ATTACHMENT 18 – Mn/DOT MEMORANDUMS DOCUMENTING CRACKS IN THE NORTH APPROACH SPAN GIRDER NEAR PIER 9 FROM OCTOBER 1998 THROUGH NOVEMBER 2000

(21 pages)

Minnesota Department of Transportation

Memo

Office of Bridges and Structures
Mail Stop 610
Waters Edge
1500 W. Co. Rd. B2

[redacted]

Date: October 13, 1998

To: Gary Workman
Metro Division Office of Operations

From: Donald J. Flemming
State Bridge Engineer [redacted]

Subject: Bridge No. 9340
Cracks in North Approach Span Girder Near Pier 9

Bridge No. 9340 carries TH 35W over the Mississippi River in Minneapolis. The bridge, which was constructed in 1967, consists of a steel deck truss main span and continuous steel girder approach spans.

During the 1998 bridge safety inspection on October 12, 1998, Metro bridge inspectors noticed a large inverted U-shaped crack more than 50" long in a 48"-deep welded approach span girder about 20 feet south of Pier 9. The crack is contained within the web of the 3rd girder from the east edge of the bridge (G2 per the original plans) at the diaphragm connection to the girder. The crack extends 12" to the south of the diaphragm connection and 42" to the north of the connection. Both ends extend downward towards the bottom flange. This location is in a negative moment region of the girder near the point of contraflexure (meaning it is in an area of stress reversals.) The crack likely started as a result of out-of-plane bending in the girder web at the diaphragm connection. To arrest further crack growth, Metro Bridge Maintenance drilled a 2" diameter hole through the web at each end of the crack based on the initial recommendation from our office.

After site visits by myself, Professor Dexter from the University of Minnesota and other engineers from our office, the following repair method was devised to strengthen the girder web and prevent further propagation of the crack. An attached sketch shows recommended details of the repair and the approximate location of the crack.

> Redrill the holes in the web to 6" diameter at the locations shown. These holes are shown offset from the existing 2" holes in order to locate the drill pilot hole in the web. The hole locations may be shifted as necessary with respect to the actual crack and 2" hole locations.
>
> For steel testing purposes, remove a 4" x 8" coupon from the web at the indicated location. Radius the corners of the cut and grind the edges smooth. Submit the coupon to Todd Niemann, Structural Metals Engineer.
>
> Bolt 3/8" thick steel plates to each face of the web at each side of the diaphragm stiffeners. Bolts need to be placed only at the locations shown on the sketch. Avoid drilling holes in the web at the crack. Bolt locations may be shifted as necessary with respect to the actual crack and 6" hole locations. Minimum bolt spacing is 2⅝".

Gary Workman

> Remove the rivets in the diaphragm attachment to the stiffener on each side of the girder and replace with 3/4" diameter x 2" A 325 bolts. Hand-tighten the bolts to a snug condition only and upset the threads to prevent the nuts from turning. Thirty-six bolts are required. The intent of this work is to allow flexure between the diaphragms and the girder.

Since there is visible movement in the web at each side of the crack associated with truck traffic on the bridge, it is recommended that the exit ramp to University Avenue be closed during the repair operation.

Attachment

cc:		
	D. S. Ekern	J. R. Allen
	G. D. Peterson	P. Kivisto
	R. Noreen	T. Moravec
	T. Niemann	J. Pirkl
	M. Pribula	D. Hoff
	File Br 9340	

Minnesota Department of Transportation

Memo

[redacted]

Office of Bridges and Structures
Mail Stop 610
Waters Edge
1500 W. Co. Rd. B2

Date: October 23, 1998

To: Gary Workman [redacted]
Metro Division Office of Operations [redacted]

From [redacted] Donald J. Flemming [redacted]
State Bridge Enginee[redacted]

Subject: BR 9340 - Cracks in Approach Span Girders, North End of Bridge Near Pier 9

Bridge number 9340 carries TH 35W over the Mississippi River in Minneapolis. The bridge consists of a steel deck truss main span and continuous steel girder approach spans and was constructed in 1967. During the 1998 bridge safety inspection of the north approach spans in October, 1998, Metro bridge inspectors noticed 12 crack locations in the 48" deep approach span girders at the top of the stiffener/diaphragm connection near Pier #9 at the north end of the bridge. One major crack has already been repaired by the Metro Bridge Maintenance Crew. 11 other cracks are at the web toe of the web to top flange weld in the base metal. These locations are in a negative moment region and thus are in tension. See the attached plan sheet for a detailed location of the cracks.

After review in this office, it is recommended that Metro Bridge Maintenance drill out the ends of the cracks with a 1 1/2" or 2" core drill. The core samples should be submitted to Todd Niemann for analysis of the steel. During drilling it is recommended that ultrasonic testing be completed such that we can be certain the end of the crack has been arrested. If the ends of the cracks can not be drilled out, we will recommend additional procedures or repairs to undertake. Additional recommendations to loosen or modify the diaphragm connections at these problem areas will be discussed at a November 5 meeting.

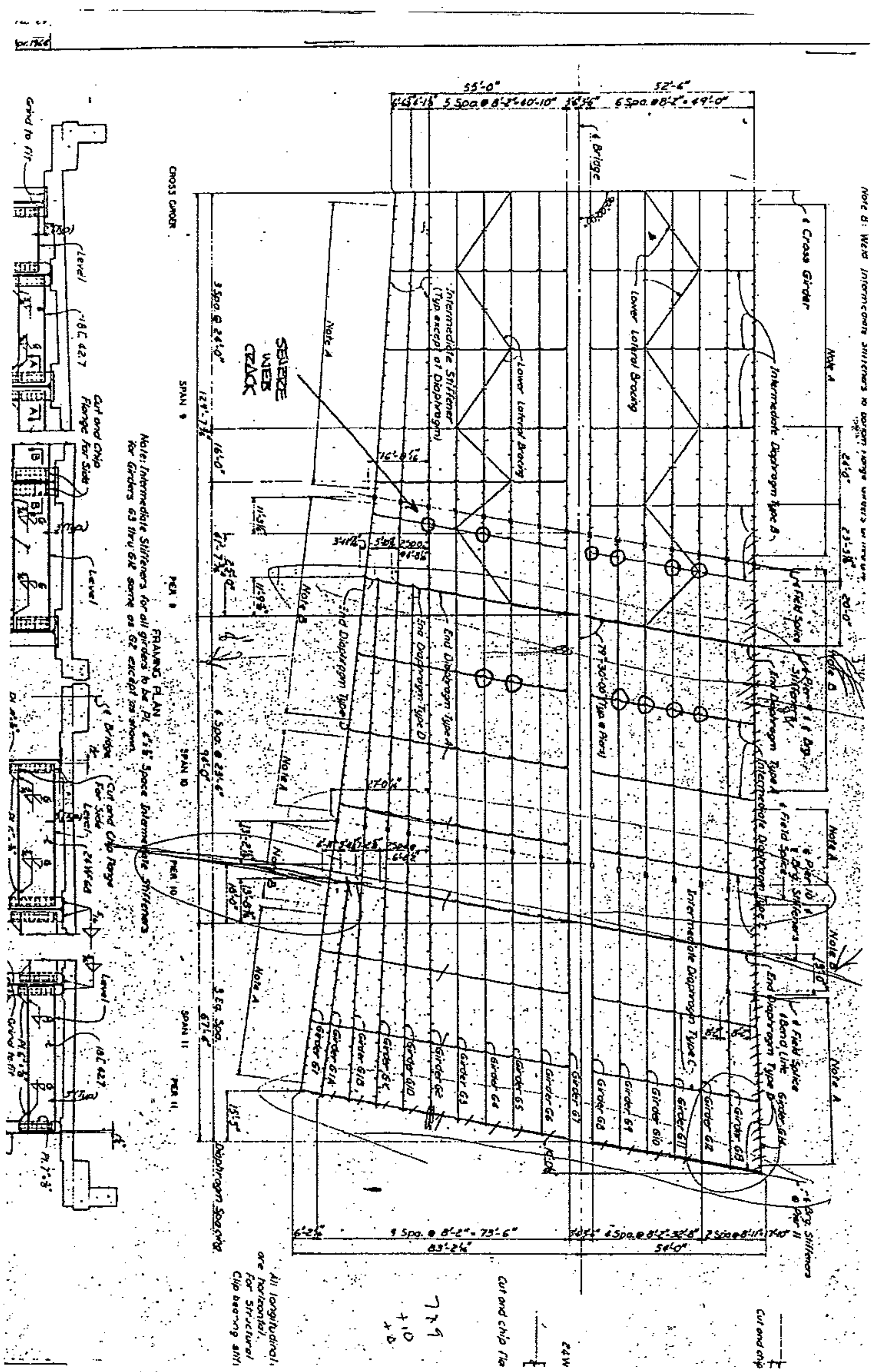
Since 33 cracks have been found this year in the approach span girders, we are concerned that these locations have potential for further cracking. We recommend that you perform close in-depth inspections of these areas on a six month interval, and keep a detailed weld/crack inspection log for these areas. As suggested by Mark Pribula in an October 14, 1998 memo to Jack Pirkl, it will be prudent to perform a detailed inspection of Br. #27855, I-94 over TH 55, to determine if similar problems exist on another continuous steel structure with high traffic volumes.

