

EMERGENCY BRIDGE REPAIRS

A look at Emergency Repairs due to Critical Findings and Truck Impacts in Missouri, Illinois and Kansas

Scott Moeder, PE & Ryan Hagerty, PE

GBA

Emergency Project Spotlights

Purpose:

To highlight the amount of emergency repair projects that happen on a regular basis due to truck impacts and critical findings.

Common Themes for Emergency Repair Projects

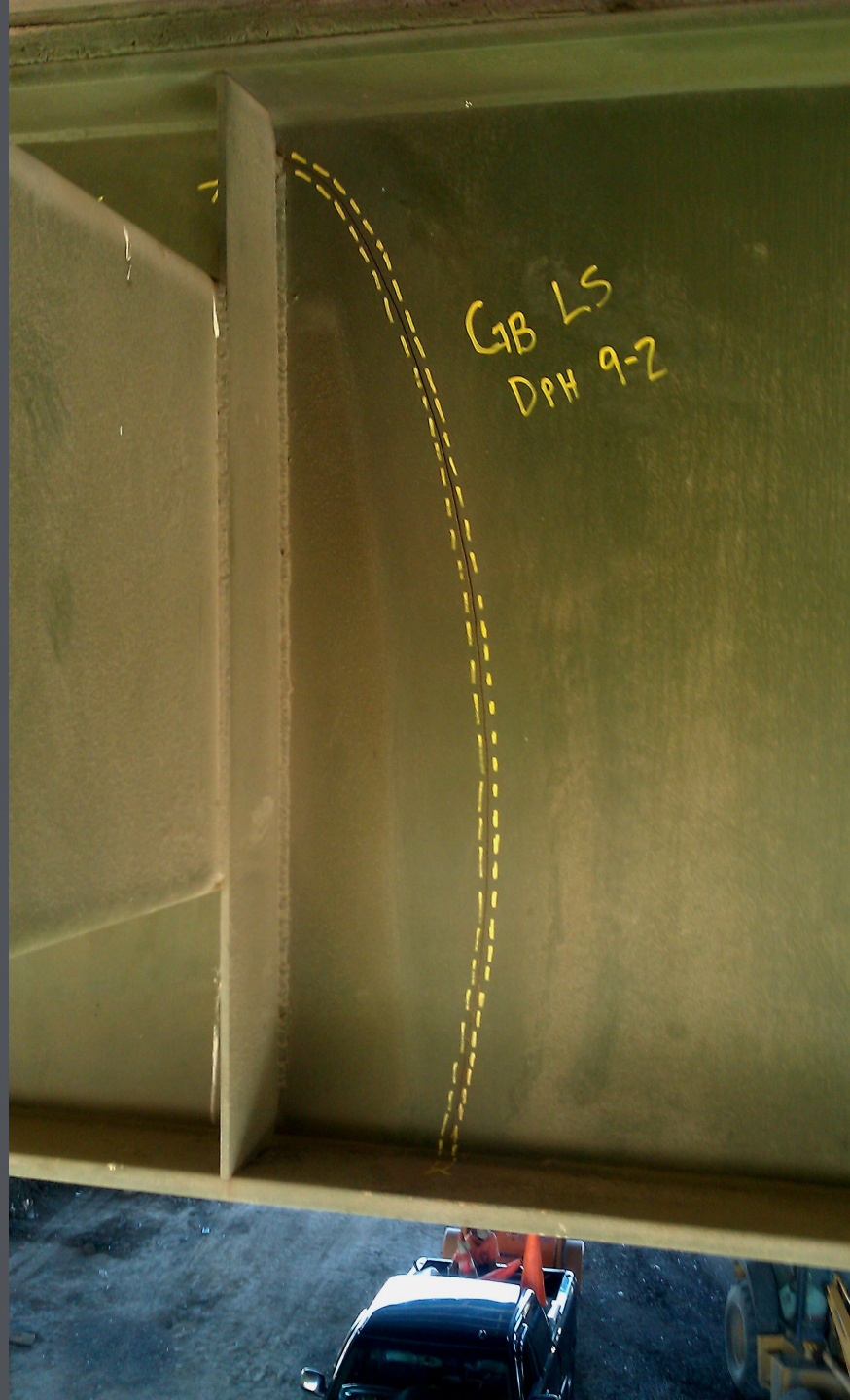
- Schedule is insane, DOTs are looking at PS&E plans in a matter of weeks.
- Constant communication between the DOT & consultant is key to timely decisions.
- A bridge will always get hit at the most inopportune time.
- Be very clear in explaining unique lump sum items



