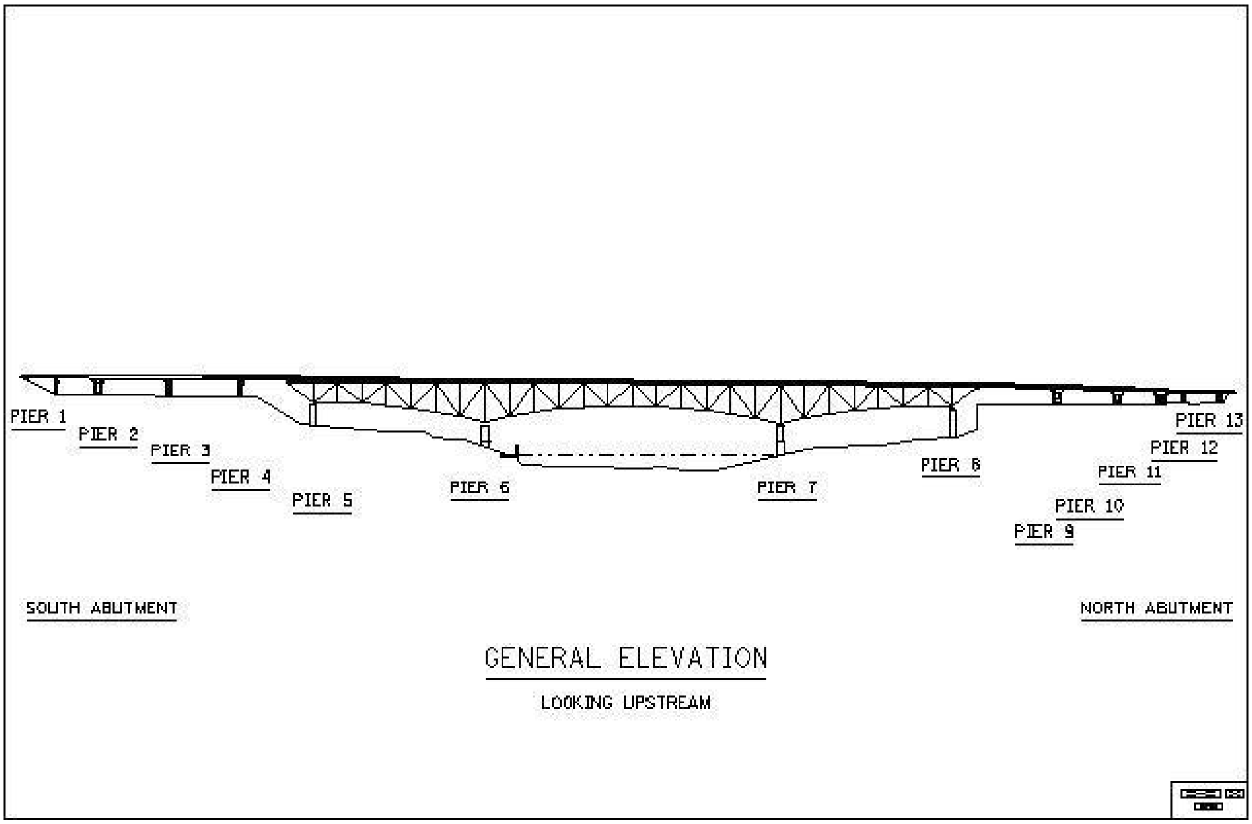


Figure 3 – Elevation of entire length of bridge from south abutment to north abutment

Table 2 shows the distance between the piers and the type of superstructure used to support the deck.

Table 2 – Distance between each pier and type of girder / truss

Location	Distance (feet)	Type of Girder / Truss
South abutment to Pier 1	53 feet 1 inch	2 span continuous beams
Pier 1 to Pier 2	72 feet	2 span continuous beams
Pier 2 to Pier 3	110 feet	3 span continuous girders
Pier 3 to Pier 4	110 feet	3 span continuous girders
Pier 4 to Pier 5	109 feet 4 inches	3 span continuous girders
Pier 5 to Pier 6	265 feet 8 inches	3 span continuous trusses

Pier 6 to Pier 7	456 feet	3 span continuous trusses
Pier 7 to Pier 8	265 feet 11 inches	3 span continuous trusses
Pier 8 to Pier 9	168 feet 1 inch	3 span continuous girders
Pier 9 to Pier 10	94 feet	3 span continuous girders
Pier 10 to Pier 11	68 feet	3 span continuous girders
Pier 11 to Pier 12	47 feet	3 span continuous voided slab
Pier 12 to Pier 13	57 feet 11 inches	3 span continuous voided slab
Pier 13 to North abutment	30 feet 1 inch	3 span continuous voided slab

The fixed supports (bearings) were located at piers 1, 3, 7, 9, 12, and 13. The expansion supports (expansion bearings) used at the south abutment, north abutment, and at piers 2, 4, 5, 6, 8, 10, and 11.

4. DECK WIDTH, THICKNESS, AND HORIZONTAL ALIGNMENT

The total width of the deck was approximately 113 feet and 4 inches. The width of the northbound lanes of traffic was approximately 52 feet, consisting of four travel lanes. The width of the southbound lanes of traffic was identical to the northbound lanes. The total number of travel lanes on the bridge was eight. The northbound lanes were separated from the southbound lanes by a 4-foot wide, 28-inch-high, F-shaped median barrier. The railing and curb located on the outside edges of the bridge was approximately 2 feet and 8 inches wide.

The bridge deck was originally constructed to an approximate depth of 6 ½ inches (minimum) using cast-in-place concrete. A 2-inch, low-slump concrete wearing surface was added in a 1977 contract.

A horizontal curve existed on the south end of the bridge that consisted of a 3-degree and 15 minute curve for vehicles traveling in the northbound and southbound direction of travel.

4.1 LOCATION OF EXPANSION JOINTS AND HINGE

The total number of expansion joints on the deck was eleven. The first expansion joint was located at the south abutment. The second expansion joint was located near Pier 2. The third expansion joint was located at the south end of the steel truss near Pier 5. The fourth through eighth expansion joints were located at nodes 4, 8, 14, 8'and 4' respectively on the main truss spans. The ninth expansion joint was located at the north end of the steel truss near pier 8. The tenth was located at pier 11. The eleventh expansion joint was located at the north abutment.

The bridge contained only one hinge located between Piers 1 and 2 in span 2.

2007 CONSTRUCTION PLAN FOR FURNISHING AND DELIVERING EXPANSION JOINT DEVICES FOR THE I-35W BRIDGE

The 2007 construction plan[1] for the deck repair of Bridge #9340 involved removing the concrete wearing course to 2" deep and adding a new 2" concrete wearing course. The construction plan included removing unsound concrete from the curb and patching with concrete. The construction plan also included reconstructing the expansion joints, reconstructing the concrete median, and removing and replacing the anti-icing system spray disks and sensors in the deck.

The project was to begin on June 4, 2007, with a substantial completion date of September 21, 2007, and a final completion date of October 25, 2007. The minutes of the pre-construction conference listed Eric Embacher as the Mn/DOT project engineer, Liz Benjamin as the resident engineer, Barry Nelson as project supervisor, Mark Lemay as the chief inspector of grading, and Harvey Unruh as the chief bridge inspector.

CONTRACTOR OPERATIONS

This section of the conference minutes set out a general schedule. United Rentals was scheduled to close I-35W right-hand lane on Thursday June 14, 2007. PCI was scheduled to begin work on June 18th on southbound I35W right-hand lane and ramps. Work hours were designated as 12 hours per day six days a week. The baseline schedule was to be given to MNDOT on June 6, 2007, the day of the conference. The controlling Critical Path Method (CPM) schedule was to be delivered before the start of the project. Weekly progress meetings were scheduled for 1 pm each Tuesday.

Other scheduled items included but were not limited to the following:

1. Work was scheduled on Northbound 35W right lane and ramps Wednesday June 20th.
2. PCI selected the 1st six weekends allowed for the weekend closures (6/22-6/25), (6/29-7/2), (7/6-7/9), (7/27-7/30), (8/10-8/13), and (8/17-8/20)
3. PCI requested lower speed limits of 40 mph through the active work zone with 45 mph otherwise.
4. Ramps south of the river to be done in stage 3A
5. Deck planing was to be done in each stage
6. PCI made Mn/DOT Lab aware of concrete plant being mobilized to site and bituminous plant being used for certification purposes

(1803) CRITICAL PATH METHOD (CPM) SCHEDULE

---

[1]Minnesota Department of Transportation, Construction Plan for Rehabilitation(Deck Overlay and Joints) for Bridge #9340, Bridge #27873, Bridge #27874, Bridge #27879, Bridge #27879A, Bridge #27880, Bridge #27880A, Bridge #27887, Bridge #27888, Bridge #27902, and Bridge #27903 Located on T.H. 35W from North of T.H. 94 to Stinson Blvd in the City of Minneapolis, April, 27, 2007.