I feel that we need to discuss the short and long range plan for Br. #9340. Our office has scheduled a meeting with Metro Division personnel on November 5 from 9:00 to 11:00 in Conference Room D to discuss topics such as the upcoming contract to paint the girders in 1999, redecking the bridge within 10 years, other long term improvements, and any additional repair strategies. Please contact me if you have any comments or concerns with the long range plan for this bridge.

cc: D. J. Flemming, J. R. Allen
G. D. Peterson, P. Kivisto
R. Noreen, T. Moravec
E. Evans, T. Niemann
J. Pirkl, M. Pribula
R. Schultz, D. Hoff

File Br 9340

p:\wp\memos\9340_crk4.wpd


SEVERE WEB CRACK
FRAMING PLAN
CROSS GIRDER
SPAN 9
PIER 9
SPAN 10
PIER 10
SPAN 11
PIER 11
Lower Lateral Bracing
Intermediate Stiffener (Typ. except at Diaphragm)
Intermediate Diaphragm Type B
Note: Intermediate Stiffeners for all girders to be PL. 6"x 5/8". Space Intermediate Stiffeners for Girders G3 thru G12 same as G2 except as shown.

Minnesota Department of Transportation [redacted]

Memo

Office of Bridges and Structures
Mail Stop 610
Waters Edge
1500 W. Co. Rd. B2

[redacted]

Date: November 17, 1998

To: Gary Workman
Metro Division Office of Operations

From: Donald J. Flemming [redacted]
State Bridge Engineer

Subject: Bridge No. 9340
Stress Testing of Plate Girders

Following the discovery of cracks in the webs of several steel plate girders of the approach spans of Bridge No. 9340, we have concluded that these cracks were caused by out-of-plane bending of the web plates. The bending was due to movements of diaphragms that are rigidly attached to the webs within the negative moment areas of the girders. To mitigate growth of the known cracks and to prevent new cracks from forming, we have consulted with Dr. Robert Dexter of the University of Minnesota. Dr. Dexter recommended that we release the rigid diaphragm connections. The connections can be released, but the diaphragms cannot be removed entirely because they are necessary for bracing the girders. To confirm that this procedure will reduce the stress that is causing the cracks, we have asked Dr. Dexter to perform stress tests on two uncracked girders. The procedure includes repositioning the diaphragms by lowering and reattaching them near the bottom of the test girders.

Dave Reinsch of your Construction Administration Unit is currently negotiating a supplemental agreement with Progressive Contractors, Inc. (PCI), holders of a repair contract on this bridge, to perform the work. The University will be a sub-contractor to PCI to perform the tests and furnish us with a report. PCI will handle the remaining work. The testing will be performed during daylight hours and will not require any traffic restrictions.

If testing validates the work on the diaphragms, the remaining approach span diaphragms adjacent to the piers should be repositioned as an extension of the current contract, or be added to a painting contract scheduled for letting in January, 1999.

The attached plan sheets show details for disconnecting, repositioning and reconnecting all of the diaphragms--in the particular line of the test locations--with a less rigid connection as part of the stress testing. Details and procedures for the tests are also shown.

Attachments

cc: D.S. Ekern
G.D. Peterson/A.D. Ottman
J.R. Allen/P.M. Kivisto
D. Ruffelle
J. Pirkl
D. Reinsch

Minnesota Department of Transportation

Memo

Office of Bridges and Structures
Mail Stop 610, 2nd Floor
Waters Edge Building
1500 W Co Rd B2
Roseville, MN 55113

[redacted]

March 21, 2000

To: Gary Workman
Metro Division Office of Operations

From: Donald J. Flemming [redacted]
State Bridge Enginee[redacted]

Subject: BR 9340 – Cracks in Approach Span Girders

Bridge number 9340 carries TH 35 W over the Mississippi River in Minneapolis. The bridge consists of a steel deck truss main span and continuous steel girder approach spans and was constructed in 1967. During a March 20, 2000 bridge safety inspection, Metro bridge inspectors noticed 3 crack locations approximately 4" long in the 48" deep approach span girders at the top of the stiffener/diaphragm connection at the north end of the bridge. The cracks are at the web toe of the web to top flange weld in the base metal and are turning down slightly into the web.

After review in this office, it is recommended that Metro Bridge Maintenance drill out the ends of the cracks with a 1 ½" core drill. During drilling, it is recommended that ultrasonic testing be completed such that you are certain the end of the crack has been arrested. If the ends of the cracks can not be drilled out, we will recommend additional repair procedures.

It appears that these locations have potential for further cracking. We recommend that you perform close in-depth inspections of these areas on a six month interval, and keep a detailed weld/crack inspection log for these areas.

DJF:lmz

Cc: Pat Hughes
J.R. Allen
P. Kivisto
T. Niemann
M. Pribula
File Br 9340
D.J. Flemming
G.D. Peterson
T. Moravec
J. Pirkl
D. Hoff

Minnesota Department of Transportation

Memo

Office of Bridges and Structures
Mail Stop 610
3485 Hadley Avenue North
Oakdale MN 55128-3307

[redacted]

November 3, 2000

To: Gary Workman
Metro Division, Office of Operations

From: Donald J. Flemming [redacted]
State Bridge Engineer

Subject: Inspection Frequency on Br. #9330 and Br. #9340

Bridge #9330, TH 35E over the Mississippi River, and Br. #9340, TH 35W over the Mississippi River have both been inspected every 6 months because of past problems with cracking in the steel bridge members. The Metro Division Bridge Inspection Office has requested that both bridges be returned to a 12 month inspection cycle.

Bridge #9330 developed many fatigue cracks between 1995 and 1998. The ends of these cracks were contained by drilling and/or structural modifications to the details. Since 1998 no additional cracks have been noted in this bridge. We recommend that the inspection frequency be decreased to a 12 month cycle beginning with the 2001 inspection.

Bridge #9340 developed many fatigue cracks in the approach span steel girders in 1998. The ends of the cracks were drilled out and structural repairs made to the diaphragms since that time. Three existing cracks were drilled in March, 2000 but no additional cracks have been found. We recommend that the inspection frequency be decreased to a 12 month cycle beginning with the 2001 inspection.

The truss portion of Br. #9340 is fracture critical and it is important that close inspections be done on a regular basis to ensure that any problems are found as soon as possible. We recommend that a fracture critical inspection on the truss portion of this bridge be completed on a two-year frequency and that special attention be paid to fracture critical members during annual inspections. The Office of Bridges and Structures will provide fracture critical inspection assistance to the Metro Division.

Please contact us with any questions regarding these recommendations.

cc: Gary Peterson
Paul Kivisto
Jack Pirkl
Mark Pribula

Minnesota Department of Transportation

Memo

Office of Bridges and Structures
Mail Stop 610
Waters Edge
1500 W. Co. Rd. B2

[redacted]

Date: December 29, 1998

To: Gary Workman
Metro Division/Office of Operations

From [redacted] Donald J. Flemming
State Bridge Engineer

Subject: BR 9340 - Results of Load Testing, Recommendations for Repositioning Diaphragms

Enclosed is a letter from the University of Minnesota outlining the results of the load tests conducted on Br. # 9340 in December, 1998. Load testing was performed both before and after lowering the diaphragms near Pier 3, and the resulting stresses in the webs of the girder decreased significantly after the diaphragms were lowered. We concur with the University's recommendation that all of the diaphragms near piers 2, 3, 4, 9, and 10 be repositioned as detailed in the attached plan. We expect this will decrease the web stresses and reduce the potential for further cracking in the approach span girders.

