

Memorandum



CITY OF DALLAS

DATE August 10, 2018

TO Honorable Members of the Mobility Solutions, Infrastructure & Sustainability Committee

SUBJECT **Margaret McDermott Bridge Status Update**

This memorandum provides an update on the status of the Margaret McDermott (IH30) Bridge project. The City has been working with TxDOT, the Engineer of Record and their third-party engineering forensic firm towards a path forward to complete the bridge construction and safely open it to pedestrian and bicycle use. The Engineer of Record provided the City and TxDOT with drawings for two design alternatives in late July that *may* resolve the vibration and fatigue issues associated with the cable anchorage system. The City has requested that TxDOT obtain pricing from their Contractor associated with implementing these alternatives.

As Staff has been working through the summer to gain greater clarity and a proposed path forward, the information provided by the Engineer of Record indicates that the cable anchorage system has failed to perform as originally designed and intended for long-term maintenance; the remedies to date including additional dampners have failed to address the vibrations, and prior vibrations have subjected some of the elements to premature fatigue. Attached you will find a photo diagram showing the bridge assemblage (Exhibit A), and plan view of the locations of the cable subsystem failures with areas of concern (Exhibit B) as prepared by the Engineer of Record. In the March to April 2016 timeframe, during bridge construction, the anchor rod on the lower cable assemblage assembly fractured on two different cables on the East Bound Bridge.

As Staff understands it, the bridge is not anticipated to fall down, or become unstable in the event that a cable breaks. The Engineer of Record has explained that *“If any one cable anchorage were to fracture, it would not have a detrimental effort on the bridge structural stability. A cable loss analysis was included in the original design.”*

The Engineer of Record has as provided information that explains that *“Because the anchor rods have been exposed to potential fatigue damage that is not quantifiable, it is not possible to assess if / when a particular cable anchor rod may fail. In its currently constructed bridge configuration including the cable dampers, it is estimated the probability of failure for EB-C-E2-S (recent instrumented cable) is approximately 23 percent over the 40-year design service life. For cables with similar properties and behavior to EB-C-E2-S, 1 out of 4 cables is likely to experience a fatigue failure within 40-years. As a further comparison, literature and design codes typically restrict the acceptable probability of a component over its service life to 2 percent for fatigue limit states. For Cable EB-C-E2-S, a probability of failure of 2 percent is reached after the cable reaches a service life of approximately 2 years.”* In plain language, there are concerns that the cable vibrations may

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be reducing the design life of the cables and anchor rods, so that they have to be replaced every two-to-five years, rather than every 40 years as is typical for most bridge structures.

The Engineer of Record has indicated: *“Fracture of an anchor rod would be classified as a “brittle failure” which means there is no appreciable plastic deformation prior to fracture. These types of failures typically occur without any prior evidence of a potential break, thus they are characterized by rapid crack propagation without significant plastic deformation.* In plain language, this means there are no visual or other indications of pending cable anchor failure, so this could happen without warning.

As Staff understands it, there is a potential for the anchor rod that holds the cable to the bridge to break. If that happens, the loose cable could swing into the pedestrian path. As stated by the Engineer of Record, *“If the anchor rod were to fracture, the cable will travel along its axis in the direction of applied tension if unrestrained. Since the cables are inclined from the deck level connection to the arch connection, a fractured cable would initially travel upward and inward over the bridge walkway / bike path area. This is a sudden dynamic response that is dependent on the cable length and applied tension. As the energy is dissipated, the cable will swing back and forth / up and down until ultimately resting vertically under its arch connection, i.e. will be hanging vertically within walkway / bike path area roughly 3 to 5 feet above the deck surface”.* This simply means that a cable has the potential to swing into pedestrian and bicyclists paths.

The City has also requested alternative implementation plans from the Engineer of Record to facilitate partial opening of the bridge, while the testing, cable anchor fabrication and installation are being performed. We anticipate receipt of this information within five weeks. Upon receipt, Staff will provide this information, along with a recommendation to City Council for their consideration.

Additionally, Staff have consulted periodically with the City Attorney’s Office to advise on the appropriate next steps from the City’s perspective and as recently as last week. Staff is also working to identify an independent third party forensic structural engineering expert in advance of follow up meetings that will need to be held.