KDOT
SB I-35 over SW Blvd
Kansas City, Kansas

GBA

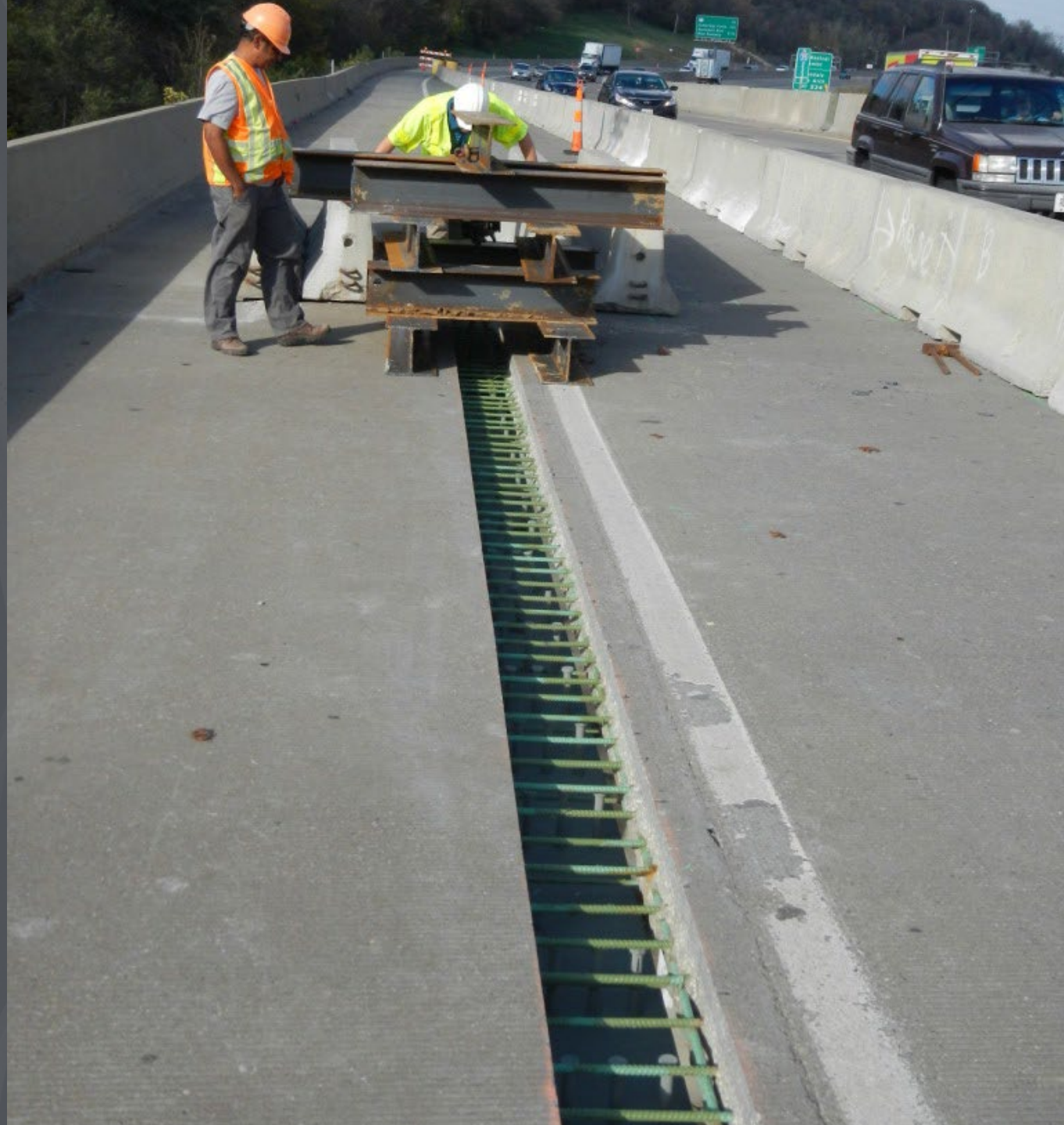




GBA

GIB L5
DIN 912





GBA



GBA



FBA



KDOT

Mission Road Barrier Hit

Leawood, Kansas

GBA





GBA





KDOT

College Blvd. Wall Failure

Leawood, Kansas







The background of the slide is composed of numerous white, rectangular strips of paper that are layered and slightly offset from each other, creating a sense of depth and movement. The strips are oriented vertically and appear to be falling or floating, with some overlapping others. The overall effect is a clean, modern, and somewhat abstract aesthetic.

KDOT

K-15 Barrier Hit

Near Washington, KS

GBA



Br. No. 15-101-237.05 (023)