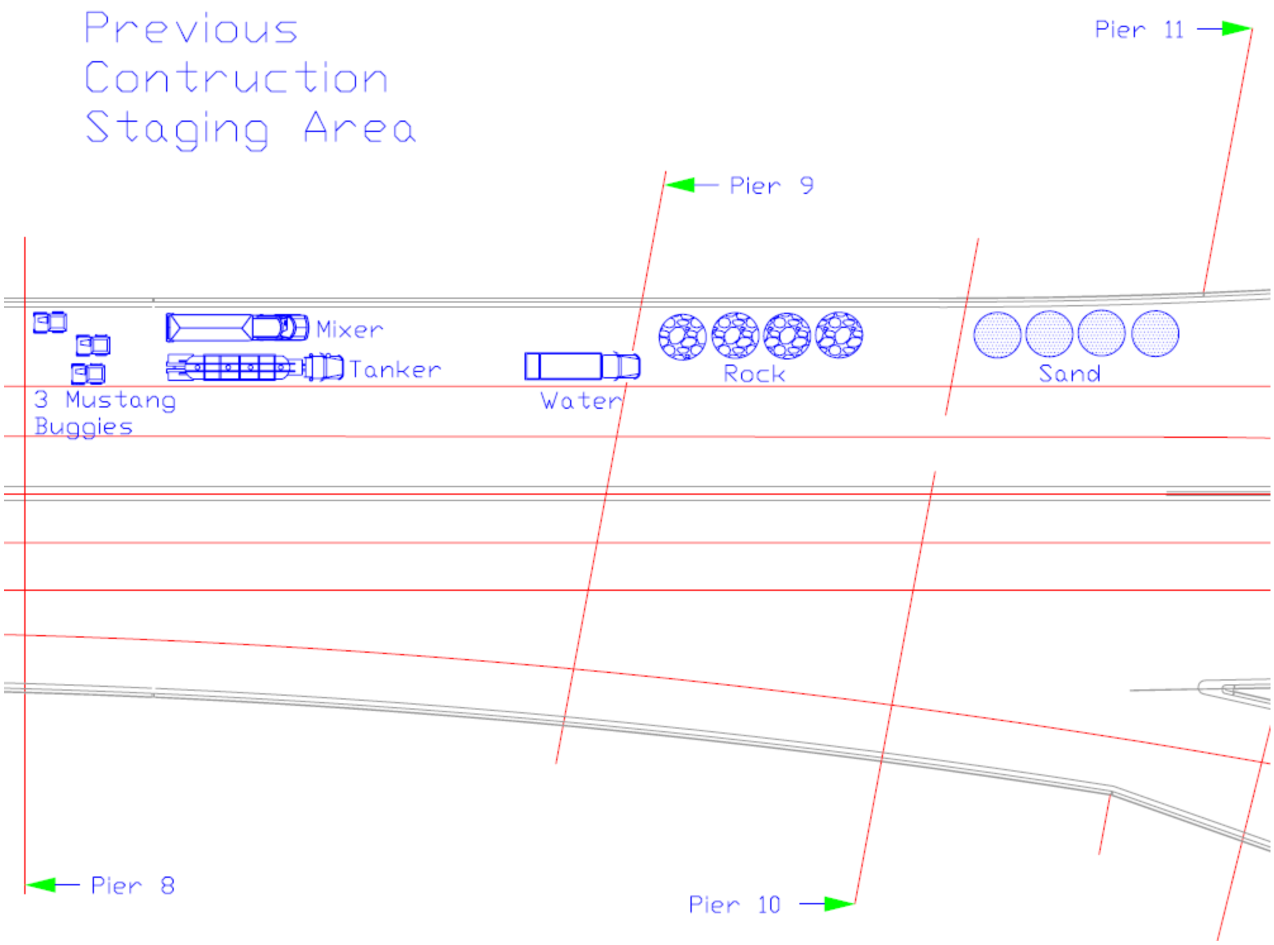
As part of the contact special provisions the contractor was required to complete and update a computerized CPM schedule for acceptance. The work was required to be planned, reported and accomplished using the critical path method. Other scheduling provisions were found in section S-29 (Prosecution of Work) of the contract. In section S-29.2 the contractor was advised of permissible lane closures and dates and warned that the schedule for chosen weekend lane closures could only be changed in case of inclement weather. Mn/DOT provided the NTSB with the CPM schedule on August 23, 2007. The schedule shows the activity that the contractor was to be engaged in on every day from June 18th through September 28th. See Attachment 9 for additional details.

PAVEMENT OVERLAYS

Seven pavement overlays had been completed prior to August 1, 2007. Preparation for overlay pour number eight was underway at the time of the bridge collapse. Of the seven completed overlays, five involved staging construction materials on the ramps and one overlay involved placing materials on the bridge deck, and one overlay involving staging on the ramp and the deck. The overlays were completed between June 28th and July 27th. The northbound outside lanes had been milled and repaved. The northbound inside lanes had not yet been planed or milled. The southbound outside lanes had also been completed. At the time of the collapse PCI was preparing to pour a 530-foot overlay in the southbound inside lanes

On the night of July 6th, 2007 two crews paved the outside southbound lanes from pier# 8 south to the end of the south bridge deck. Materials for the southbound lanes staging area and projected 720-foot overlay from pier# 6 to the south end were staged off the bridge deck. The materials for the projected 750-foot overlay from pier# 6 in the other direction towards pier 8 were staged on the bridge deck and off the bridge past the north abutment. The equipment and aggregates staged on the deck for this overlay consisted of an arrangement similar to how it was arranged on the day of the collapse except for two additional loads of sand and two additional loads of rock that was off of the bridge. The deck staging area was bordered on the north end by the expansion joint at pier# 11south to the finger joint near pier# 8. This area was approximately centered over the mid-point between spans 10 and 11.

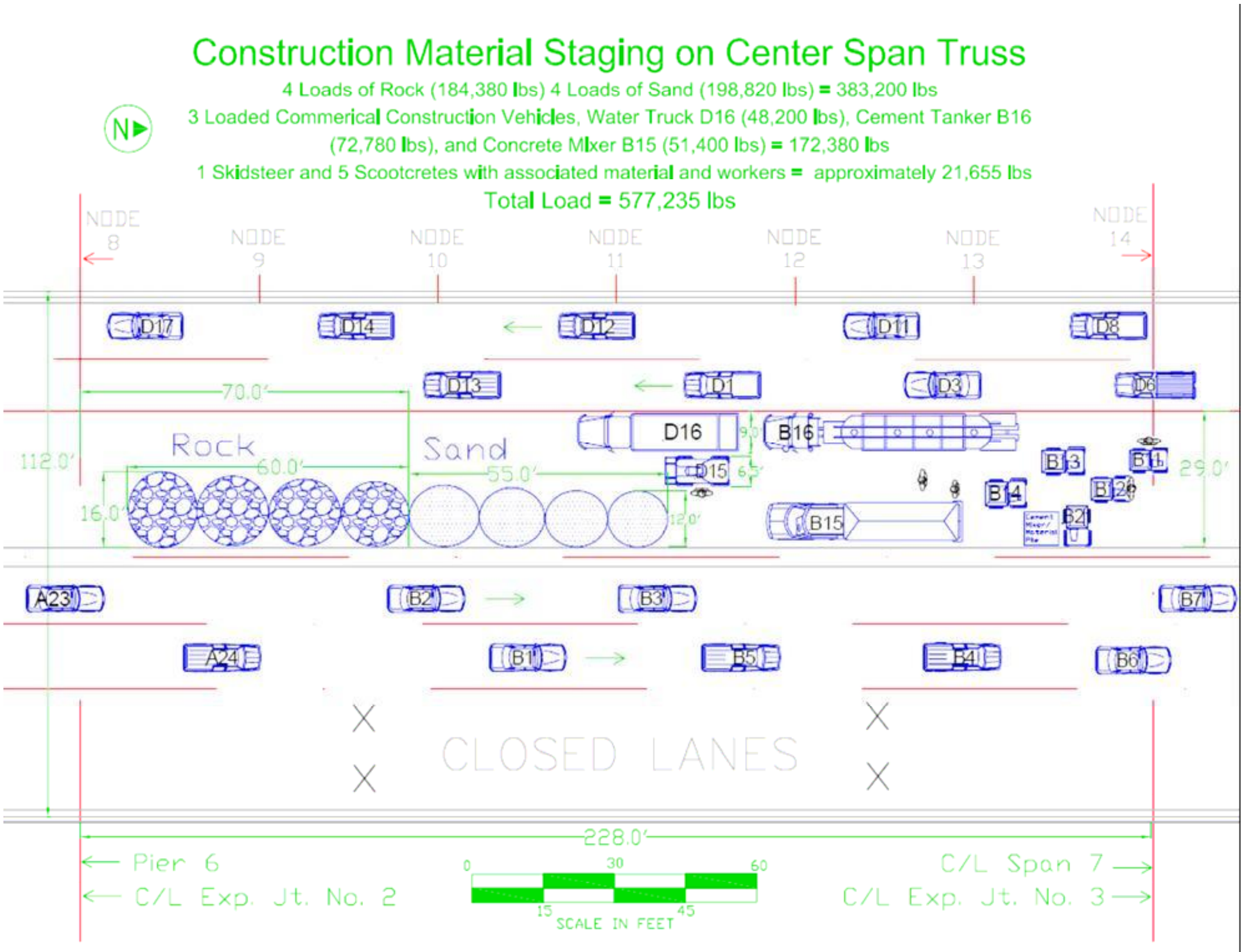
The PCI job foreman indicated that he had asked the state construction inspector for permission to place the loads on the bridge deck, and was authorized to do so. However, the MN/DOT bridge inspector did not recall this conversation. PCI viewed the inspectors as acting on behalf of the engineers. On another occasion the PCI Vice President had requested to use a planing machine to remove unsound concrete at depths deeper than the standard two inches. The inspector/project supervisor went directly to the bridge office and set up an experiment at another location. The bridge engineers determined there was too much vibration when the machine was used to remove deeper depths. Again PCI relied on the guidance of the inspectors.



See Attachment 3 for diagrams of the overlays and staging areas. The weight of the equipment and materials of this overlay was similar to the weight of materials on the deck at the time of the collapse.

WEIGHT AND POSITION OF MATERIALS AND EQUIPMENT ON TRUSS AT TIME OF COLLAPSE

Weight tickets were obtained from Amcon Block and Pre-cast, Inc. in St. Cloud, MN. for the rock aggregate. Weight tickets were obtained from Aggregate Industries for the sand, which was delivered by Steve Miller Trucking Company in St. Cloud, MN. The weight of the equipment was estimated by PCI. The precise area where the equipment and material were stored on the deck was established by witness interviews, examining the limits of the work area, and examining photographs after the accident including one taken by a passenger on a Northwest Airlines flight that flew over the bridge about 3:30 p.m. See the diagram below for a graphic representation of the staging area location and weight of materials and equipment.



The positions of the materials and vehicles were changed after the 3:30 p.m. photograph was taken. Construction workers from PCI used a skidsteer to move the materials closer to the median barrier to make room for the movement of construction vehicles and traffic moving in the outside lanes. (See Photo 1 in Highway Construction Factors Group for Details)

In the right center of this photograph the plastic covering can be seen over previously repaired areas that had not yet cured. For that reason the length of the material staging area was reduced to what can be seen here. The gray colored material is the load of rock and the brown colored material is the sand. In the photograph the edge of the rock is over pier 6 and the center of the aggregate piles of sand and rock is located over structural truss node U-10.

During the investigation the following organizations were contacted to determine if they had any specifications, policies, guidance, practices or training about what weights of materials could be stored on bridge decks or how they should be positioned:

1. Mn/DOT
2. PCI

3. Minnesota Safety Center
4. Minnesota State Patrol
5. Minnesota General Contractors Association
6. Minnesota Trucking Association.
7. American Association of State Highway Traffic Officials (AASHTO)
8. Federal Highway Administration (FHWA)

Initially, none of the agencies or organizations listed had any policies or guidance on how to stage construction materials on a bridge deck.