We recommend that you either supplement the current Br. # 9340 contract to accomplish this work or add it to the upcoming painting contract. Please contact this office if you would like to discuss the report or the repair details.

cc: D.S. Ekern
J. R. Allen
G. D. Peterson
P. Kivisto
A. Ottman
J. Pirkl
D. Reinsch
File Br 9340

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Department of Civil Engineering
Institute of Technology

122 Civil Engineering Building
500 Pillsbury Drive S.E.
Minneapolis, MN 55455-0116

[redacted]

FY98-PCi-001
PCILET02

December 21, 1998

Mr. Donald J. Flemming
State Bridge Engineer
Offices of Bridges and Structures – Mn/DOT
Mail Stop 610 – Waters Edge Building
1500 West County Road B2
Roseville, MN 55113

Re: Bridge No. 9340 - Load Test Results

Dear Mr. Flemming:

The intent of this letter is to give you a brief synopsis of the load tests conducted on Bridge No. 9340 and a recommendation from the University of Minnesota concerning repositioning the diaphragms. The South Approach Span on the northbound side of Bridge No. 9340 was instrumented at two locations with strain gages. Both locations were just north of Pier 3 on Girder 2 and Girder 6, in the region where diaphragms frame in to the plate girders. Strain gages were placed to determine if lowering the diaphragms and reducing the rigidity of the diaphragm connection would reduce the stress in the web of the plate girder. Strain data were collected when trucks with a known weight were driven over the bridge prior to the diaphragm being lowered and after the diaphragms were lowered. A memo from the Office of Bridges and Structures dated November 17, 1998 to Gary Workman, Attachment A, discusses the instrumentation locations, truck test locations, and procedures for lowering the diaphragms.

Instrumentation
Prior to any work related to lowering the diaphragms (rivet removal and hole drilling in the stiffeners) six strain gages were affixed at each location. Four of the six strain gages were attached to the web plate as close as possible to the toe of the tension flange/web weld near the diaphragm connection plate. The gages were orientated in a vertical direction (transverse to the direction of the girder). Two strain gages were attached on each side of the web with one strain gage on each side of the stiffener. The other two strain gages were located on the compression flange. The purpose of these gages was to correlate the pre-diaphragm lowering truck test data with the post-diaphragm lowering truck test data. At the Girder 2 location, an additional four gages were attached to the web and tension flange to determine the torsional stresses and the neutral axis location in the girder due to the rigid diaphragm connection. A portable PC based data acquisition system capable of simultaneously reading 12 strain gages was used to collect the strain data.

Truck Tests Procedure
Two load tests were conducted on Bridge 9340: the first load test was performed prior to removing the rivets and lowering the diaphragms and the second load test was performed after the diaphragms were lowered. (Four bolts were used at each connection and placed in a snug tight condition). The same procedure was used for each load test. Three Mn/DOT Tandem-Axle Dump Trucks, each with a gross vehicle weight of 50,000 pounds, were used. For the first load test, the trucks trailed each other by about 5-10 seconds. In the second load test the follow time between trucks varied from 20-35 seconds. The first set of passes over the bridge was in the east outside lane directly over Girder 2 and is refereed to as Load Position 1. The second set of truck passes was in the east inside lane and is refereed to as Load Position 2. The third set of truck passes was in the west inside lane and is refereed to as Load Position 3. The fourth set of truck passes was in the west outside lane directly over Girder 6 and is refereed to as Load Position 4.

Results – Girder 2
No data from Load Position 1, Load Position 3, and Load Position 4 are shown for Girder 2, because the maximum stresses developed in the web of Girder 2 as a result of the load tests occurred during Load Position 2 (trucks in east inside lane). Figure 1 contains four charts which show stress (ksi) versus time (seconds) in the girder web and compression flange prior to

lowering the diaphragms for Load Position 2. The upper left chart is a comparison of all six strain gages. The upper right chart contains the flange strain data, the lower left chart contains web strain data for the web on the west side, and the lower right chart contains web strain data on the east side of the web. In a like manner, Figure 2 contains the results for Load Position 2 after the diaphragms were released and lowered. Stress values were calculated from the strain gage data collected during the load tests.

Prior to releasing and lowering the diaphragms, the web of Girder 2 near the diaphragm connection plate is bending around the flange, as one would expect. The west side of the web is in tension with a peak value about 1 ksi and the east side of the web is in compression with a peak value about 1 ksi. After the diaphragms were lowered, the stress in the web was almost completely eliminated, with a peak value less than 0.2 ksi. The flange stress and response in both load tests are almost the same, indicating that lowering the diaphragms has not changed the distribution of load among girders or the torsion.

Results – Girder 6

The maximum stresses developed in the web of Girder 6 during the load tests occurred while the trucks were in Load Position 3 (trucks in the west inside lane). As a result, no data from Load Position 1, Load Position 2, and Load Position 4 are shown for Girder 6. Using the same chart layout as explained above, Figure 3 contains the results prior to lowering the diaphragms for Load Position 3 and Figure 4 contains the results for Load Position 3 after the diaphragms were released and lowered.

This section did not behave as expected. Prior to lowering the diaphragms the west side of the web shows a tensile stress of approximately 3 ksi the east side of the web shows a tensile stress of about 2 ksi. One can conclude that the web has a net tensile stress of about 2.5 ksi along with a bending stress of approximately 0.5 ksi. After the diaphragms were released and lowered, the stress on the west side was tensile with a magnitude of approximately 1.2 ksi and on the east side the stress was compressive with a magnitude of about 0.6 ksi. Again this section has a net tensile stress along with a bending component, although the magnitudes are reduced substantially. Similar to Girder 2, the flange stress and response in both load tests are almost the same, indicating that lowering the diaphragms has not changed the distribution of load among girders or the torsion.

Conclusion

The decrease in stress in the affected areas, a factor of over two for Girder 6 and considerably more for Girder 2, should be sufficient to preclude any further cracking in the web. Therefore, on Bridge No. 9340, the University of Minnesota recommends repositioning the diaphragms and decreasing the rigidity of the diaphragm-stiffener connection at other affected locations on the bridge.

If you have any questions, please call me [redacted].