Please let me know if you have any questions.



Sarah Standifer
Director, Trinity Watershed Management

[Attachments]

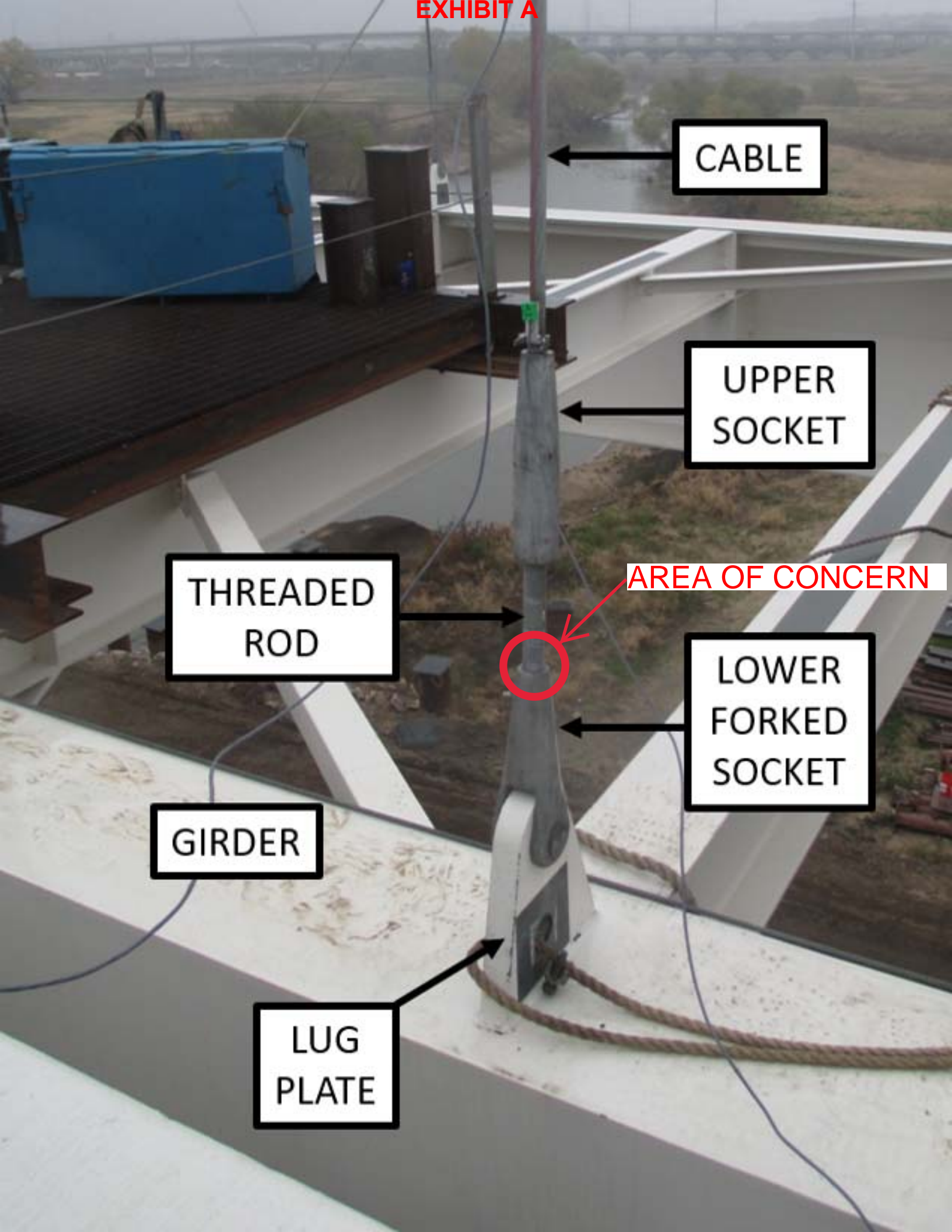
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c: Honorable Mayor and Members of the City Council
T.C. Broadnax, City Manager
Larry Casto, City Attorney
Craig D. Kinton, City Auditor
Billerae Johnson, City Secretary
Preston Robinson, Administrative Judge
Kimberly Bizer Tolbert, Chief of Staff to the City Manager
Majed A. Al-Ghafry, Assistant City Manager