Later Mn/DOT provided a copy of specification 1513 to the NTSB, stating that it applied to construction loads. This directive is found in the 2005 Mn/DOT Edition of Standard Specifications for Construction. The specification is quoted below:

"The hauling of materials and the movement of equipment to and from the project and over completed structures, base courses, and pavements within the project that are open for use by traffic and are to remain a part of the permanent improvement, shall comply with the regulations governing the operation of vehicles on the highways of Minnesota, as prescribed in the Highway Regulations act.

The contractor shall comply with legal load restrictions, and with any special restrictions imposed by the contract, in hauling materials and moving equipment over structures, completed subgrades, base courses, and pavements within the project that are under construction, or have been completed but have not been accepted and opened for use by traffic. (There were no special restrictions regarding construction material loads imposed by this contract.)

The contractor shall have a completed weight information card in each vehicle used for hauling bituminous mixture, aggregate, batch concrete, and grading material (including borrow and excess) prior to starting work. This card shall identify the truck or tractor and trailer by Minnesota or prorated license number and shall contain the tare, maximum allowable legal gross mass, supporting information, and the signature of the owner. The card shall be available to the engineer upon request. All contractor related costs in providing, verifying, and spot checking the cab card information (including weighing trucks on certified commercial scales, both empty and loaded) will be incidental, and no compensation other than the plan pay items will be made.

Equipment mounted on crawler tracks or steel tired wheels shall not be operated on or across concrete or bituminous services without specific authorization from the engineer. Special restrictions may be imposed by the contract with respect to speed, load distribution, surface protection, and other precautions considered necessary. (No special load distribution restrictions were imposed by this contract.)

Should construction operations necessitate the crossing of an existing pavement or completed portions of the pavement structure with equipment or loads that would otherwise be prohibited, approved methods of load distribution or bridging shall be provided by the contractor at no expense to the Department.

Neither the issuance of a special permit, nor by adherence to any other restriction imposed, shall the contractor be relieved of the liability for damages resulting from the operation and movement of construction equipment."

On August 8, 2007, U.S. Secretary of Transportation Peters provided a cautionary statement to the states about construction loads on bridges. Following that statement, the FHWA issued Technical Advisory # 5140.28 concerning construction loads on bridges. The advisory cautioned states not to overload members on a structure with construction loading and stockpiled raw materials. The advisory referred readers to AASHTO Standard Specifications for Highway Bridges, 17th Edition, Division II, Section 8.15 or the AASHTO Load Resistance and Factor Design Bridge Design Specifications, 4th Edition, Section 3 for more discussion on this issue. These documents are quoted below:

AASHTO Standard Specifications for Highway Bridges, 17th Edition, Division II, Section 8.15.3 Construction Loads.

"Otherwise, loads imposed on existing, new or partially completed portions of structures due to construction operations shall not exceed the load carrying capacity of the structure, or portion of the structure, as determined by the load factor design methods of AASHTO using load group 1B. The compressive strength of concrete to be used in computing the load carrying capacity shall be the smaller of the actual compressive strength at the time of the loading or the specified compressive strength of the concrete."

AASHTO Load Resistance and Factor Design Bridge Design Specifications, 4th Edition, Section 3.4.2.1, Load Factors For Construction Loads

"All appropriate strength load combinations in Table 3.4.1-1, modified as specified herein, shall be investigated. When investigating strength load combinations I, III, and V during construction, load factors for the weight of the structure and appurtenances, DC and DW, shall not be taken to be less than 1.25. Unless otherwise specified by the owner, the load factor for construction loads shall not be less than 1.5 in strength load combination I. The load factor for wind in strength load Combination III shall not be less than 1.25."

Opposite the specification a commentary is found in section C3.4.2.1. "The load factors presented here should not relieve the contractor of responsibility for safety and damage control during construction. Construction loads are permanent loads and other loads that act on the structure only during construction. Construction loads include the weight of equipment such as deck finishing machines or loads applied to the structure through falsework or other temporary supports. Often the construction loads are not accurately known at design time; however, the magnitude and location of these loads considered in the design should be noted on the contract documents."

REVISION to MNDOT SPECIFICATION 1513

In April 2008 MnDOT revised Specification 1513 to add more specific guidance and requirements concerning the storage or placing of construction materials on bridges. (See Policy Below)

(1513) RESTRICTIONS ON MOVEMENT AND STORAGE OF HEAVY LOADS AND EQUIPMENT
Use on all jobs.
NEW WRITEUP 4/8/08
SP2005-21.1

The provisions of Mn/DOT 1513 are hereby deleted and replaced with the following:

The hauling or storage of materials and/or the movement and storage of equipment to and from the Project and over completed structures, base courses, and pavements within the Project that are open for use by traffic and are to remain a part of the permanent improvement, shall comply with the regulations governing the operation of vehicles on the highways of Minnesota, as prescribed in the Highway Traffic Regulation Act.

The Contractor shall comply with legal load restrictions, and with any special restrictions imposed by the Contract, in hauling or storing materials, moving or storing equipment on structures, completed subgrades, base courses, and pavements within the Project that are under construction, or have been completed but have not been accepted and opened for use by traffic.

The Contractor shall have a completed Weight Information Card in each vehicle used for hauling bituminous mixture, aggregate, batch concrete, and grading material (including borrow and excess) prior to starting work. This card shall identify the truck or tractor and trailer by Minnesota or prorated license number and shall contain the tare, maximum allowable legal gross mass, supporting information, and the signature of the owner. The card shall be available to the Engineer upon request. All Contractor-related costs in providing, verifying, and spot checking the cab card information (including weighing trucks on certified commercial scales, both empty and loaded) will be incidental, and no compensation other than for Plan pay items will be made.

Equipment mounted on crawler tracks or steel-tired wheels shall not be operated on or across concrete or bituminous surfaces without specific authorization from the Engineer. Special restrictions may be imposed by the Contract with respect to speed, load distribution, surface protection, and other precautions considered necessary.

Should construction operations necessitate the crossing of an existing pavement, bridges or completed portions of the pavement structure with equipment or loads that would otherwise be prohibited, approved methods of load distribution or bridging shall be provided by the Contractor at no expense to the Department.

Neither by issuance of a special permit, nor by adherence to any other restrictions imposed, shall the Contractor be relieved of liability for damages resulting from the operation and movement of construction equipment.

Unless specifically allowed in the design plans, or approved by the Engineer, the storage of construction materials on the bridge will be limited by this specification. These requirements are intended to limit construction loads to levels commensurate with the typical design live load. A stockpile shall be distributed over an area such that the average uniform loading does not exceed 976 kg/m^2 (**200 lbs./ft^2**). Construction materials stored on the bridge deck will not exceed 31,702 kg/100 m^2 (**65,000 lbs./1000 ft^2**) for any area. The Contractor may submit alternate loadings to the Project Engineer 30 Calendar days prior to placement. Any submittals will require the calculations be certified by a Professional Engineer.

MNDOT SPECIFICATION 1515 REVISION DATED 9/18/2008

(1513) RESTRICTIONS ON MOVEMENT AND STORAGE OF HEAVY LOADS AND EQUIPMENT
Use on all jobs.
REVISED 9/18/08
SP2005-21.1

The provisions of Mn/DOT 1513 are hereby deleted and replaced with the following:

The hauling or storage of materials and/or the movement and storage of equipment to and from the Project and over completed structures, base courses, and pavements within the Project that are open for use by traffic and are to remain a part of the permanent improvement, shall comply with the regulations governing the operation of vehicles on the highways of Minnesota, as prescribed in the Highway Traffic Regulation Act.

The Contractor shall comply with legal load restrictions, and with any special restrictions imposed by the Contract, in hauling or storing materials, moving or storing equipment on structures, completed subgrades, base courses, and pavements within the Project that are under construction, or have been completed but have not been accepted and opened for use by traffic.

The Contractor shall have a completed Weight Information Card in each vehicle used for hauling bituminous mixture, aggregate, batch concrete, and grading material (including borrow and excess) prior to starting work. This card shall identify the truck or tractor and trailer by Minnesota or prorated license number and shall contain the tare, maximum allowable legal gross mass, supporting information, and the signature of the owner. The card shall be available to the Engineer upon request. All Contractor-related costs in providing, verifying, and spot checking the cab card information (including weighing trucks on certified commercial scales, both empty and loaded) will be incidental, and no compensation other than for Plan pay items will be made.

Equipment mounted on crawler tracks or steel-tired wheels shall not be operated on or across concrete or bituminous surfaces without specific authorization from the Engineer. Special restrictions may be imposed by the Contract with respect to speed, load distribution, surface protection, and other precautions considered necessary.

Should construction operations necessitate the crossing of an existing pavement, bridges or completed portions of the pavement structure with equipment or loads that would otherwise be prohibited, approved methods of load distribution or bridging shall be provided by the Contractor at no expense to the Department.

Neither by issuance of a special permit, nor by adherence to any other restrictions imposed, shall the Contractor be relieved of liability for damages resulting from the operation and movement of construction equipment.

Unless specifically allowed in the Contract, or approved by the Engineer, all construction material and/or equipment which might be temporarily stored or parked on a bridge deck while the bridge is under construction will be limited by this specification. These requirements are intended to limit construction loads to levels commensurate with the typical design live load. The storage of materials and equipment as a whole will be limited to all of the following:

- Combinations of vehicles, materials, and other equipment are limited to a maximum weight of 31,702 kg/100 m^2 (**65,000 lbs./1000 ft^2**).
- Material stockpiles (including but not limited to pallets of products, reinforcing bar bundles, aggregate piles) are limited to a maximum weight of 12,200 kg/10 m^2 **(25,000 lbs./100 ft^2)**.
- Combinations of vehicles, materials, and other equipment are limited to a maximum weight of 90,700 kg **(200,000 lbs.)** per span.

The Contractor may submit alternate loadings to the Project Engineer 30 Calendar days prior to placement. Any submittals will require the calculations be certified by a Professional Engineer.