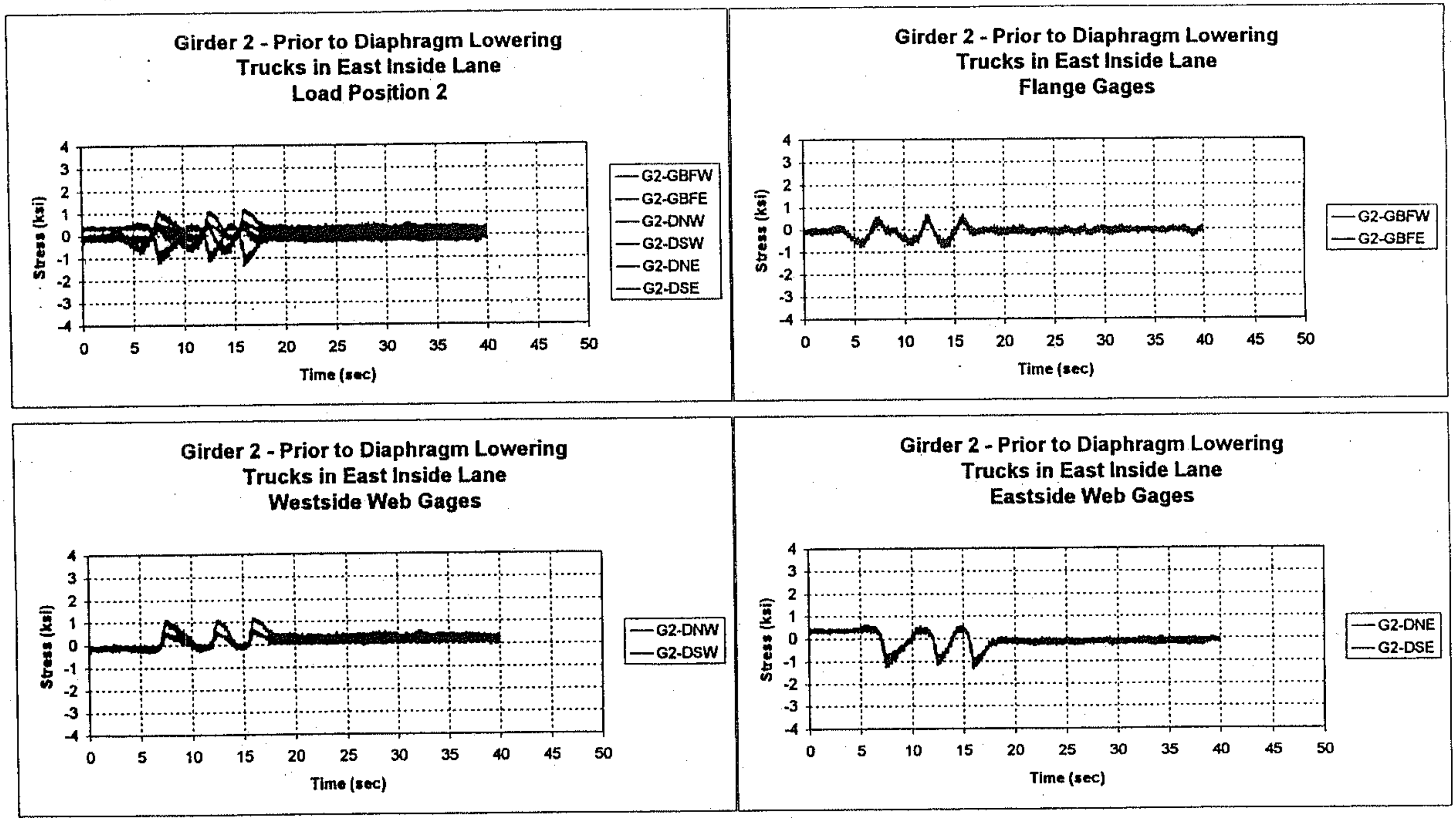
Sincerely,

[redacted]

Paul Bergson, PE
Research Fellow

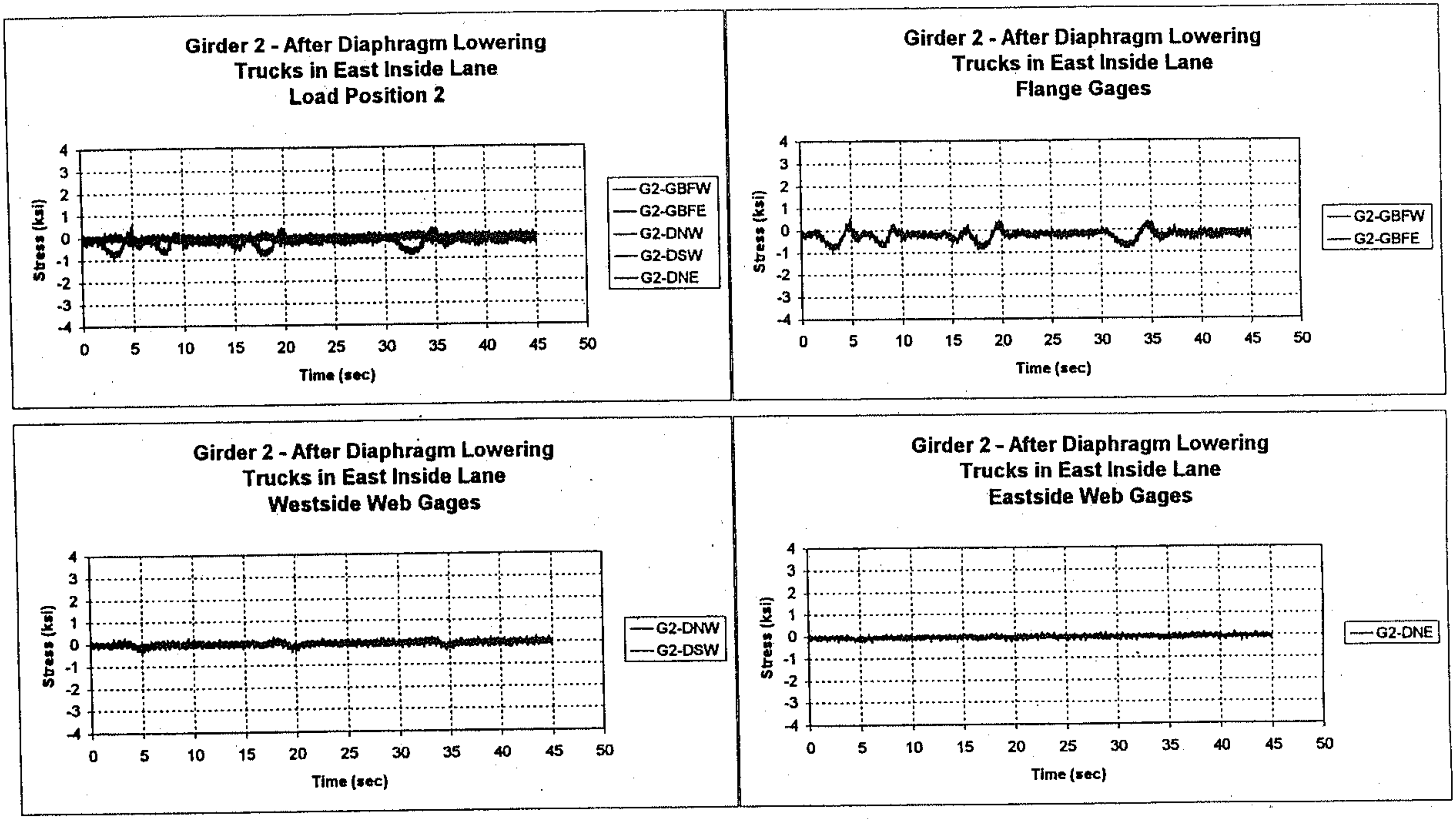
Enclosures (2)

cc: Professor Robert Dexter - UM
Professor Carol Shield - UM
Gary Peterson – Mn/DOT
Paul Kivisto – Mn/DOT
Arlen Ottman – Mn/DOT
Mr. Tom Sloan



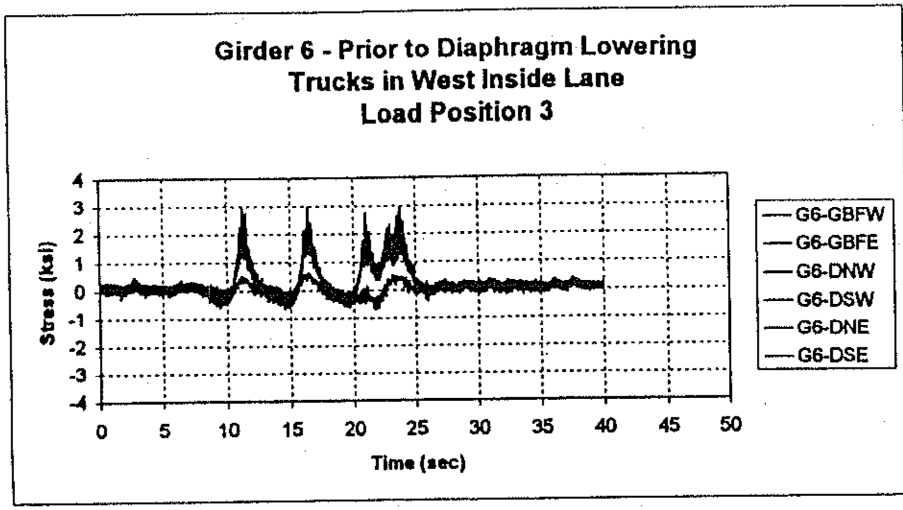
G2-GBFW	Girder 2 – girder bottom flange, west side of girder flange
G2-GBFE	Girder 2 – girder bottom flange, east side of girder flange
G2-DNW	Girder 2 – girder web north side of diaphragm connection plate, west side of girder web
G2-DSW	Girder 2 – girder web south side of diaphragm connection plate, west side of girder web
G2-DNE	Girder 2 – girder web north side of diaphragm connection plate, east side of girder web
G2-DSE	Girder 2 – girder web south side of diaphragm connection plate, east side of girder web