10-18-17

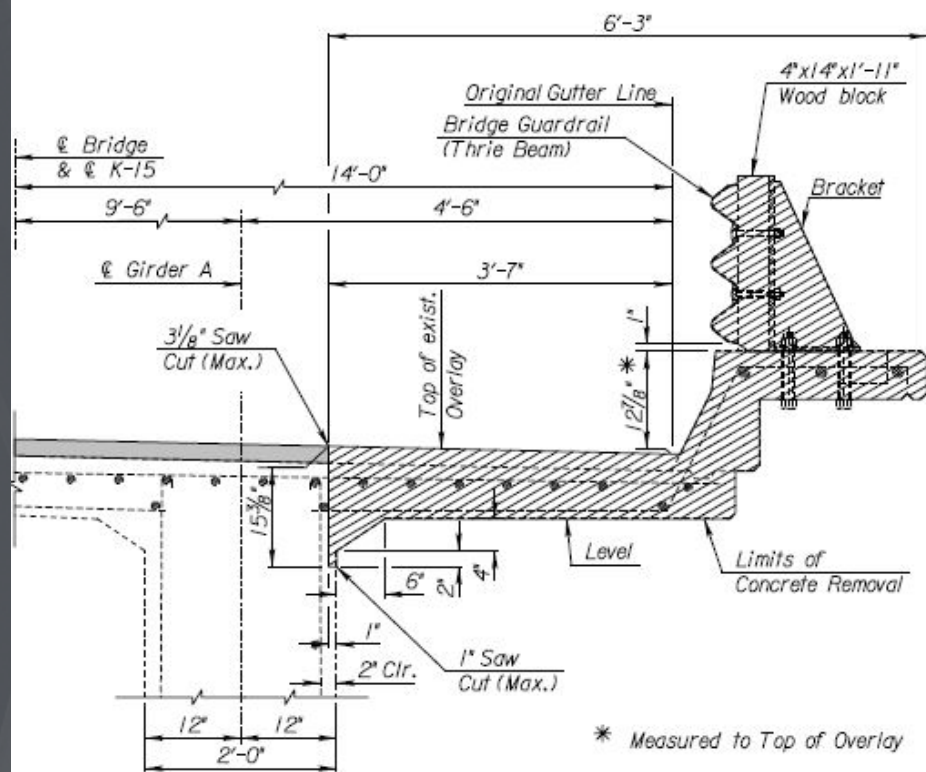
Chip 1-1-19

Parapet damage in Span 3 left side of bridge

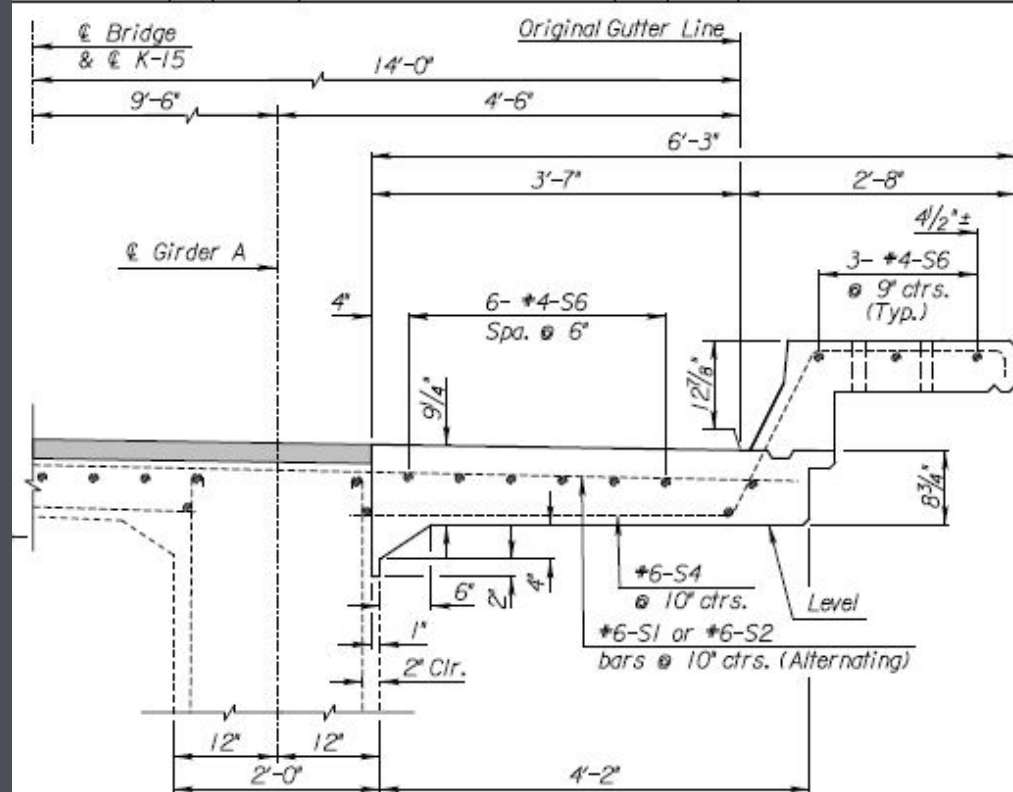
Br. No. 15-101-237.05 (023)

10-18-17

Chip



TYPICAL SECTION - OVERHANG & PARAPET REMOVAL
(On Bridge) (Looking South)



TYPICAL SECTION - OVERHANG RECONSTRUCTION
(On Bridge) (Looking South)

Notes:

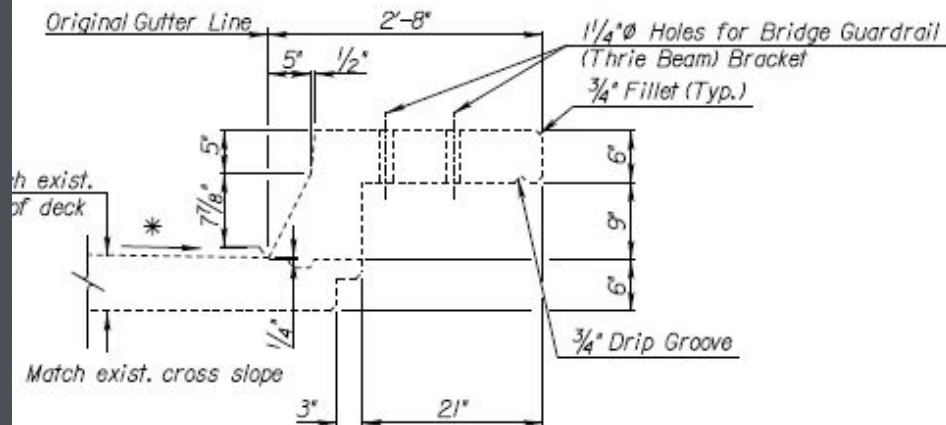
A 12 inch strip of Bridge Deck Overlay shall be removed to a clean line in areas of Parapet Only Removal.

Follow saw cut depth recommendations provided to avoid damage to reinforcing steel. Depth dimensions are from top of overlay or face of concrete. Adjust saw cut depth if reinforcing steel is encountered.

REMOVAL OF EXISTING BRIDGE STRUCTURES: Take care not to damage existing reinforcing steel in the overhang and parapet, clean and reuse, unless damaged or section loss is found.

Existing concrete surface to be covered by new concrete shall be thoroughly roughened and cleaned prior to placing new concrete.

Note: Dimensions taken from rehab 1987 plans.



TYPICAL EXISTING OVERHANG SECTION





Girder Hits!

GBA



GBA

MoDOT Route MM over I-44

It's usually a matter of inches



GBA



GBA



GBA



GBA



KDOT

K-196 Bridge Hit

Near Wichita, KS

GBA



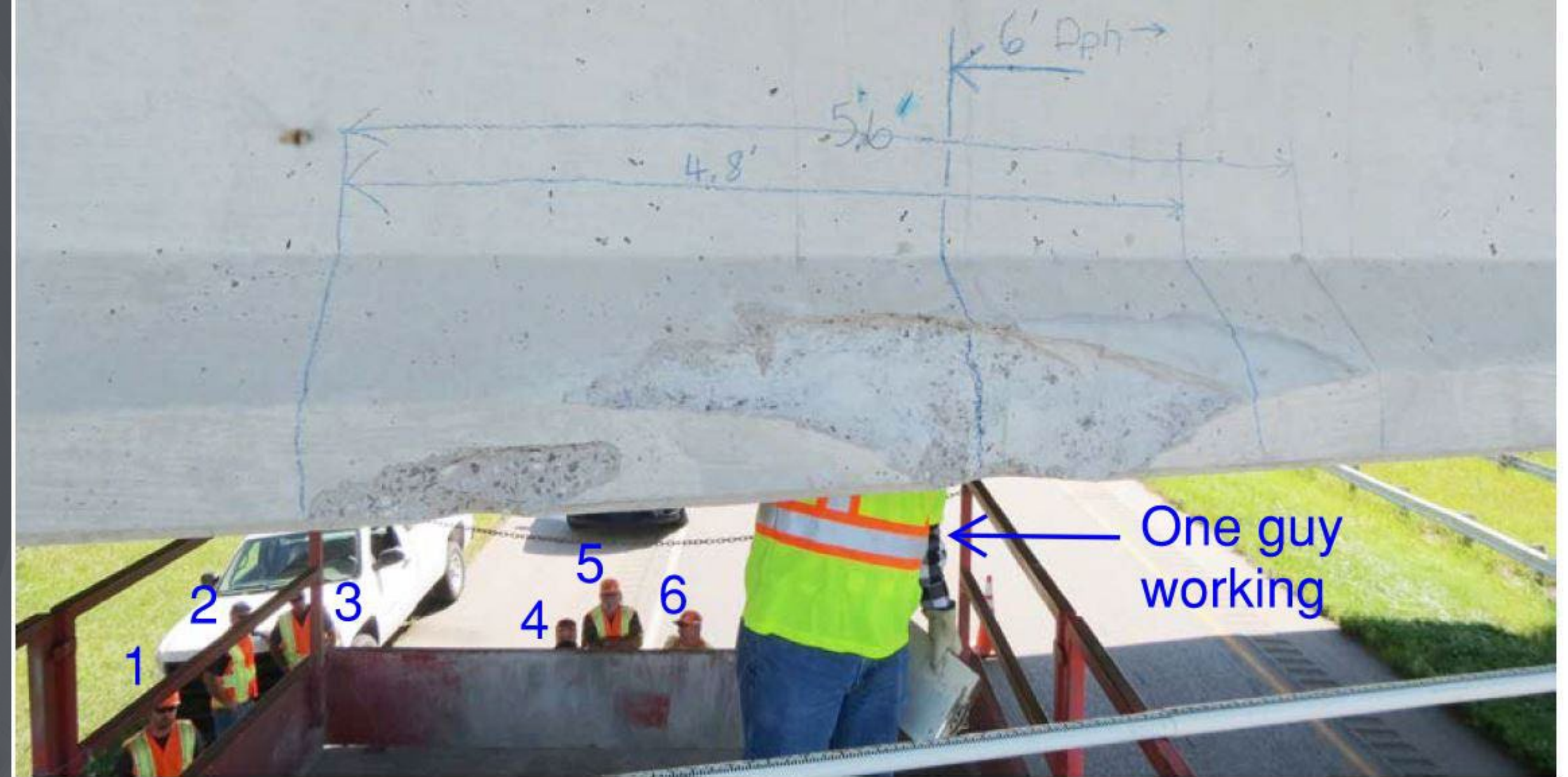
Br. No. 196-8-28.38 (160)