OVERWEIGHT PERMITTED LOADS

The Mn/DOT overweight permit office documented the number of known overweight permitted loads that have traveled over bridge 9340 in the preceding 12 months. They reviewed 3200 single permit and annual permit loads to determine if they used the route that would allow them to travel over the bridge. Mn/DOT provided the NTSB with copies of 25 permitted loads that traveled over the I-35W Bridge. Additionally, the Minneapolis Fire Department provided a list of 19 fire apparatus trucks that used the I-35W Bridge. The Minneapolis and St. Paul Public Works Department indicated that it did not issue any permits for overweight trucks to cross the I-35W Bridge.

AASHTO AND NTSB SURVEY REGARDING PLACEMENT OF CONSTRUCTION MATERIALS ON BRIDGE DECKS IN OTHER STATES.

After the accident the NTSB requested AASHTO to survey their member states to determine what type of specifications they hade to prevent the storage of heavy construction materials on bridges. Thirty-nine member States of AASHTO responded. Seven member states from the response list were interviewed and an additional four member states that did not respond to the survey were interviewed.

The following states were interviewed: Pennsylvania, Texas, Washington, West Virginia, Minnesota, New York, Ohio, Oregon, Alabama, California, and Massachusetts. The interviews focused on their specifications to prevent or limit staging aggregates on bridges. Seventeen of the states indicated they had no such policies or specifications. The other states varied in response but generally required some advance notice and an engineering evaluation by a registered engineer before construction loads could be placed on a bridge. The problems related to the policies appear to be how construction loads are defined and how storage is defined. Most of the policies were specific to vehicles and heavy equipment. Only one state, Utah, had a policy that specifically prohibited placing loose aggregates on a bridge. Another state, Alabama, had a general specification requiring calculation and working drawings on any bridge loading if the engineer thought it should be required. West Virginia required calculations before materials could be stockpiled on a bridge, but the specification was not inclusive of staging aggregates in preparation for an immediate overlay. And, Minnesota developed a very specific policy in April 2008. In this collapse the materials were staged on the bridge day of the accident but not actually stored. Most states have a policy or specification about storage of materials but rarely does the policy intend to limit staged materials on a bridge deck. Evaluation of the specifications and policies from the States, AASHTO, and FHWA shows that they all specifically address overweight vehicles and heavy equipment, such as cranes. These are common problems and the policies reflect this. However, repaving or overlaying a large river bridge such as the 1-35 bridge is not a common occurrence. It last occurred on the I-35 Bridge in 1977. Policy makers have had few opportunities to refine the needed loading limits for this type operation because it occurs so infrequently. (See Attachments 16, 17, 18 and 19 for complete details of the survey and specifications).

ACCIDENT STATISTICS

During the preceding six-year-period from 2001-2006, 1,574 traffic accidents have occurred within an area one mile on either side of the bridge and including the bridge. The area includes RP +00.357 to RP 019+00.719. The severity of accidents is broken down below:

Fatal accidents	8
Incapacitating Injury Accidents	2
Non- Incapacitating Injury Accidents	60
Possible Injury Accidents	267
Property Damage Only Accidents	1,237

In response to a request by the NTSB Highway Construction Factors group to treat the construction material load as a wheeled load and to see if the vehicle could be permitted, the Mn/DOT Bridge Office provided the following response: Also, Mn/DOT was requested to load-rate the bridge using AASHTO LRFD standards.

When the construction loads were simulated as a wheeled vehicle they exceeded the capacity of a stringer in the south approach spans. When the construction loads were rated according to the AASHTO specifications they did not exceed the operating capacity of the bridge.

Load Rating of Bridge 9340 with Construction Loads.

This study is based on the loading diagram supplied by the Highway Construction factors group Chairman to MNDOT on October 18. 2007. This diagram consisted of 184 k rock, 199 k sand, plus 194 k other construction equipment, for a total of 577 k. This loading is in the inner two south bound lanes, south half of the main span.

MNDOT indicated that had this proposal been forwarded to them from the contractor at the start of the overlay contract, they would likely have rejected it, before doing any analysis for the loads. They indicated they would have questioned if there were alternate locations for stockpiling the materials. They indicated that this loading is immediately seen to be much larger than design loads. For example, the HS 20 design lane load is 0.64 k / ft. The rock and sand piles weigh about four times as much as this, spread over a width of 14 ft, just slightly more than a design lane.

Never-the-less, as requested, MNDOT continued to further check these loads using more rigorous methods.

This load rating was done under the governing AASHTO Bridge Design Specification, Seventeenth Edition and the Manual for Condition Evaluation of Bridges, Second Edition. The load factors used for dead load and live load were 1.30, the operating level.

An overall comparison was made of all the loads included in the 577 kips. On a square foot basis, the rock and sand piles were almost twice as heavy as the next highest loads, D16, B16, or B15. On a linear foot basis, the rock and sand were more than twice as heavy as D16, B16, or B15.   The three trucks are of legal highway weight (as close as we can tell without axle spacings and loads). The side by side trucks are 15 feet apart, more than the lane width of 12 ft. There is a 20 foot overlap between the D16 truck and the sand pile. This is not significant to the stringers, since D16's weight would fall mainly on the 3rd and 4th stringers from the median and the sand actually produces uplift on the 3rd stringer (and a very small downward force on the 4$^{th)}$. (According to the STAAD analysis)

Overall, the rock and sand piles are the heaviest loads, present the most concentrated loading effects, and warrant the most scrutiny.

To facilitate the calculations, the rock and sand piles were converted to "ridges" or "prisms". The rock became a triangular prism load, 14 ft wide x 60 ft long at 3.07 k / ft. The sand became a triangular prism load, 14 x 55 ft at 3.61 k / ft.

To determine the load distribution of the rock and sand to the structure, STAAD was used. The deck was modeled as a continuous structural member over the stringers. The results of this showed that 29.0 % of the load went to the stringer closest to the median. The stringer next to it (the first interior from the median) received 74.4 % of the load.

At this point, the stringers were checked using the Bridge Analysis and Rating System (BARS). This program is based on the load factor method and the specifications mentioned above. BARS does not have the capability for user input of uniform loads. Two methods were used:

First the rock and sand piles were converted to a model multi-axle truck. The model consisted of 19 axles at about 6 ft spacing. For the spans under consideration the controlling rating factor was 0.96, negative moment at 2.0 (truss panel point 9) and adjusted to zero impact.

In the second method the stringers were checked by applying the rock and sand piles to the BARS influence lines. The method used alternate span loading to the maximum detriment of the stringer, and the STAAD lateral distribution. The controlling rating factor was 1.11 at point 3.0, negative moment. A rating factor of 1.0 or greater is acceptable. This method would be considered a more accurate representation of the loading than in the paragraph above where a moving load was applied.

The floor trusses were checked with the influence lines from the original calculations. Two members of the floor truss were selected for checking. Under the dead load member U5-U6 has the most compression force and member
L4-L7 has the most tension force. The load case under consideration was the construction loads plus HS 20 trucks in three adjacent traffic lanes (3 lanes govern). The trucks, D16, B16, or B15, were modeled as uniform loads over their lengths. HS 20 loads in adjacent lanes were positioned to produce maximum effect on the floor trusses. It showed that the floor truss at U11 received the most reaction from the construction loads. The operating rating factor for the construction loads is 2.1 for tension member L4-L7 and 1.4 for compression member U5-U6.

The main trusses were checked with the influence lines from the original calculations. Nine members were selected based on their locations and original design forces. The load case under consideration was the construction loads plus HS 20 lane loads with concentrate load in adjacent traffic lanes. The trucks on the bridge were assumed as uniform loads over their lengths. Article 3.11.3 Lane Loads on Continuous Spans was followed for HS 20 lane loads to produce maximum effects on trusses. The capacity of each member was based on original calculations that are shown on the original plan. The operating rating factors for the main truss members are shown in the table.

Member	L13-L13’	U8-U10	U6-U8	L11-L13	U10-L11	U8-L9	L9-U10	L8-L9	U10-U12
RF Oper.	4.5	11.6	3.3	2.7	3.0	2.0	2.2	3.8	2.0

In conclusion MNDOT stated,”The most direct response to your question is we would have likely denied the contractors request based on a quick and fairly simple review. However a more rigorous analysis shows all rating factors to be above one.”

Notes:

The BARS rating uses a dead load distribution that was a standard practice at Mn/DOT up to the mid 1990s. Interior stringers were designed for their self-weight, the contributory deck weight and 33 % of the railing weight. This is a conservative method in this and almost all cases.

The dead load increases had previously been entered in BARS. For the analysis of the floor trusses and the main trusses, a dead load increase of 19.5 % over the original design was used.

These calculations have not considered that on August 1 the bridge was lighter by the amount of the 2 inches of concrete that had been removed from the two lanes.

No impact was added to the construction loads.

<u>Additional Loading of the I-35W Bridge Since Original Construction</u>

To better understand how much additional loads were added to the bridge the NTSB asked the Mn/DOT about previous loads and their justifications. Mn/DOT provided the following information:

Bridge 9340 original construction from 1967 included 1 ½ inches of cover over the top reinforcing bars in the deck. By the early 1970's numerous states including Minnesota with harsh environments were having corrosion problems due to the minimal concrete cover over the uncoated reinforcing. As a protective measure Minnesota adopted a policy based on research in the mid 1970's of increasing the cover of top deck rebar to 3 inches with the addition of a high-density concrete overlay. Other states used similar systems or membranes with bituminous overlays. The concrete overlay policy reduced the permeability of harsh chemicals from reacting with the steel and has extended the life of bridge decks at least another 20 years. Overlays were included in new designs and added to many existing bridges.

The original 1967 railings and median guardrail did not meet the requirements of NCHRP 350 for a TL-4 barrier. The F rails on the median and the modifications on the exterior barrier in 1998 do meet safety requirements. The original center median curb and guardrail and the exterior rail were deteriorating from corrosion and traffic impact. They required repair by 1998. When traffic rail modifications are made to existing bridge on the National Highway System (NHS) the FHWA requires we upgrade the railing to meet NCHRP 230/350 standards. Therefore, two new concrete Type F rails with a pre-cast cap were added in the median. The cap between the inside railings stopped the harsh chemicals from leaking onto the underside of deck overhang and the floor trusses. Also a 10-inch-thick inside face was added to the exterior 1 line concrete rails.