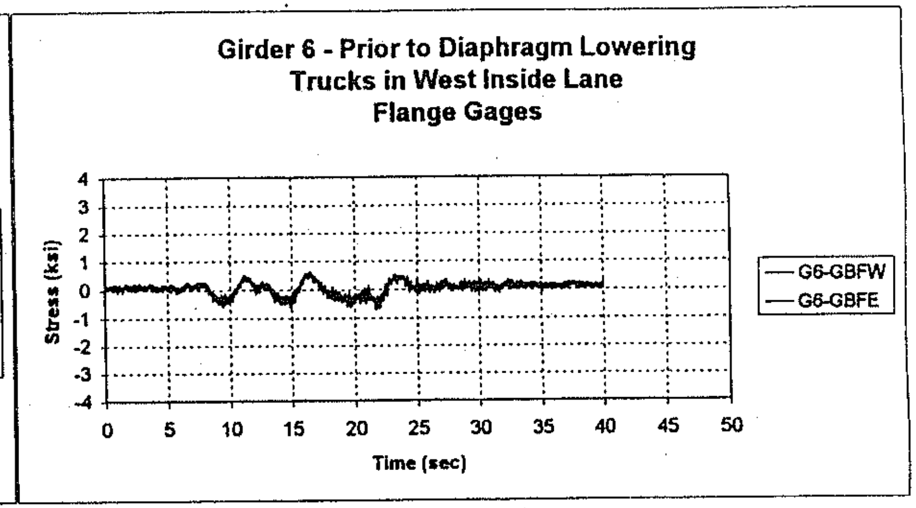
Figure 1
Girder 2 - Prior to Diaphragm Lowering

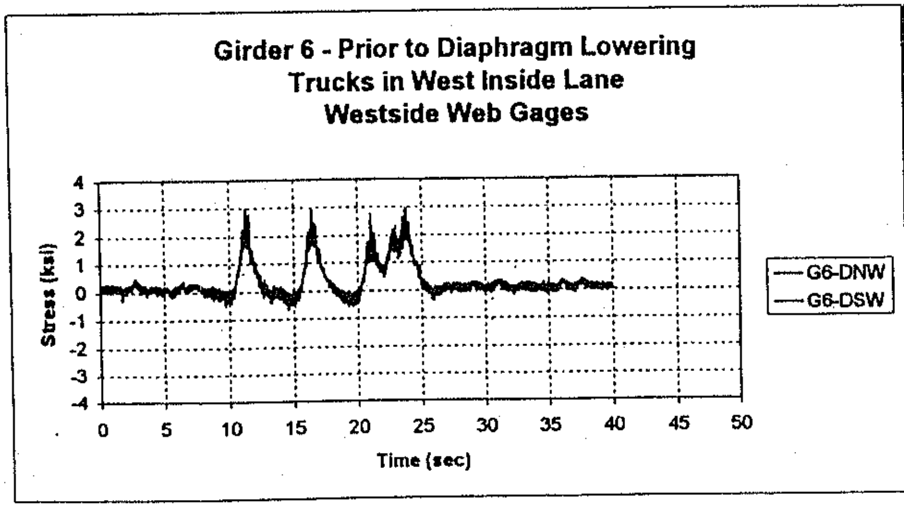


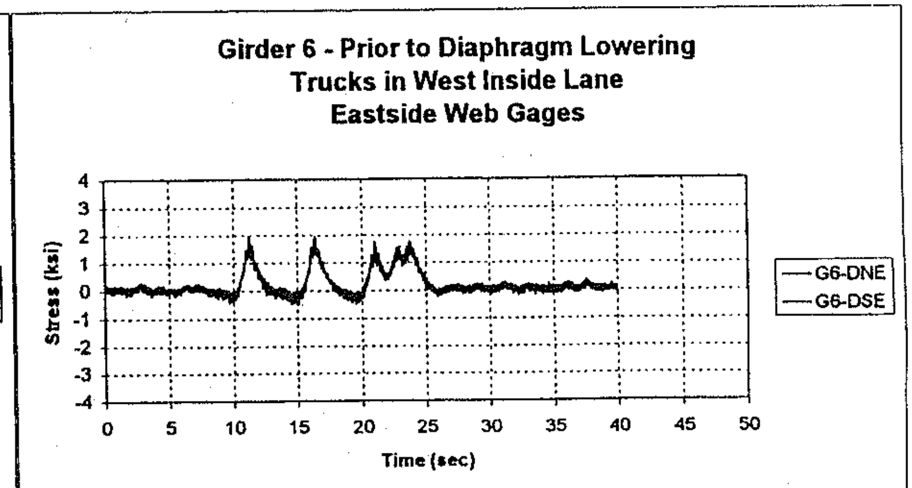
G2-GBFW	Girder 2 – girder bottom flange, west side of girder flange
G2-GBFE	Girder 2 – girder bottom flange, east side of girder flange
G2-DNW	Girder 2 – girder web north side of diaphragm connection plate, west side of girder web
G2-DSW	Girder 2 – girder web south side of diaphragm connection plate, west side of girder web
G2-DNE	Girder 2 – girder web north side of diaphragm connection plate, east side of girder web
G2-DSE	Girder 2 – girder web south side of diaphragm connection plate, east side of girder web

Figure 2
Girder 2 - After Diaphragm Lowering



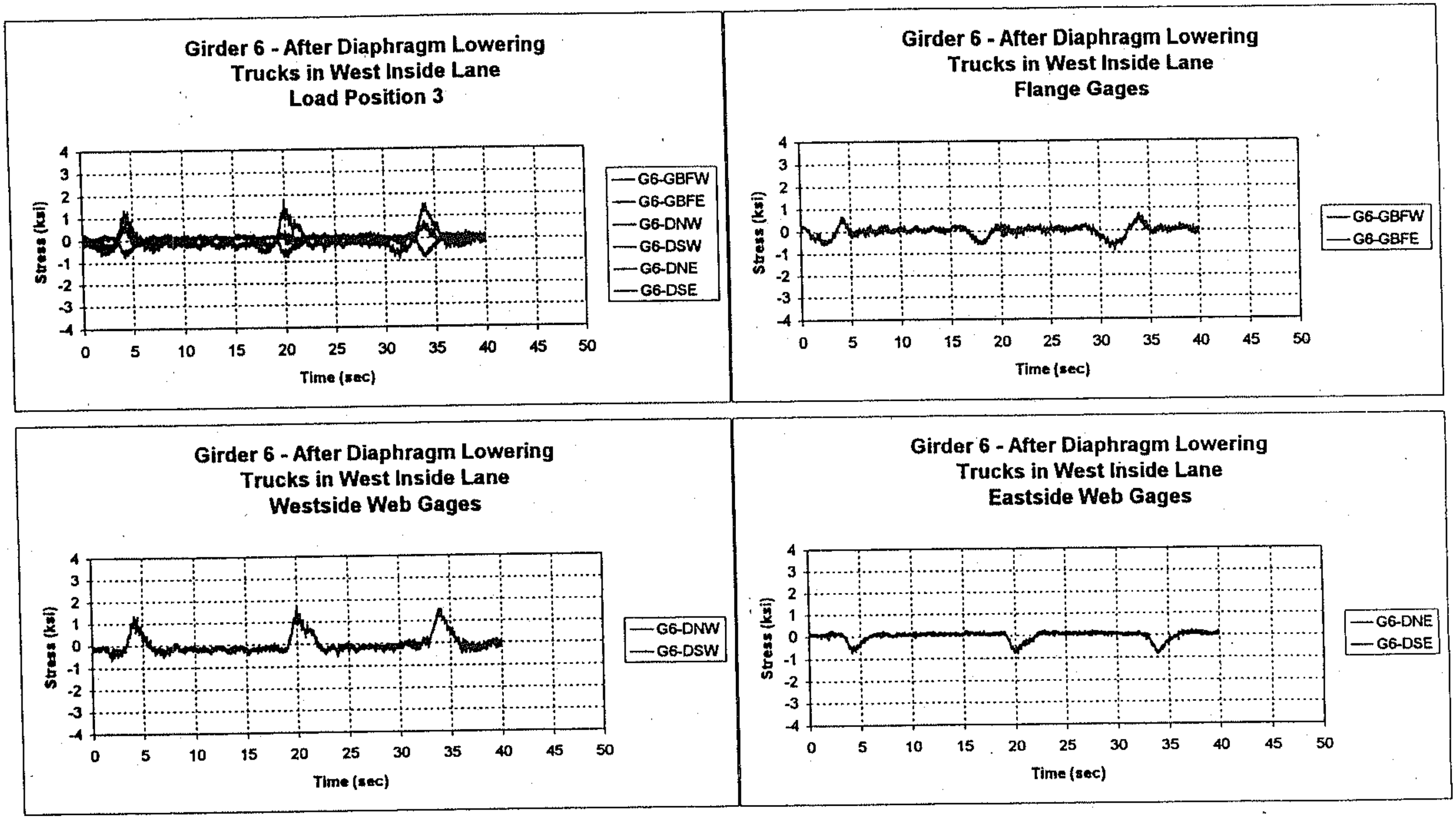






G6-GBFW	Girder 6 – girder bottom flange, west side of girder flange
G6-GBFE	Girder 6 – girder bottom flange, east side of girder flange
G6-DNW	Girder 6 – girder web north side of diaphragm connection plate, west side of girder web
G6-DSW	Girder 6 – girder web south side of diaphragm connection plate, west side of girder web
G6-DNE	Girder 6 – girder web north side of diaphragm connection plate, east side of girder web
G6-DSE	Girder 6 – girder web south side of diaphragm connection plate, east side of girder web