Jon Fortune, Assistant City Manager
Joey Zapata, Assistant City Manager
M. Elizabeth Reich, Chief Financial Officer
Nadia Chandler Hardy, Chief of Community Services
Raquel Favela, Chief of Economic Development & Neighborhood Services
Theresa O'Donnell, Chief of Resilience
Directors and Assistant Directors

EXHIBIT A



CABLE

UPPER
SOCKET

THREADED
ROD

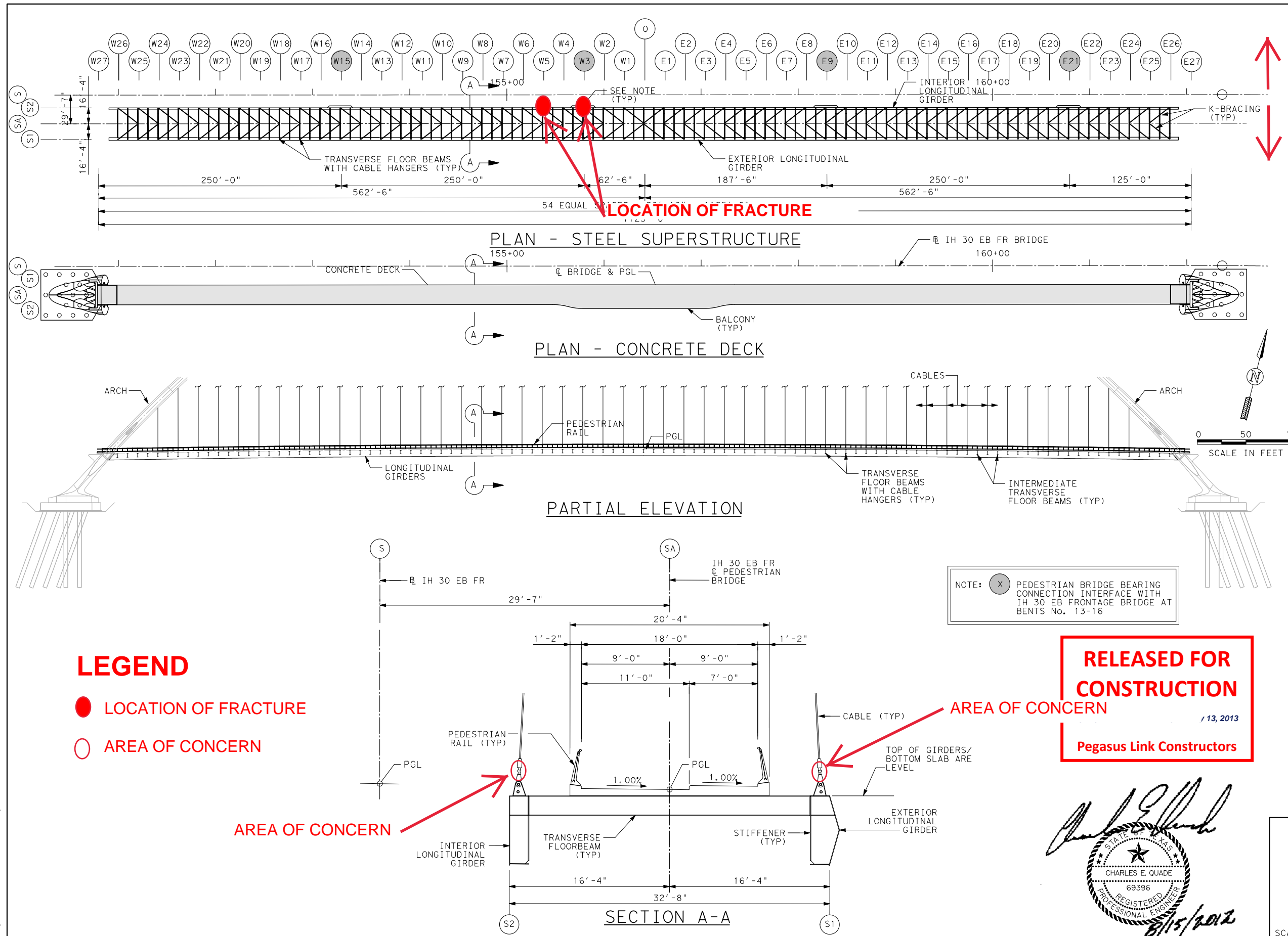
AREA OF CONCERN

LOWER
FORKED
SOCKET

GIRDER

LUG
PLATE

dthompson 1:23:11 PM 8/15/2012



PROFILE GRADE LINE ELEVATIONS
EB Frontage Road / Pedestrian Bridges

W25	151+20.02	449.73	449.14
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INTERSTATE 30

TRINITY RIVER FLOODPLAIN

W	E	E	E
W26	152+24.10	451.19	450.00
W19	152+45.02	451.45	450.86
W18	152+65.85	451.69	451.10
W17	152+86.68	451.91	451.32
W16	153+07.52	452.13	451.54
W15	153+28.35	452.33	451.74
W14	153+49.18	452.52	451.93
W13	153+70.02	452.69	452.10
W12	153+90.85	452.86	452.26
W11	154+11.68	453.00	452.41
W10	154+32.52	453.14	452.55
W9	154+53.35	453.26	452.67
W8	154+74.18	453.37	452.78
W7	154+95.02	453.47	452.88
W6	155+15.85	453.56	452.96
W5	155+36.68	453.63	453.04
W4	155+57.52	453.69	453.09
W3	155+78.35	453.73	453.14
W2	155+99.18	453.76	453.17
W1	156+20.02	453.78	453.19
0	156+40.85	453.79	453.20
E1	156+61.68	453.78	453.19
E2	156+82.52	453.76	453.17
E3	157+03.35	453.73	453.14
E4	157+24.18	453.69	453.09