Other Temporary Significant Loading

The only other heavy loading of the bridge structure that could be discovered would have been during the 1998 repair project. When the 1967 median guardrail was replaced PCI performed a slip-form operation on the bridge instead of a cast-in-place operation. However, during this time a temporary median barrier for both the north and southbound lanes was erected to protect workers in the median and to protect the new median barrier while it was curing. The temporary median barrier weighed approximately 1.6 million pounds. Coincidentally, the weight of the construction load and all of the highway traffic on the bridge the day it collapsed was approximately 1.6 million pounds. However, the 1,600,000-pound temporary-barrier was evenly distributed across the entire 1,907- foot length of the bridge.

Summary of Mn/DOTs' Position Regarding the Loading of the Bridge by PCI and PCI's Rationale for Loading the Bridge

Mn/DOT:

Since 1968 the Mn/DOT Standard Specifications for Construction Manual has contained language on limiting loads in Section 1513. Section 1513 in the current 2005 manual, states that a contractor shall comply with the same load restrictions as normal legal traffic. The restrictions are for completed structures or those under construction. The legal limits are defined per Minnesota Statute of the Highway Traffic Regulation Act Chapter 169.

The contractor can request to place larger than legal loads on a new or remodeled bridge with Mn/DOT Construction Project Engineers approval. Although not a written policy, when a contractor proposes a load that exceeds legal loads, it is a practice for the Mn/DOT Construction Project Engineer to consult with the Regional Construction Engineer in the Bridge Office. The construction loading information is provided to the load rating unit or Design Unit for evaluation to determine if the loading is acceptable or if any special procedures such as use of the load distribution mats are required. Some examples of loads that exceed legal loads are mobile cranes or heavy earth moving equipment.

Mn/DOT reiterated that the robust load rating that they did at the request of the NTSB would probably not been undertaken if the contractor had requested it. Instead, they would have rejected his request to load 200 tons of construction material in such a short area immediately and looked for alternatives. Other alternatives that existed included staging only part of the needed materials on the deck or placing all of the materials at another location and transporting the concrete to the overlay area from the offsite area. While the more robust evaluation requested by the NTSB did show the bridge main truss members (excluding gusset plates) could handle the load, it is apparent this was an extreme heavy load and one should seek professional guidance before applying this type of a load to a bridge structure.

PCI:

PCI officials had a different view. *The following representation more closely reflects PCI's rationale for loading the bridge.*

The overlay pass that PCI was preparing for on August 1, 2007 was to be 523 ' long and 26' wide. This was the area available to pour. Due to the tremendously tight time and space constraints in-place under the terms of this contract we would naturally pour what is available when it was available. High temperatures and any precipitation are just two problems that can delay pouring concrete on a prepared surface. This particular Contract included very severe restrictions on when and where we could perform our work. For example, due to the State's consideration for the convenience of the traveling public, our ability to close an adjacent lane to traffic was allowed only between the hours of 8:00PM to 5:00AM on weekdays and complete closures on six specific weekends. To meet the tight deadlines and being forced to operate within specific traffic configurations posed unique and very difficult obstacles. With this in mind, PCI on numerous occasions requested additional lane closures and additional full weekend closures. On one occasion we even formally requested to batch the wearing course material out of our nearby PCI plant site. These requests were denied. Under the terms of contracts such as this one, contractors work under the complete direction and discretion of the contracting authority, MnDOT. In accordance with the Provisions Special to the Contract and general provisions contained in MnDOT's Standard Specifications, the Engineer has the sole authority to decide all questions regarding the manner of performance, rate of progress of the work, immediate charge of the Engineering details, and , in addition, the Engineer exerts complete control regarding the payment of acceptable work, suspension and/or non-payment of unacceptable, improperly performed work. The engineer also has the authority to suspend the work in the event that the contractor fails to correct conditions found to be unsafe for the workman or the traveling public.

MnDOT Inspectors work as the Engineers representative. They are obligated to report to the Engineer's on matters related to progress and acceptability of the work, as well as having the responsibility to call to the attention of the contractor any failures or infringements on the part of the contractor. Inspectors enforce applicable Contract specifications. Specific bridge Inspectors' tasks, include, but are not limited to, material sampling, gradations, outlining limits of concrete removal, adherence to State concrete mix designs etc.. They determine when a concrete surface is *prepared acceptably; they monitor ambient conditions before allowing a concrete pour to go forward. Inspectors closely monitor inspect every facet of the contractors' operation.*

The size of the pour was computed and materials ordered and delivery was taken mid-day over the course of three hours. . On two previous pours, July 6 and July 23, and, of course on August 1, wearing course material was placed on the bridge, again, to facilitate concerns of time and space. On each of these occasions MnDOT had inspection personnel, perhaps engineers, who observed the loading. On the day of this pour, we were prepared to begin at 5:30 PM. Because of the high temperature, MnDOT directed us to begin no sooner than 7:00PM. We would generally struggle through the beginning of the pour with live adjacent traffic and then @ 8:00PM we would have been allowed to close the adjacent lane for added safety and speed of the pour.

Bringing a project such as this from concept to the bidding stage, and finally to Contract completion is a complex undertaking. During each step in the process, starting with the establishment of a need, prioritizing needs, designing and engineering a fix, then moving into encumbering funds, scheduling, specifying materials, traffic control layouts etc., the contractor's role is subordinated to that of MnDOT. As a contractor, we do not have a comprehensive bridge program. Contractors do not possess data bases relating to the general condition and special needs of the State's bridges. We, therefore, rely on MnDOT to design, fund and administrate Contracts when these needs are identified and addressed.

Summaries of Key MN/DOT and PCI Personnel

On the day of the collapse a MN/DOT construction inspector was present and fell down with the bridge. He was later question about policies governing what PCI did when they staged the aggregates on the bridge. He indicated that he was not involved in that aspect of the operation. The project construction supervisor and project engineer were also questioned. The project engineer viewed the construction supervisor as his parallel with matters regarding the bridge because he had been involved in over 60 bridge reconstruction projects. When the NTSB asked the construction supervisor if he had been present the day the aggregated were staged on the bridge if he would have question what PCI was doing or taken any steps to prevent it he answered he wasn't sure and it would have been a 50/50 chance that he might have said or done something and then only because of his close working relationship with the MN/DOT Bridge engineer Mr. Paul Kivisto. Neither the supervisor nor the project engineer were aware that PCI had staged aggregates on the deck back in July during this project.

Mr. Steve Weston and Mr. Steve Klug the Superintendent and Foreman for PCI said that that MN?DOT had never given them advice about where to stage aggregates for an overlay on a bridge deck, and Mr. Klug said it was common to do this.

<u>Records of Pavement Overlay on I-35 Bridge in 1977</u>

The only records available from the 1977, construction overlay of the I-35 bridge was an inspection report conducted by the Federal Highway Administration (FHWA) on August 3, 1977.

The inspection report identified the contractor as Denton Construction Company and the contract# as 16539. Denton Construction Company was sold to Denton Concrete Services in 1995. Mr. Denton was contacted by phone at his business in Gross Pointe Woods, Michigan. He could not remember any details about the 30-year-old project and no longer had any records dating that far back. The most notable item in the inspection report characterized the quality of the work as satisfactory but the progress of the work was unsatisfactory. Notes indicated that the contractors' method of work was adequate but needed improvement. The inspector explained that one of the reasons for the slow progress was that the contractor was mixing the concrete under the structure and then transporting it to the structure. He indicated that this process was too slow because concrete could not be supplied at an adequate rate to keep the Bidwell finishing machine in continuous operation. For more information see Attachment 15.

PROGRESSIVE CONTRACTOR'S INC
LIST OF PERSONS INTERVIEWED

1. Kevin Gulden
2. Tom Sloan
3.Reed Maitland
4.Steve Weston
5.Paul Lombard
6.Roger Lombard
7.Robert Bailey
8.Steve Klug
9.John Culver
10.Paul Holtz1
11.Mark Hagland
12.Matt Hoheisel
13.Matt Miller
14.Jeff Ringate
15.Terry Oswald
16.George Powell
17.Roger Burma
18.Wayne Krohn
19.Josh Weidendorf
20.Luis Del Real
.

TRUCK DRIVERS INTERVIEWED

1.Bryan Schmidt
2.Justin Joarnt
3.Jeremy Pollard
4.Mike Skuza

5.Ben Fisher

DOT PERSONNEL INTERVIEWED

1. Robert J. Rucker – Inspector – On Bridge at time of collapse
2. Harvey Unruh – Inspector on Duty when Material was staged on bridge previously
3. Barry Nelson – Project Supervisor
4.Eric Embacher – Project Engineer

<u>*Interview #1*</u>

Tom Sloan
V. P., Bridges and Structures
Progressive Contractors Incorporated (PCI)
14123 42nd Street NE
P.O. Box 416
St. Michael, MN 55376-0416
(612) 497-6100
[redacted]

Kevin Gulden
Bridge Division Coordinator
Progressive Contractors Incorporated (PC I))
14123 42nd Street NE
St. Michael, MN 55376-9564
[redacted]

Mr. Sloan and Mr. Gulden were interviewed on August 4, 2007, at the Westin Minneapolis, 88 South 6th Street, Minneapolis, MN 55402. Present were Dennis Collins, David Rayburn, and George Black from the National Transportation Safety Board's Office of Highway Safety. The interview began at 1402 hours.

According to Mr. Sloan and Mr. Gulden, Progressive Contractors Incorporated (PC I) was founded in 1971. The company was described as a concrete paving company, performing highway and bridge repairs. PCI currently has approximately 450 employees and handles 80 to 100 million dollars in contracts. Typically, the Bridges and Structures division is responsible for 25% of the contracts; however, this year, the percentage is closer to 30 to 40 percent. Mr. Sloan joined the company in 1980.

Mr. Sloan and Mr. Gulden described the contract for the work on the I-35W bridge as typical, involving deck overlay removal and replacement from abutment to abutment and expansion joint removal and replacement. Specifically, PCI's was to remove two inches of concrete overlay, remove and replace the expansion joints, and remove and replace any deteriorated concrete decking. A sub-contractor was to install a de-icing system. They described a shallow removal of material as a "Type I" operation and a deeper removal of material as a "Type

III" operation. They indicated the majority of their operations on the bridge were Type I. Work began in late April or early May, most likely May.

The I-35W bridge consisted of four northbound and four southbound lanes. At the time of the collapse, two lanes in each direction had been closed to traffic. For southbound traffic, the outside (west) two lanes remained open; for northbound traffic, the inside (west) lanes remained open. Mr. Sloan and Mr. Gulden described the state of the project as follows: The northbound outside lanes had been re-paved; the northbound inside lanes were untouched; the southbound outside lanes were complete; and the southbound inside lanes had been milled, removing 2 inches of material from the entire span. At the time of the collapse, PCI was preparing to pour concrete over 530 feet in the southbound lanes. The pour would run along spans seven and eight, from expansion joint to expansion joint.