Figure 3
Girder 6 - Prior to Diaphragm Lowering



G6-GBFW	Girder 6 – girder bottom flange, west side of girder flange
G6-GBFE	Girder 6 – girder bottom flange, east side of girder flange
G6-DNW	Girder 6 – girder web north side of diaphragm connection plate, west side of girder web
G6-DSW	Girder 6 – girder web south side of diaphragm connection plate, west side of girder web
G6-DNE	Girder 6 – girder web north side of diaphragm connection plate, east side of girder web
G6-DSE	Girder 6 – girder web south side of diaphragm connection plate, east side of girder web

Figure 4
Girder 6 - After Diaphragm Lowering

ATTACHMENT A

Minnesota Department of Transportation

Memo

Office of Bridges and Structures
Mail Stop 610
Waters Edge
1500 W. Co. Rd. B2

[redacted]

Date: November 17, 1998

To: Gary Workman
Metro Division Office of Operations

From: Donald J. Flemming [redacted]
State Bridge Enginee[redacted]

Subject: Bridge No. 9340
Stress Testing of Plate Girders

Following the discovery of cracks in the webs of several steel plate girders of the approach spans of Bridge No. 9340, we have concluded that these cracks were caused by out-of-plane bending of the web plates. The bending was due to movements of diaphragms that are rigidly attached to the webs within the negative moment areas of the girders. To mitigate growth of the known cracks and to prevent new cracks from forming, we have consulted with Dr. Robert Dexter of the University of Minnesota. Dr. Dexter recommended that we release the rigid diaphragm connections. The connections can be released, but the diaphragms cannot be removed entirely because they are necessary for bracing the girders. To confirm that this procedure will reduce the stress that is causing the cracks, we have asked Dr. Dexter to perform stress tests on two uncracked girders. The procedure includes repositioning the diaphragms by lowering and reattaching them near the bottom of the test girders.

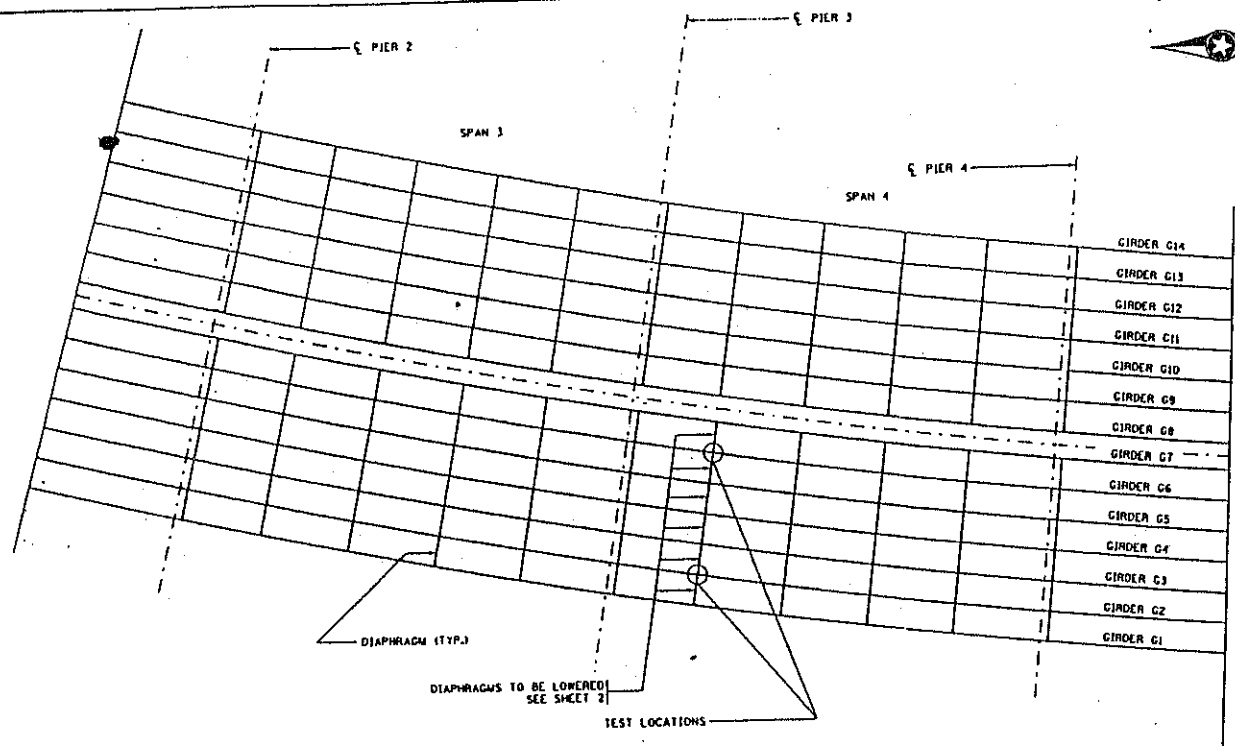
Dave Reinsch of your Construction Administration Unit is currently negotiating a supplemental agreement with Progressive Contractors, Inc. (PCI), holders of a repair contract on this bridge, to perform the work. The University will be a sub-contractor to PCI to perform the tests and furnish us with a report. PCI will handle the remaining work. The testing will be performed during daylight hours and will not require any traffic restrictions.

If testing validates the work on the diaphragms, the remaining approach span diaphragms adjacent to the piers should be repositioned as an extension of the current contract, or be added to a painting contract scheduled for letting in January, 1999.

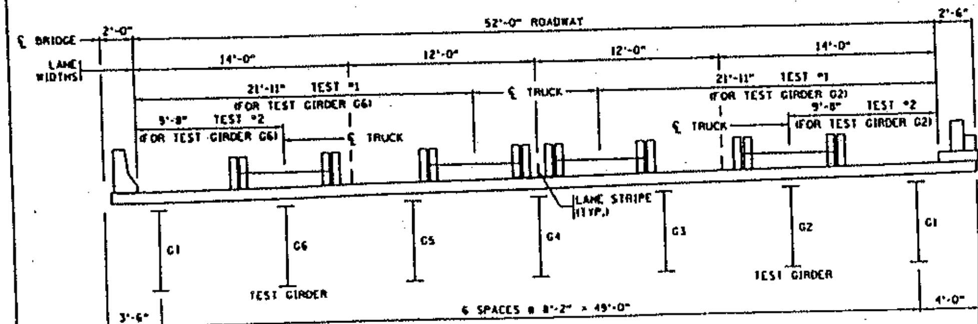
The attached plan sheets show details for disconnecting, repositioning and reconnecting all of the diaphragms--in the particular line of the test locations--with a less rigid connection as part of the stress testing. Details and procedures for the tests are also shown.