8-18-17

Chip 8-2-10

Girder A, left side, 8-16-17 impact, 2 exposed strands, (none were severed).

GBA

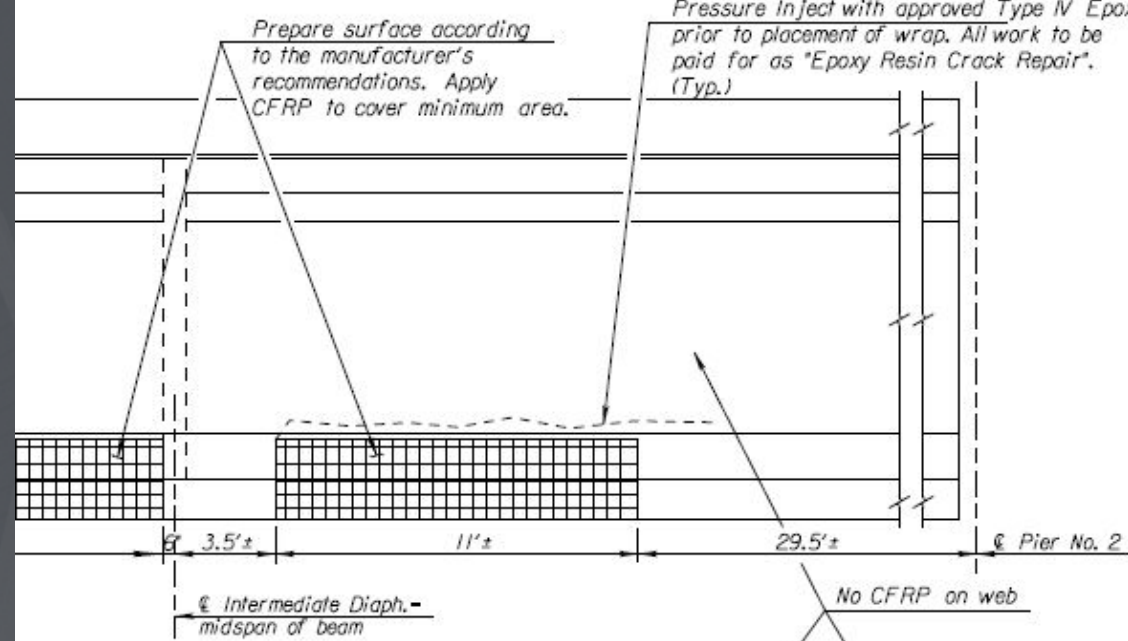


Br. No. 196-8-28.38 (160)

8-18-17

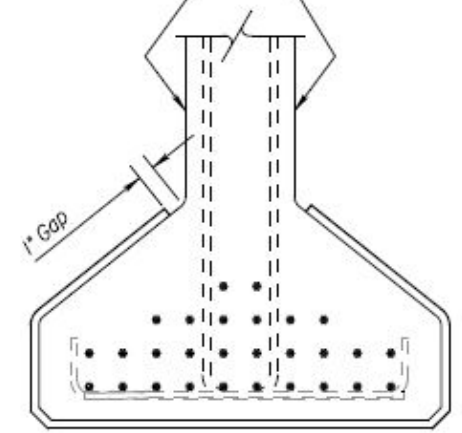
Chip 8-2-11

Girder A, left side, 2015 impact, (hit again in 2017).



ELEVATION OF IMPACTED EXTERIOR BEAM

CFRP REINFORCED POLYMER WRAP: The wrap shall be the bi-directional MasterBrace FIB600/50 per wet layup system or approved equivalent. The surfaces shall be prepared according to the Manufacturer's instructions. A UV resistant, concrete colored coating shall be applied to the surface of the CFRP after installation. Specifications for the coating system shall be sent to the State Bridge Office for review 3 weeks prior to installation.



PARTIAL SECTION

NOTE: Existing Beam Concrete:
 $f'_c = 5,000$ p.s.i.





KDOT
US-75 over Topeka Blvd.
Topeka, KS

GBA



GBA



Dump trucks clear bridges
when their dump beds are in
the down position...



GBA

I need a tow truck...