When asked, Mr. Sloan and Mr. Gulden indicated there was a staging area for the equipment involved in the pour. The staging area was approximately 228 feet long in the inside two lanes on the southbound side. The staging area ran approximately from expansion joint three, span seven to expansion joint two, pier six; the staging area terminated just north of joint two, pier six. The pour would end when it reached the staging area. Equipment in the staging area included a mixer truck in the inside lane at expansion joint three, a cement tanker adjacent to the mixer in the next lane, a 3000 gallon water tanker, and an XT90 skidsteer. In the inside lane, adjacent to the median, four loads of sand and four loads of rock – used in the concrete – had been placed. The piles of sand and rock began at the southern edge of the staging area and proceeded north approximately 114 feet. Just outside of the staging area, beyond expansion joint three, four concrete delivery buggies had been arranged in a 2 by 2 formation. With the assistance of Mr. Sloan and Mr. Gulden, investigators were able to graphically depict this setup.[2]

Mr. Sloan and Mr. Gulden were able to provide the following weight information:

Daffin Mixer, 1990 Ford L9000	30,000 lbs
Water truck, Ford L9000	26,000 lbs
3000 gallon of water	24,000 lbs
Case XT90	8950 lbs
Cement Tanker (full)	80,000 lbs
"Buggies" (4)	11,000 lbs (2755 lbs each)
4 loads sand, 4 loads rock	192 TONS (24 tons each)

Note: These loads were initial estimates that changed when the weight tickets became available.

When asked, Mr. Sloan and Mr. Gulden indicated that the concrete was broken up for removal with hand-held 35-pound jackhammers. A vehicle-mounted jackhammer was used to remove expansion joints. They indicated that the expansion joints were as deep into the decking as they went. They stated the expansion joints were exposed for two to four days at most, and that the state would have rain records for the project. The expansion joints at the north and south abutments were type "B"; the remaining joints were type "D". The contract called for the removal and replacement of all the expansion joints on the bridge.

[2] A "white board" was used; following completion of the diagram, a picture was taken.

Mr. Sloan and Mr. Gulden stated this was at least the third contract for work on the I-35W bridge. The prior contracts had called for additional concrete to be added to the bridge (described as “fattening”), for “J” type barriers to be installed at the inside of the bridge, and for the addition of a concrete lid between the northbound and southbound lanes. In 2001, an overlay repair project was conducted.

Mr. Sloan and Mr. Gulden stated the Minnesota Department of Transportation Project engineer for the project was Eric Embacher; the project supervisor was Barry Nelson; and the bridge inspector was Harvey Unruh.

Mr. Sloan and Mr. Gulden provided investigators with a list of PCI employees working on the bridge at the time of the collapse.

Reed Maitland Interview Summary

Others Present:Kevin Gulden and
Counsel – Gregory SpalJ

Time and Date – 1:15 pm 8/6/07
PCI Headquarters

Mr. Maitland is a concrete mason age 50. He said he arrived on the bridge about 11:30 and positioned the Bidwell paving machine. Then he staged a dry run around 2-2:30 pm. He finished the dry run about 5-5:30pm. During a dry run you set your depth about ½ inch over the expansion joint and then he discussed the operation with the state inspector, Harvey Unruh. Then he sent Schweniger to pick up a catwalk.

Mr. Maitland said he was experienced working on bridge paving operations. He had worked on several other pours on the bridge. He was expecting to work until about 1 am on this job. He indicated they normally poured about 100 feet per hour. He was unsure about the length of the pour or how long the staging area was. Note: At this point Mr. Gulden indicated the pour area in this case was limited by the other repaired areas on the deck that had not cured yet, which prevent workers from driving on that surface.

He had left the bridge area, and was told about the collapse by Schweniger on the telephone.

Steve Weston Interview Summary

Time and Date 1:45 pm 8/6/07
PCI Headquarters

Mr. Weston is a construction Superintendent. He has been with PCI for 27 years and is experienced in all areas of bridge repaving work. He said it was a normal day maybe a little hot in the afternoon. He went to work about 6 am and planned to work until midnight or 1am. When the collapse occurred he was about 800 feet north of the staging area walking south. He said he felt unusual movement, saw dust flying, and yelled for the men to run. He described the movement as an excessive undulating type movement. He indicated it all happened in a second or two. He was running the other way when the deck fell. He thought he made maybe 10 steps when he was knocked down.

When questioned he answered that no state inspector had ever given him instructions or advice about where to stack materials or stage equipment on a bridge when preparing to pour an overlay. He indicated longer pours might even take another load of sand and rock. He said Steve Klug did the calculations for how much material was needed.

He went on to say that the three factors that limited your staging area were the traffic control, the length of your planned pour, and the repairs that had already been made.
Mr. Weston said he thought the south end of the bridge gave away first because all the dust came from the south end.

Interview Summary of Paul Lombard

Mr. Lombard was 41 and had been working at PCI since 4/9/07. He has been a carpenter all his adult career. He frames patches and joints and helps the other crew on overlays. He said his crew framed all the type three repairs. A type three repair requires the jackhammer operator to remove bad pavement through the complete width of the deck. He builds frame to catch the concrete and then builds forms for others to pour in the patches. He said he never heard of any accidents on the project and never noticed any unusual damage. Mr. Lombard was in the southbound lanes over the north abutment when the collapse occurred. He had no recall of hearing or feeling but became aware when he saw flying dust. Then he saw his brothers truck go down and the deck come up. He couldn't see Steve Weston on the downward side where the pavement broke. Next he went to help his friend George and then he came across his brother Roger.

Interview of Roger Lombard

Mr. Lombard is 42 and has been employed at PCI since April 2007. He was working with the overlaying crew on the day of the collapse. He was near the Bidwell paver located at the end of the planned 530-foot pour area setting up a catwalk when he heard a loud noise. Next he heard Steve Weston yell "Run." Then he felt the deck trembling. His next memory was picking himself up from the deck. He said he saw dust before he turned to run. It looked like the dust came from the northbound side of the south end of the bridge. After the collapse he helped people get to safety.

Earlier in the day he had patched some holes on a different job on University. In the past he has worked on the "Snooper Truck", framing holes underneath the deck. He said he never noticed anything unusual underneath the bridge. He had no knowledge of any accidents or anything that could have damaged the bridge prior to the collapse.

Interview Summary of Robert Bailey

Mr. Bailey is a 40-year-old carpenter with 7 months on the job. He had been patching on the south end of the bridge south of the staging area. He came to work about 10 am and expected to work until 1 am. He normally frames joint repairs. He was not aware of any accidents or damage done to the bridge during repair and replacement of joints.

He was at Bobby and Steve's gas station and convenience store taking a break when the collapse occurred.

Interview Summary of Steve Klug
9 a.m. 8/7/07
Counsel Present
Kevin Gulden Present

Steve Klug is 41 years old and has been with PCI for 21 years. He is a job Foreman. He had been working on this project for 3 weeks and came to work about 5:30 a.m. on the day of the collapse. He said he expected to work until about midnight or 1 a.m. He stated that he and Gary Gulden ordered the materials for this overlay. He said he had 4 end dumps of sand and 4 end dumps of rock with 3 cement tankers; one on-site and two off-site. When asked had the MNDOT or any State inspector ever gave him guidance on where to stage materials, he stated, " On the last northbound pour he asked inspector Harvey Unruh was it okay to stage on the bridge?" He said Mr. Unruh's reply was, " What are you asking me for, sure it's okay. no problem." Mr. Klug said he asked to make sure because he didn't want to have to move the load. He indicated this was the second pour in July. He went on to say that no inspector had ever given him any guidance on how to stage materials on bridge decks, and that it was common to have to place materials on the decks. Mr. Klug advised the truck driver's where to place the materials. He said the sand loads came first and then the rock loads. The trucks came on the deck one at a time because they didn't want them traveling over a freshly sand blasted area and their were patch repairs on the other end that limited space.

Next he and Terry Holleman traveled to get another water truck. He was northbound between the abutment and pier# 5 in the traffic lane with the general public when the collapse occurred. He said he got out of the truck and then the truck slid down the pavement and fell.

He indicated this was pour number 8 in the overlay sequence. He and Kevin Gulden then provided diagrams and they both provided the following sequence.

June 28th – Ken Dobel and his crew staged on the ramp and poured a sliver to widen the road.

July 2nd – Staged on university ramp and poured a 473-foot by 26-foot-wide overlay

July 6th – Two crews met and poured in both directions. They pour a 750-foot overlay in the outside southbound lanes from just north of pier 8 in span9 southbound to pier 6 at the end of span 7. The other crew poured southbound from pier 6 to the abutment over a 720-foot-long area.

On the southbound abutment pour the staging area was off the bridge. On the southbound pour near pier 8 span 6 staging was similar to the weights and overall dimensions of the staging area on the day the bridge collapsed except that any additional three loads of sand and rock were stored of the bridge for the extra long overlay pour.
Next, the 4th overlay on July 19th was staged off the bridge.

July 23rd – 5th overlay was a planned pour from expansion joint 5 northbound lanes near the mid-point of span 8 just north of pier 8 to the expansion joint1 at the end of span 7 or 589 feet of overlay. The staging area for this pour was about 183 feet long. It extended from expansion joint 5 through one half of span 8 and about 50 feet of span 9. The staging area had three 24-ton loads of rock and three 24-ton loads of sand. An additional load of rock and sand was stored on the ramp to avoid extra clean-up in the am.

July 25 – The 7th overlay pour was staged on the ramp.

Interview Summary of Harvey Unruh

Mr. Unruh was interviewed in-person by the NTSB On August 2007, and again by telephone on January 23, 2008 at 1:30 p.m. Mr. Unruh indicated he had worked for MNDOT for over 20 years. He worked as a surveyor for the first five years and on concrete paving jobs during the past 15 years. He said he had only worked on one other large bridge overlay job.. That was the arched bridge near Mendota. He said he could not ever remember a contractor staging materials to make concrete on the bridge deck. When asked about the conversation between him and Steve Klug on July 6, 2007, he said he did not remember telling him it was okay to stage on the bridge. In fact, he didn't remember talking to him, and he had no specific memory of seeing the load on the bridge. He explained that he had been working with the other crew on the other end of the bridge. He said most of the paving is done at night so he probably could not see the materials stacked on the deck. (Note) A concrete mixer calibration was done with Mr. Klug on July 6th so the two did have contact, but Mr. Unruh did not recall him asking for permission to stage the material load on the bridge.) However, Mr. Eric Embacher the project engineer, stated that concrete inspection records showed Mr. Unruh was present that night.