Attachments

cc: D.S. Ekern
G.D. Peterson/A.D. Ottman
J.R. Allen/P.M. Kivisto
D. Ruffelle
J. Pirkl
D. Reinsch

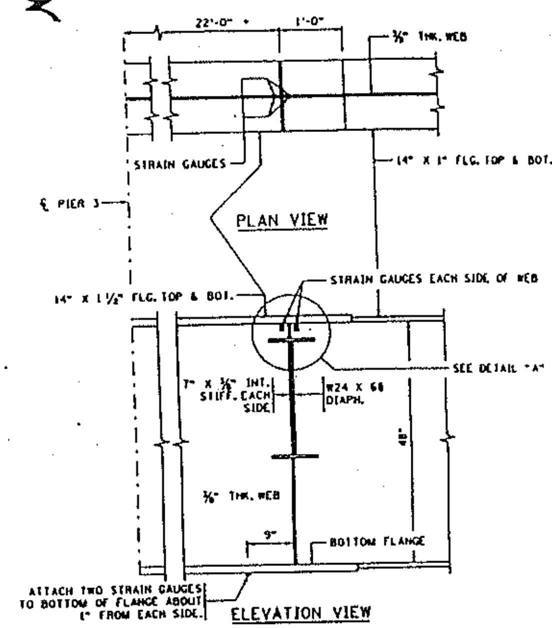


KEY PLAN - PART FRAMING PLAN



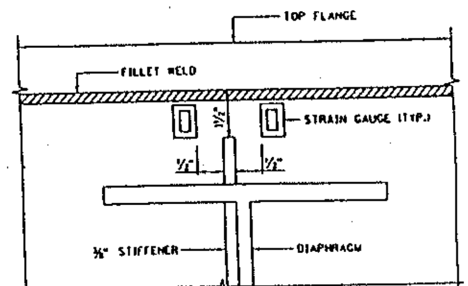
HALF DECK CROSS-SECTION
POSITIONS OF TEST TRUCK
(LOOKING NORTH)

NOTE:
FOR TESTING OF GIRDERS, FOLLOW PROCEDURE GIVEN ON SHEET 2.



ELEVATION VIEW

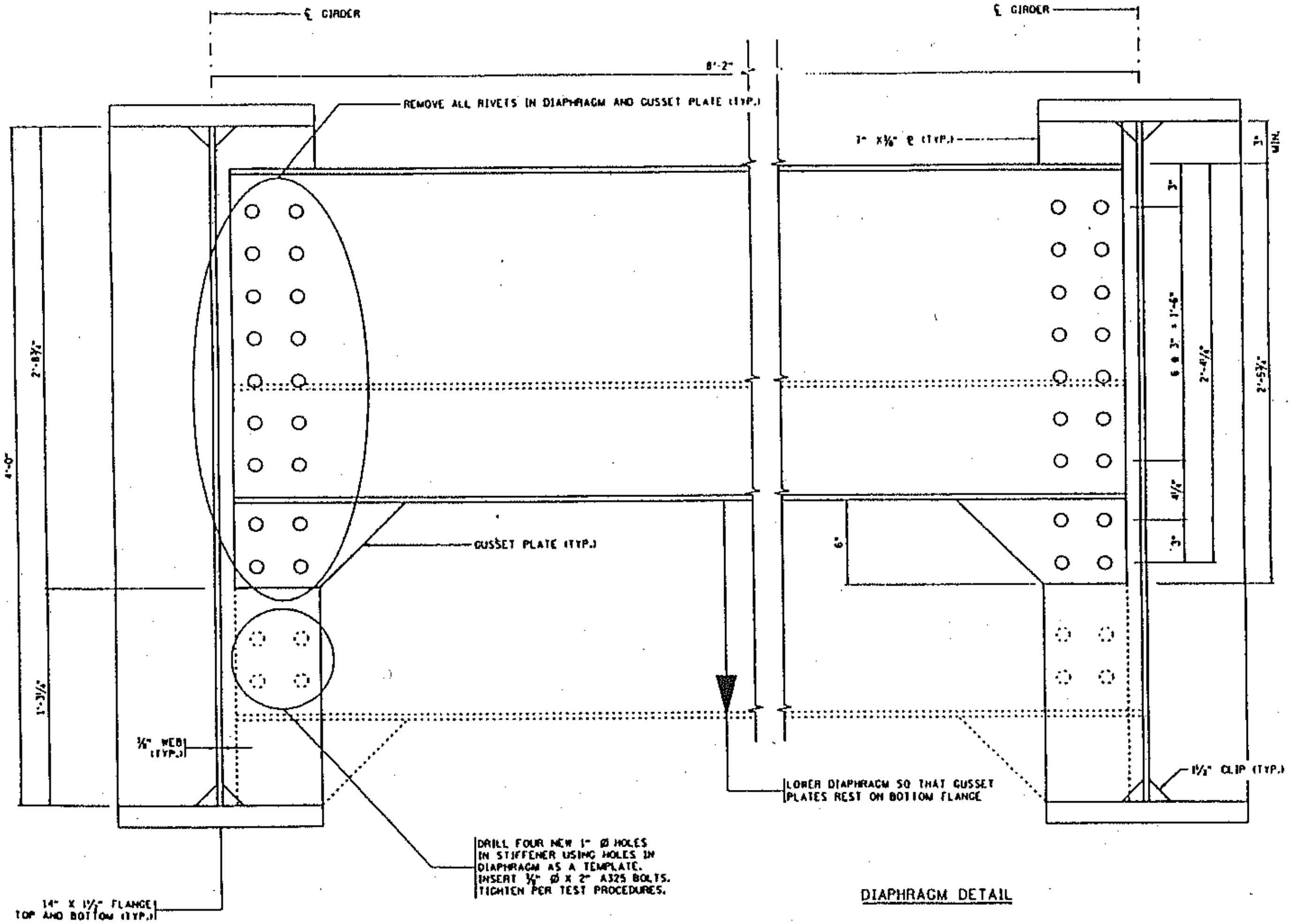
ATTACH STRAIN GAUGES TO WEB AND BOTTOM FLANGE IN POSITIONS SHOWN. STRAIN GAUGES ON WEB SHOULD BE AS CLOSE AS POSSIBLE TO THE TOE OF THE FILLET WELD. DO NOT PLACE ON WELD FILLETS.



DETAIL "A"
PLACEMENT OF STRAIN GAUGES

[redacted]

INSTRUMENTATION OF GIRDER WEB	DES: / CHK:	DN: ELA / CHK: ADO	APPROVED:	BRIDGE # 9340
	SHEET NO. 1 OF 2 SHEETS			



DIAPHRAGM DETAIL

PROCEDURE FOR CONDUCTING STRESS TESTS

Note: The Civ.Engineering Dept. of the Univ. of Minn. will attach strain gauges and record data from the tests.

1. Attach strain gauges to test girders G2 and G6 as indicated.

2. Connect data recording instruments to strain gauges at first girder to be tested.

3. Conduct tests #1 and #2 on the girder by driving a 50,000 pound (gross) test truck across the bridge positioned as shown for each test. Up to three passes of the truck will be required for each test. The three passes may be conducted by three consecutive trucks at one-minute (min.) intervals.

4. Repeat tests #1 and #2 for the other test girder in the same manner described in Step 3.

5. Remove data recording instruments from girders.

6. Lower indicated diaphragms to the bottom flange of the girders. Drill holes in stiffeners and reattach diaphragms with four bolts at each end. Tighten bolts to "snug" only.

7. Repeat procedures of Steps 2, 3, 4 and 5.

8. Tighten the four bolts at each end of each diaphragm per spec 2402.3G2c(4). Bolt rotation shall be 1/3 turn beyond "snug ti...

9. Repeat procedures of Steps 2, 3, 4 and 5.

EQUIPMENT TO BE FURNISHED BY THE CONTRACTO...

1. Extendable work platform for access to girders.

2. Observer and communication equipment to inform U/M personnel of proximity of test truck to test sight during all passes of truck across bridge.

3. Portable generator for data recording.

EQUIPMENT TO BE FURNISHED BY THE DEPARTMEN...