Make it a double





1/4" Displacement

10/07/2020

IBA

MoDOT

Route 370 over Ferguson Lane

St. Louis County, MO

GBA



A4896: MO 370 over Ferguson Ln.
Dump truck bed struck G14

06/17





THIS SHEET HAS BEEN
DESIGNED, CHECKED AND
DATED ELECTRONICALLY

DATE PREPARED
7/27/2020

ROUTE 370 STATE MO

DISTRICT BR SHEET NO. 2

COUNTY ST. LOUIS

JOB NO. J6MO283

CONTRACT ID.

PROJECT NO.

BRIDGE NO. A48961

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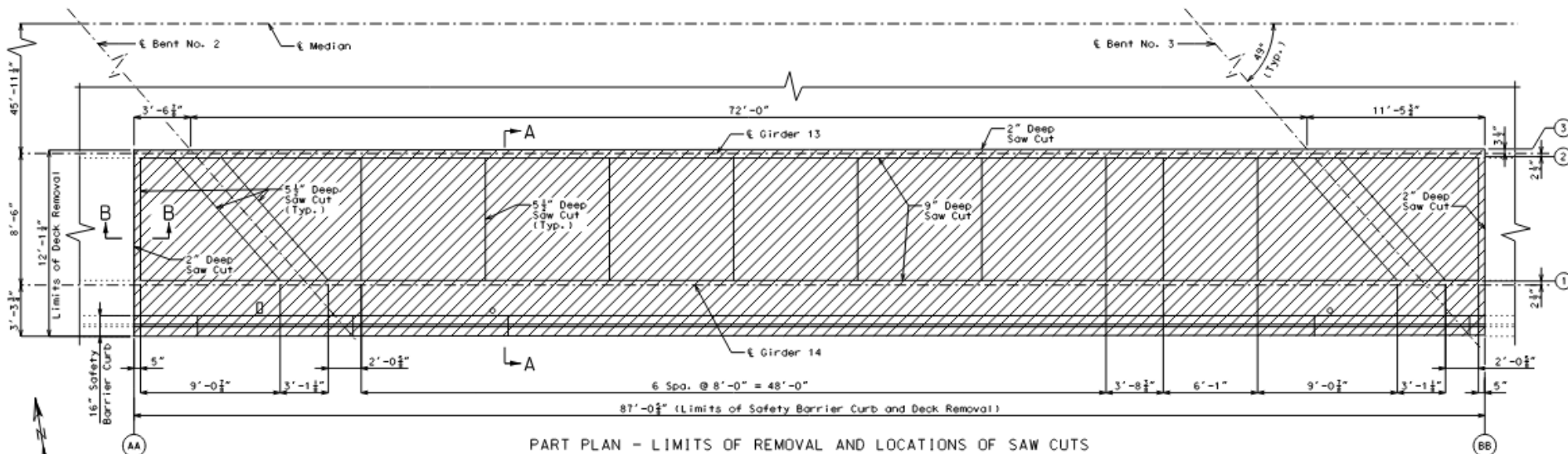
BRIDGE NO. A48961

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BRIDGE NO. A48961

BRIDGE NO. A48961

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATE REV. 9/07/20 AM 7/27/2020

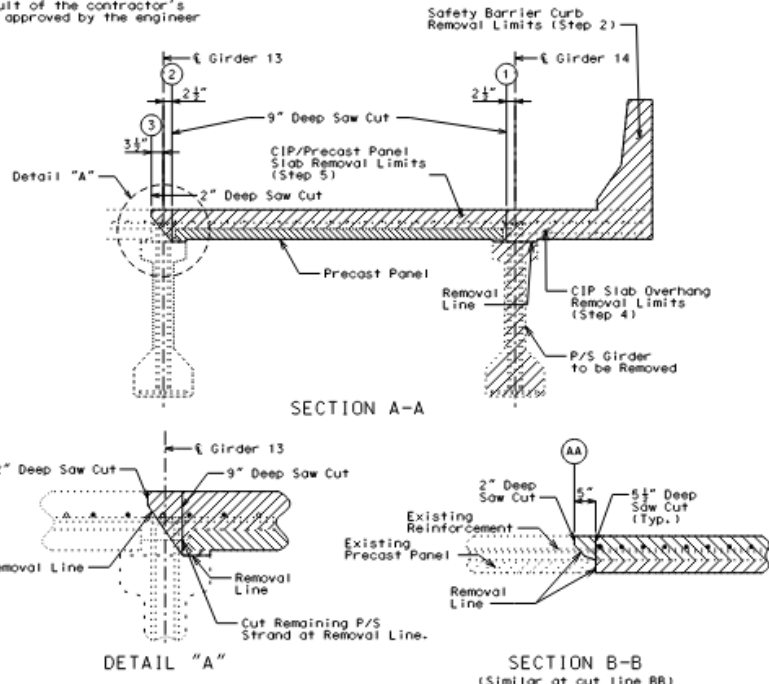


PART PLAN - LIMITS OF REMOVAL AND LOCATIONS OF SAW CUTS

The existing slab for Bridge A4896 to be repaired was constructed as composite.
Any damage sustained to the remaining structure as a result of the contractor's operations shall be repaired or the material replaced as approved by the engineer at the contractor's expense.