Interview Summary of Paul Holtz

Mr. Holtz is a 27 year-old concrete finisher that has been employed with PCI for 5 years. He was with Wayne Khron and Luis Del Rio when the collapse occurred. He first became aware of a problem when the bridge shook like a truck going by. Then he saw dust and heard someone yell "RUN." He began running and then the surface collapsed and he fell down. He received minor cuts and scrapes. Mr. Holtz began working on this bridge about 10 days before the collapse. He never heard of or noticed any accidents or observed any unusual damage.

Mark Hagland Interview Summary

Mr. Haglund is 48 years old and has 27 years with PCI. He is a cement finisher/Foreman. He came to work about 7 a.m. and expected to work to about midnight. He had worked on the bridge for about three weeks, and was on the north end of the bridge when the collapse occurred. He said he felt excessive movement. Then the movement became worse so he turned around to walk the other way because he felt like something was not right. About that time he heard Steve Weston yell for everyone to run. He made a few steps and then heard a loud roar. He also saw dust before turning to run. Next he was face down on the deck. Then he tried to locate members of his work crew, and helped some motorists escape to areas of safety.

Matt Hoheisel Interview Summary

Mr. Hoheisel is a 24-year-old concrete finisher/laborer with 1 ½ years on the job with PCI. He cam to work about 10 a.m. and expected to work to midnight or 1 a.m. He remembered he ate lunch in the staging area and began walking back to the pour area. He was walking toward the north end in the southbound lanes. He said he saw Steve Weston, then he saw dust and hear Steve yell to run. He felt the bridge deck throw him into the air. Then he came down and injured his left arm. He remembered being in the area of the boom truck and blue minivan. After the accident he tried to find his co-workers and gave statement to the police.

Matt Miller Interview Summary

Mr. Miller is a 21-year-old college student at Bethel University that works during the summer at PCI. This is his second summer as a construction worker. He operates jackhammers and other equipment. He had worked three days plus one other weekend on this bridge. He came to work about noon on the day of the collapse and expected to work through until midnight or 1 a.m. From about noon until 1:30 p.m. he worked underneath the 4th St. bridge on pour footings and then walked underneath the University Bridge north end 50 yards from the north abutment. When the collapse occurred he did not hear anything. He remembers seeing traffic stopped, he walked south and saw dust. Then he walked to the end and saw that the bridge had collapsed.

Jeff Ringate Interview Summary

Mr. Ringate is a 30-year-old construction worker with 5 years on the job at PCI. Normally he installs expansion joints, but on this job he was helping the overlay crew. He had worked on this project for 2 ½ - 3 weeks. He cam to work on 8/1/07 about 10 a.m. and expected to work until the paving job was finished about midnight or 1 a.m. He was located on a Mustang buggy. He was moving the buggy out of an MNDOT inspectors' way. He believed he was facing south. He felt the bridge shake like a truck going by and then felt it falling. He looked up and could see that he was falling. He could see the south end still in the air. Then he landed and fell in the river. He was lying partially on the concrete and partially in the river when he came to. Next he pulled Josh out of the water and then helped a couple of other people. He said his back was injured. He evacuated the area by boat. The four in that area were Roger, Jolly, he and Jeff.

Terry Oswald Interview Summary

Mr. Oswald is a 44-year-old laborer that has been working at PCI for three summers. He does overlay work, Joint replacement, and has operated the jackhammer, but not on this job. He had been on this job for 5-6 weeks. On 8/1/07 he came to work about noon and expected to work until 1 a.m. During the day he had done patching work, placed the tarp over the patch repairs and watered it down to keep it cool. Next he collected equipment and cleaned out the grout bucket. He was taking a break with Reed Maitland at a gas station when the collapse occurred.

George Powell Interview Summary

Mr. Powell is a 58-year-old worker that has been with PCI since 1981. He operates a jackhammer and removes expansion joints. He has worked on this bridge since June. He went to work about 6 a.m. and was scheduled to work until 1 a.m. George was with a state inspector in the southbound lanes on the north end abutment. He had done 6 or 7 type one patches. He became aware of the accident when he was walking up from the south end of the bridge. He heard a boom and saw the bridge coming at him like a domino falling. George was with Gene Weidendorf. He said his section dropped out from underneath him. He was on the last span by the boom truck; the boom truck was behind him and Gene. He said he ended up on the slanted down pavement that was on top of the railroad cars. He received injuries to his right shoulder and arm.

He said he never noticed any accidents or unusual damage on the bridge. Some of his work that day included consisted of jackhammering some curb somewhere south of the staging area. He went on to say that the rubble from Type one repairs is stacked on the deck and then removed with a skidsteer. He says he thinks the inspector located the location of his patches.

WITNESS INTERVIEW

Date:	August 7, 2007
Location:	PCI Construction Company
Name:	John Culver
Age:	58
Job Title:	Carpenter
Employed by PCI:	Part-time from 1977 – 93 and full-time since May 2007
On the Job:	2 weeks
Schedule:	11:30 am to 1:30 pm

Summary of Interview

He said that he was working on the ‘snoop truck’ to build the ‘false works’ under the bridge. ‘False works’ are wooden structures placed under holes in the bridge decking to secure the cement that is being poured to repair the hole. He did this at the direction of the PCI supervisors and with the approval of the State inspector.

He indicated that a “type 1” hole is about 3 inches to 4 inches wide. A “type 3” hole is completely through the deck.

He was not at the site when the bridge collapsed.

He has no direct knowledge of the circumstances of the collapse.

End of interview.

WITNESS INTERVIEW

Date:	August 7, 2007
Location:	PCI Construction Company
Name:	Josh Weidendorf
Age:	21
Job Title:	Laborer
Employed by PCI:	Part-time from 1977 – 93 and full-time since May 2007
On the Job:	3 weeks
Schedule:	10:00 am to midnight

Summary of Interview

He said his work hours vary; some times he starts at 6:00 am and sometimes at 10:00 am. This job he started at 10:00 am. His job was shoveling, sandblasting and other manual labor tasks. He was patching holes in the concrete at this site. He took a break about 5:15 pm – 5:30 pm and went with Jeff Ringate to the Taco Bell at the north end of the bridge where he had parked his black Chevrolet Breeta on the side of the bridge. He returned about 5:45 pm. He took on of the diesel “buggies” southbound on the bridge back to the work site. About 10 minutes later he felt a ‘shaking of the roadway” [a vibration]. He felt the bridge slide to the west. He heard a lady screaming in the car next to him. The next thing he remembers is that he was in the water.

He suffered a broken kneecap and some abrasions on his legs.

He said that up to that time he had noticed no unusual activity on the bridge and did not think the construction material was load any differently than before.

End of interview.

WITNESS INTERVIEW

Date:	August 7, 2007
Location:	PCI Construction Company
Name:	Luis Del Real
Age:	24
Job Title:	Laborer
Employed by PCI:	Part-time from 1977 – 93 and full-time since May 2007
On the Job:	2 weeks
Schedule:	10:00 am to midnight

Summary of Interview

He said he was working on another bridge till about 4:30 pm when he came to work on the 35W bridge. At 5:00 pm the entire crew took a break until 6:00 pm. He was several other workers were walking north from the south end back from their break when he heard a "bang" or "crash". He saw dust near the center of the area of the bridge. The "cracking" sound was getting closer. He turned to run but fell down. The center span fell down. His uncle, Hector Bustes-Peralta was walking in front of him, fell down with the bridge.

He did not feel any movement prior to the "cracking" sound.

He did not know of any thing unusual about how the bridge was loaded or how they were going about their business.

End of interview.

WITNESS INTERVIEW

Date:	August 7, 2007
Location:	PCI Construction Company
Name:	Josh Weidendorf
Age:	21
Job Title:	Laborer
Employed by PCI:	Part-time from 1977 – 93 and full-time since May 2007
On the Job:	3 weeks
Schedule:	10:00 am to midnight

Summary of Interview

He said his work hours vary; some times he starts at 6:00 am and sometimes at 10:00 am. This job he started at 10:00 am. His job was shoveling, sandblasting and other manual labor tasks. He was patching holes in the concrete at this site. He took a break about 5:15 pm – 5:30 pm and went with

Jeff Ringate to the Taco Bell at the north end of the bridge where he had parked his black Chevrolet Bereta on the side of the bridge. He returned about 5:45 pm. He took on of the diesel "buggies" southbound on the bridge back to the work site. About 10 minutes later he felt a 'shaking of the roadway" [a vibration]. He felt the bridge slide to the west. He heard a lady screaming in the car next to him. The next thing he remembers is that he was in the water.

He suffered a broken kneecap and some abrasions on his legs.

He said that up to that time he had noticed no unusual activity on the bridge and did not think the construction material was load any differently than before.

End of interview.

WITNESS INTERVIEW

Date:	August 7, 2007
Location:	PCI Construction Company
Name:	Wayne Krohn
Age:	56
Phone #	[redacted]
Cell #	
Job Title:	Cement Finishing Foreman
Employed by PCI:	36 years
On the Job:	10 days
Schedule:	Noon to midnight

Summary of Interview

He said he normally works with a set crew, but because of construction at other site he was working with only part of this crew. He supervises the operation of the "Bidwell" which is a concrete leveling machine. He began work about 1:30 pm and took a break about 5:00 pm. He left the site and had lunch under the 4th st. bridge in a closed lane on 35W near the north side of the bridge.

He was walking back to the site, near where the bridge crosses over the rail line. He saw a large cloud of dust to the south end of the bridge. The cloud covered the whole bridge. He heard a sound "like a train coming at you"; like thunder. It got louder as it got closer.

A fellow worker, Steve Westin yelled "run". He took only a few steps and felt the bridge give way under him. He fell down and suffered minor injuries on his knees, right arm, and chin.

He indicated he did not feel anything unusual prior to the bridge collapse, nor was there anything unusual about the loading on the bridge.

End of interview.