E5	157+45.02	453.63	453.04
E6	157+65.85	453.56	452.96
E7	157+86.68	453.47	452.88
E8	158+07.52	453.37	452.78
E9	158+28.35	453.26	452.67
E10	158+49.18	453.14	452.55
E11	158+70.02	453.00	452.41
E12	158+90.85	452.86	452.26
E13	159+11.68	452.69	452.10
E14	159+32.52	452.52	451.93
E15	159+53.35	452.33	451.74
E16	159+74.18	452.13	451.54
E17	159+95.02	451.91	451.32
E18	160+15.85	451.69	451.10
E19	160+36.68	451.45	450.86
E20	160+57.52	451.19	450.60
E21	160+78.35	450.93	450.34
E22	160+99.18	450.65	450.06
E23	161+20.02	450.36	449.77
E24	161+40.85	450.05	449.46
E25	161+61.68	449.73	449.14
E26	161+82.52	449.40	448.81
E27	162+03.35	449.06	448.47

LEGEND

● LOCATION OF FRACTURE

○ AREA OF CONCERN

RELEASED FOR CONSTRUCTION

13, 2013

Pegasus Link Constructors

Charles E. Ouade

REGISTERED PROFESSIONAL ENGINEER

CHARLES E. OUADE

69396

8/15/2012

IH 30

GENERAL BRIDGE GEOMETRY

EB FR PEDESTRIAN BRIDGE

SCALE: 1" = 100'

SHEET 1 OF 4



SANTIAGO CALATRAVA

ARCHITECT & ENGINEER

PARKRING 11 - 8002 ZURICH, SUISSE

TEL: (41)44 204 5000 FAX (41)44 204 5002

HUITT-ZOLIARS

1717 McKinney Avenue, Suite 1400

Dallas, Texas 75202-1236

FIRM REGISTRATION No. F-761

Designed: JCV	FED. RD. NO. 6	STATE TEXAS	FEDERAL AID PROJECT NO. SEE TITLE SHEET	HIGHWAY NO. IH 30
Checked: CEQ	DIST. DAL	COUNTY DALLAS	CONTROL NO. 1068	SECTION NO. 04
Drawn: MTU	JOB NO. 116	SHEET NO. 49		

EXHIBIT B