SUGGESTED SEQUENCE OF CONSTRUCTION

- Mark layout lines on bridge deck as follows:
 - Mark layout lines representing E Bents 2 and 3. Mark transverse saw cut lines AA and BB at limits of removal near Bents 2 and 3. See Part Plan - Limits of Removal.
 - Mark longitudinal saw cut lines 1, 2, and 3 as shown in Part Plan - Limits of Removal.
 - Mark transverse and skewed saw cut lines at precast slab panel joint locations. Contractor to field verify and modify accordingly.
- Saw 1" deep cut on each face of concrete barrier at AA and BB. Carefully remove barrier concrete at east and west limits to preserve longitudinal reinforcing steel.
- Provide 9" deep saw cuts at longitudinal line 1.
- Remove cast-in-place bridge deck overhang from fascia to longitudinal cut line 1. This will include the removal of slab drains.
- Saw cut bridge deck as follows and per Part Plan - Limits of Removal:
 - 9" deep saw cuts at longitudinal line 2.
 - 2" deep saw cut at longitudinal line 3.
 - 2" deep saw cuts at transverse lines AA and BB.
 - 5 1/2" deep saw cuts at transverse and skewed precast panel joint locations.
- Remove cast-in-place deck and precast slab panels between longitudinal lines 1 and 2 as shown in Part Plan - Limits of Removal.
- Saw 1" deep cut in each face of Bents 2 and 3 diaphragms located 5'-3 3/4" from E of Girder 14 as shown on Sheet No. 3.
- Carefully remove Bents 2 and 3 diaphragms to limits shown in Elevation and Sections B-B and C-C on Sheet No. 3 using handheld chipping hammers as specified in Sec 704.4.1.2. Care shall be taken to preserve the longitudinal deck reinforcing steel near Bents 2 and 3 for installation of mechanical bar splices. When removing concrete between the ends of girders at Bents 2 and 3, care shall be taken so as to not damage the prestressing strands protruding from the ends of Girder 14, Span 1 and Girder 14, Span 3.
- Remove steel intermediate diaphragm and store for future re-installation.
- Remove Girder 14, Span 2. Remove and dispose of existing bearing devices and joint filler at Bents 2 and 3.
- Carefully remove concrete deck at Girder 13 to limits shown in Section A-A using lightweight handheld chipping hammers. Partial exposure of vertical reinforcing steel from Girder 13 is required. Care shall be taken not to damage any vertical reinforcement protruding from the top of Girder 13. Repair epoxy coating to transverse bars and epoxy coat the ends of existing bars that have been cut. The top transverse deck reinforcing steel at Girder 13 shall be preserved for installation of mechanical bar splices; cut remaining precast panel P/S strand extensions at removal limits.
- Install bearing devices and joint filler at Bents 2 and 3.
- Set replacement Girder 14 and reinstall steel intermediate diaphragm.
- Install precast slab panels.
- Form deck and diaphragms. Install mechanical bar splices, deck reinforcing steel, diaphragm reinforcing steel, and slab drains. Partially install barrier curb reinforcing steel embedded within deck.
- Place diaphragm and bridge deck concrete. Cure in accordance with Sec 703.3.6.
- Install remaining barrier curb reinforcing steel. Place barrier curb concrete.
- Install sign brackets and sign on slab.