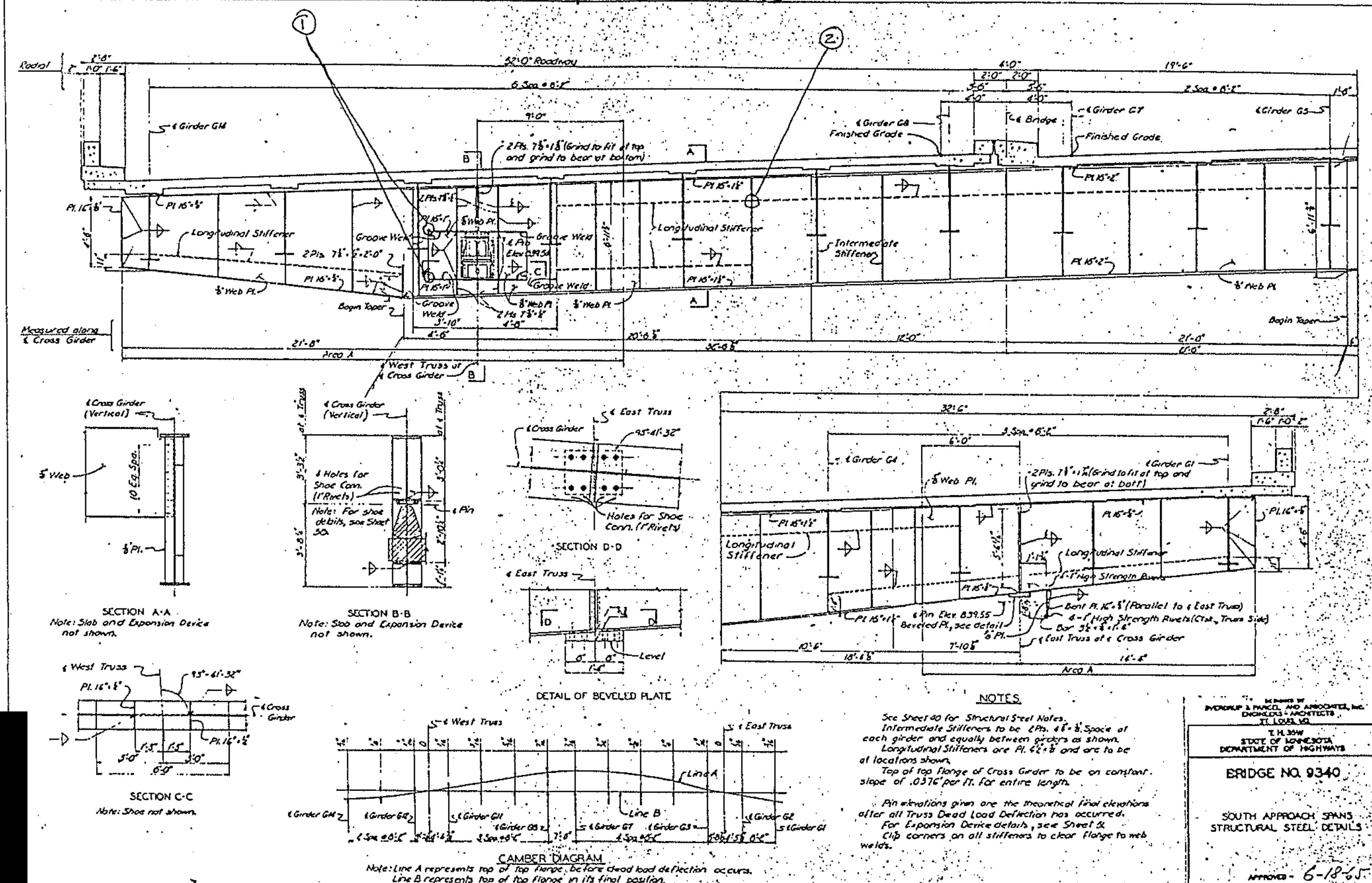
1. Three 50,000 pound (gross) tandem axle straight dump trucks loaded with sand.

[redacted]

TITLE: REPOSITION DIAPHRAGM DETAIL | DES. | DR. ELR | APPROVED | CHK. | CHK. | SHEET NO. 2 OF 2 SHEETS | BRIDGE 9340

Floor Beam
Cracks Found in 1998

Also Some found in 1997
Some found in 1993



NOTES

See Sheet 40 for Structural Steel Notes.

Intermediate Stiffeners to be 2 Pls. 4½ × ⅜. Space at each girder and equally between girders as shown.

Longitudinal Stiffeners are Pl. 4½ × ⅜ and are to be at locations shown.

Top of top flange of Cross Girder to be on constant slope of .0376' per ft. for entire length.

Pin elevations given are the theoretical final elevations after all Truss Dead Load Deflection has occurred.

For Expansion Device details, see Sheet 51.

Clip corners on all stiffeners to clear flange to web welds.

SVERDRUP & PARCEL AND ASSOCIATES, INC.
ENGINEERS - ARCHITECTS
ST. LOUIS, MO.

T. H. 35W
STATE OF MINNESOTA
DEPARTMENT OF HIGHWAYS

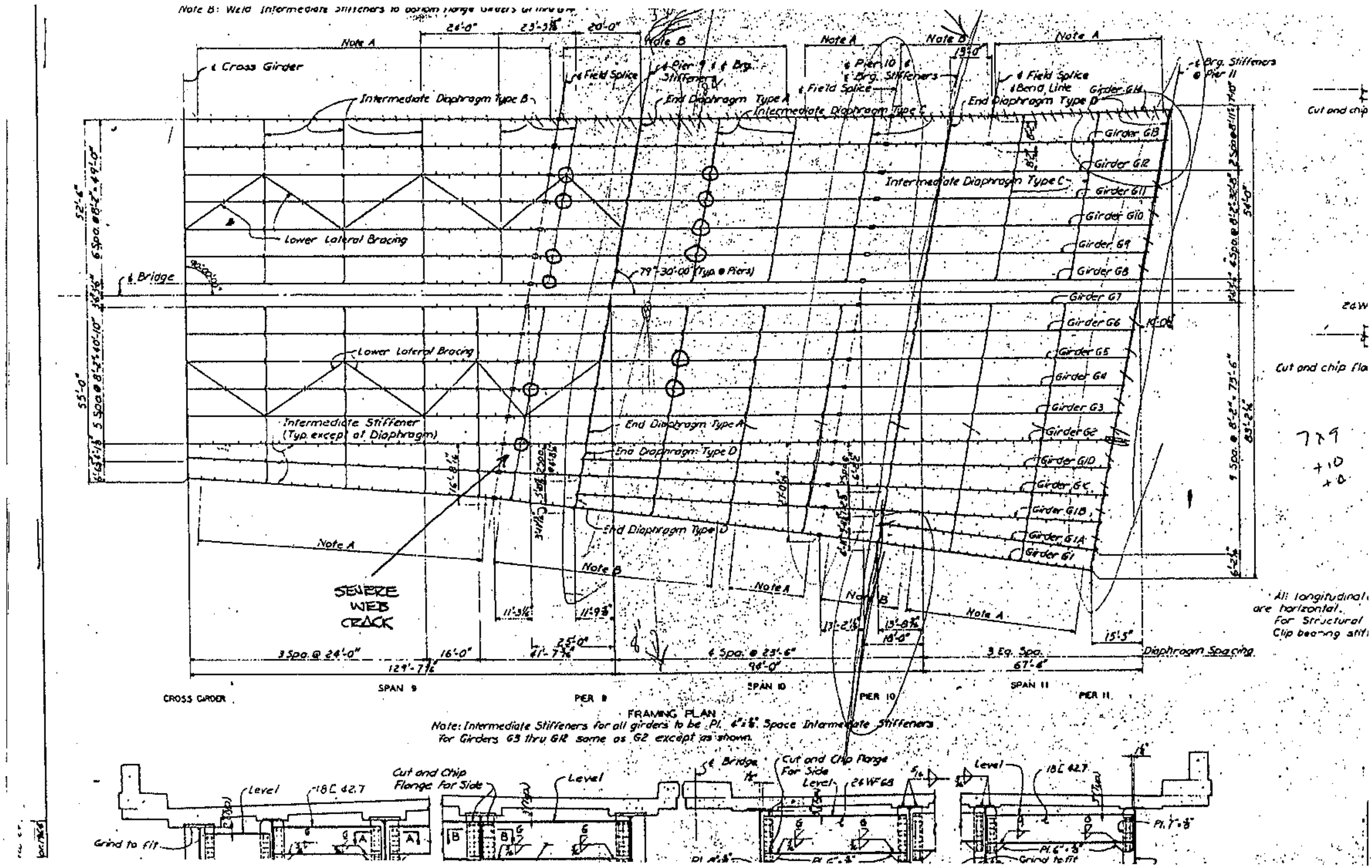
BRIDGE NO. 9340

SOUTH APPROACH SPANS
STRUCTURAL STEEL DETAILS

APPROVED - 6-18-65

[redacted]

North End of Bridge
12 Crack Locations



South End of Bridge
21 Crack Locations