RECORD OF INTERVIEW
Robert John Rucker, Minnesota DOT Bridge Inspector
Interviewed August 4, 2007 at Hennepin County Medical Center.
Present during the interview was NTSB Investigator Ron Kaminski and Sgt. Steve Wagner with the Minneapolis PD

Robert John Rucker (6'2" 210lbs.)

Mr. Rucker stated that he was heading southbound in his work truck and had pulled over and was setting up his equipment. Mr. Rucker stated he was walking north between a cement mixer and tanker when he felt the bridge lurch and drop slightly. Mr. Rucker said he started running away further north from his precarious position between the two large trucks because he knew the bridge was going to fall and he didn't want to be next to the large trucks. According to Mr. Rucker, he didn't take but a few steps before the entire span fell down. He said he ended up under the tanker truck near the wheels. Mr. Rucker stated that two PCI construction workers helped pull him out and he crawled further away from the large trucks.

Mr. Rucker said he sustained 5 fractured ribs to his left side, a left elbow injury with ligament damage, a torn triceps muscle to his left arm, pneumothorax to his lung (unknown which side), and road rash to his extremities.

RECORD OF INTERVIEW
Gene L Weidendorf, Construction worker on bridge
Interviewed on the phone August 11, 2007

Gene L. Weidendorf

Mr. Weidendorf stated that he was working on the deck machine and the first thing he noticed was a dull "pop" noise to the south of his position. He turned and saw what he described as the bridge deck looking like a wave. Mr. Weidendorf continued, saying that a section of bridge on the south end rose up and he could see the vehicle's rise up along with it. According to Mr. Weidendorf, he started running towards the north end because he knew the bridge was going to collapse. As he was running he said the pavement underneath him dropped and he ended up on the section of bridge atop the train tracks. As he stood up a Bidwell trailer struck him and from that point rescue workers carried him off the bridge.

Mr. Weidendorf said he sustained a fractured right ankle, a fractured and dislocated left collarbone and shoulder, stitches to his nose and lip, along with numerous spots of road rash.

<u>Roger Burma Interview Summary</u>

Mr. Burma is a 47 year-old worker that has been with PCI for 4 years. He works with the mixer truck getting material ready for the overlay. He had worked on this project since June when it began. Roger was between the mixer and the cement truck when the collapse occurred. He said he felt a roll on the deck pavement and then it fell. He said a lady in a blue scrub came out of a car to help Bob the inspector. He was rescued by boat. He says he remembers being with Bob, Jolly,Roger, Jeff, and Josh.

<u>Interview Summary of Bryan Schmidt</u>

Date and Time: 8/8/07 Noon
Location: Minneapolis Airport Construction Area

Employer – Steve Miller Trucking
Hastings, MN.

Summary:

Mr. Schmidt dumped a load of sand on the bridge deck. Then 4 trucks dumped their rock loads on the bridge deck. Then Mr. Schmidt dumper 3 more 25 ton loads of sand on the deck. He said he finished dumping about 2:30 p.m. He said the rock loads were about 40-feet long and the sand loads looked like they were about 25 feet long. Mr. Schmidt said his truck was rocking left and right as well as up and down when he was on the bridge.

Justin Joarnt Interview Summary

Mr. Joarnt is a truck driver from Osakis, Mn. He works for AmCon Block Pre-cast, Inc. He indicated he had been dumping aggregates on bridge construction projects for three years. He said he has never been given any instructions by a state inspector; it has always been the contractor that tells him where to dump. He dumped a load of rock on the bridge that collapsed.

Jeremy Pollard Interview Summary

Mr. Pollard is an independent truck driver that hauled a load of rock from AmCon Bolck to the bridge that collapsed. Mr. Pollard lives in Foley, Minnesota. He said the bridge seemed like it was rocking side to side more than normal.

Mike Skuza Interview Summary

Mr. Skuza is a 39-year-old truck driver from Sauk Rapids, Minnesota. He has 4 years experience as a truck driver with one year of experience dumping rock. He has dumped on several bridges in the past. And he has dumped to other rock loads on this bridge during earlier overlays. He said it seemed like it was moving more on the day it collapsed.

Ben Fisher Interview Summary

Mr. Fisher, age 27, from Sartell, Minnesota said he has 6 years experience dumping rock. He states that he has dumped on bridges on many occasions. He says there was more movement this day than what was normal.

Eric Embacher Interview Summary

Mr. Embacher was interviewed by Telephone on the Afternoon of September 4th, 2008 at his office number (651) 366-4302. Mr. Embacher received his Masters degree in civil engineering from the University of Minnesota and his registration as a Professional engineer in 2001. He began working for MNDOT in 1998 in Pavement Research. In 2002 until present day he has worked in the Construction Division and is now the Metro Resident Engineer. This was his first assignment ever on a major bridge rehabilitation/construction project. He indicated that his project supervisor, Mr. Barry Nelson, fulfilled what he described as a parallel roll even though he was a non-engineer. He indicated that since Mr. Nelson was very experienced in bridge projects he let Mr. Nelson fulfill many of the day-today supervisory function of the construction on the I-35 bridge. Mr. Embacher said he went to the bridge site at least once a week for the Tuesday weekly meetings with the contractor, and he sometimes went to the bridge 2-3 times a week. He indicated the last time he was at the bridge was Tuesday 7/31/08, the day before the collapse.

When questioned about any previous knowledge that he had about PCI staging materials on the deck, he said it was never brought to his attention. When question about PCI's statement that they had requested to mix the concrete for the bridge deck at a local location where they were mixing for the remainder of the project, he said that PCI had brought it up at a weekly meeting. Since they did not write a written request and never brought it up again he thought they had decided against trying to do it that way. In other words no decision was ever made.

Barry Nelson Interview Summary

Mr. Nelson the I-35 Bridge construction project supervisor was interviewed by telephone on September 4th, 2008 on his work cell number (651) 775-1094. Mr. Nelson began working for MNDOT in 1979 and began bridge construction projects in 1986. He thought he had worked on 60 bridge construction projects and had never seen a contractor stage materials on a bridge. However, he went on to say that most bridges he worked on were 200-400 feet in length and there would be no reason to stage on the bridge. He said this and the Wakota bridge in St. Paul were the longest bridges he had worked. When asked if he had been present on the day the materials were placed on the bridge if he would have questioned the contractors actions he said it would be a 50-50 chance, and then only because of his close working relationship with Paul Kivisto in the bridge office.///////////////////End of Interview///

NATIONAL TRANSPORTATION SAFETY BOARD

OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C. 20594

Bridge Inspector Robert John Rucker

Follow-up Interview

(3 pages)

NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
Washington, D.C. 20594

September 18, 2007

1:05 PM CT

SUMMARY OF INVESTIGATIVE INTERVIEW
CONCERNING THE Interstate 35W Bridge Collapse in Minneapolis, Minnesota
August 1, 2007

HWY-07-MH024

Interviewee: Robert John Rucker-MNDOT Bridge Inspector
8200 Harkness Road
South Cottage Grove, MN.
Interviewer: James G. LeBerte-Senior Accident Investigator
National Transportation Safety Board

Present: Paul Kivisto-P.E./Metro Region Bridge Engineer
MNDOT

Liz Benjamin-P.E./Resident Engineer
MNDOT

Mr. Rucker was interviewed at the MNDOT Command Trailer located at the site of the collapse in Minneapolis, Minnesota. This interview of Mr. Rucker was a follow-up from a previous interview after the accident. Mr. Rucker was questioned about the construction work prior to the collapse and his observations.

Mr. Rucker is a Transportation Generalist for the Minnesota Department of Transportation (MNDOT). His duties with MNDOT during the summer months are bridge inspection and during the winter months he is assigned to maintenance. He said that he had been employed by MNDOT for about 4 years. Mr. Rucker was located on the bridge deck near the cement mixer and cement tanker at the time of the collapse. He rode the collapse down to the river along with some of the other workers.

Mr. Rucker stated that he reported for work at approximately 7:00 am and was scheduled to work into the evening hours. He said that he took a break around noon and ate a sandwich on the site. Mr. Rucker said that he was working with the PCI crew and they were pouring concrete on the southbound side of the bridge. He said that they were doing Type I and Type III repairs that consisted of jack hammering layers of old concrete and pouring new concrete in its place. Mr. Rucker was asked about any guidance as to where to place the construction materials and equipment used at the site. He said that he was not involved in that aspect of the operation. He said that he had been on the re-surfacing crew for about 2 months and he added that he was probably the least senior person on the crew.

Mr. Rucker stated that he left the bridge around 5:00 pm and he traveled a short distance to McDonalds for dinner. After a short while he traveled back to the bridge, parked his truck, and was walking back to the area where other workers were setting up to continue working. He said that he was walking around the cement mixers when he felt the bridge move downward and to the west. At that point he started to run because he was trying to get away from the cement mixers. He said that he took about 4 steps and the bridge fell. Again, he said that the sensation was that the bridge let loose from the south-end and west area and then fell. Mr. Rucker said that he landed under the cement tanker and was knocked unconscious. He said that the next thing he remembered was some workers pulling him out from under the dual wheels of the tanker.

Mr. Rucker provided his work number [redacted] if anyone needed to asked additional questions. He has not returned to work due to his injuries. Mr. Rucker had no other information to provide and the interview was ended at 1:40 pm.

James G. LeBerte
Senior Accident Investigator
National Transportation Safety Board
Office of Highway Safety
Atlanta Regional Office

ATTACHMENTS

The following attachments will be available upon completion of the final version of the Highway Factors Group Chairman Report and located in the public Docket:

1.Witness Interview Summary – Harvey Unruh
2. Weight Tickets For Material Loads on Bridge at Time of the Collapse
3. Diagrams For Overlays
4. Excerpts From the Pavement Construction Design Plans
5. Excerpts From the Construction Contract
6.Pre-construction Conference Minutes
7.Diaries and Weekly Progress Notes From MNDOT Inspectors.
8.Over Weight Permits Issued
9.Critical Path Method (CPM) Schedule
10.Minutes of Weekly meetings
11. Photographs of Exemplar Construction Materials (4) With Photo Log
12.Interview Summaries of PCI Work Crew by Ramsey County Sheriff's Office
13. MNDOT Construction Specification 1513, AASHTO Guideline 8.15.3
14. List of Minneapolis Fire Department apparatus using Bridge 9340
15. 1977 Overlay Inspection Report
16. AASHTO Survey
17. Minnesota DOT Construction Specification 1513 (Revised 4/8/2008)
18. State Bridge Loadings Specifications