DEMOLITION PLAN



16305 S. Hwy 28 Sp. Rd.
Suite 300
Chesham, MO 63017
636.433.2444
www.gbatn.com

GEORGE BUTLER
ASSOCIATES, INC.
PRO. ENGINEER 000133
ARCHITECT 00212
PRO. LAND SURVEYOR 00000

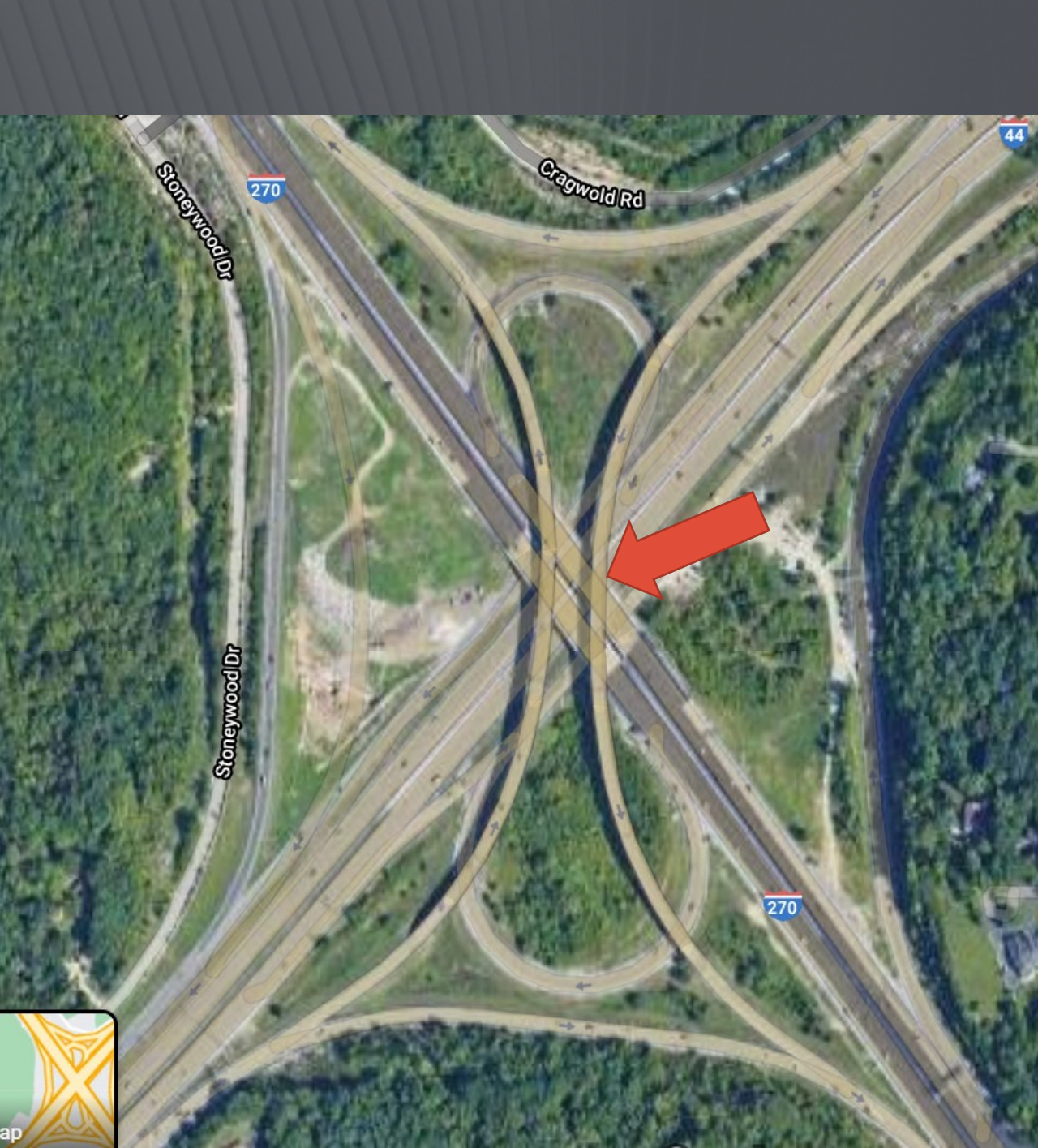
RYAN G. HAGERTY
PROFESSIONAL
ENGINEER



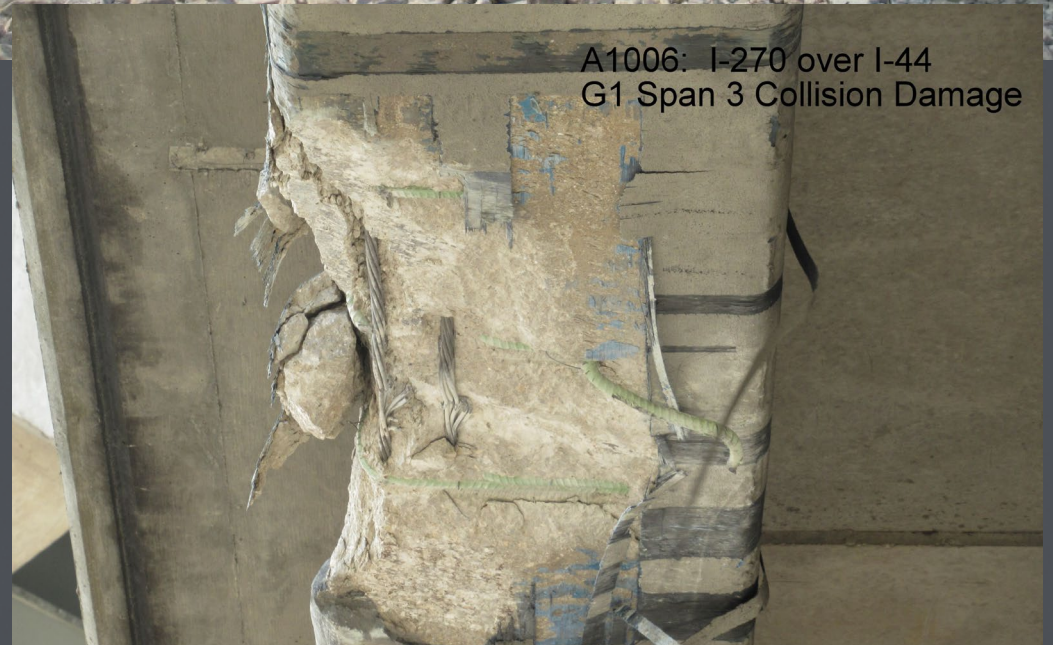




MoDOT
I-270 over I-44
St. Louis County, MO



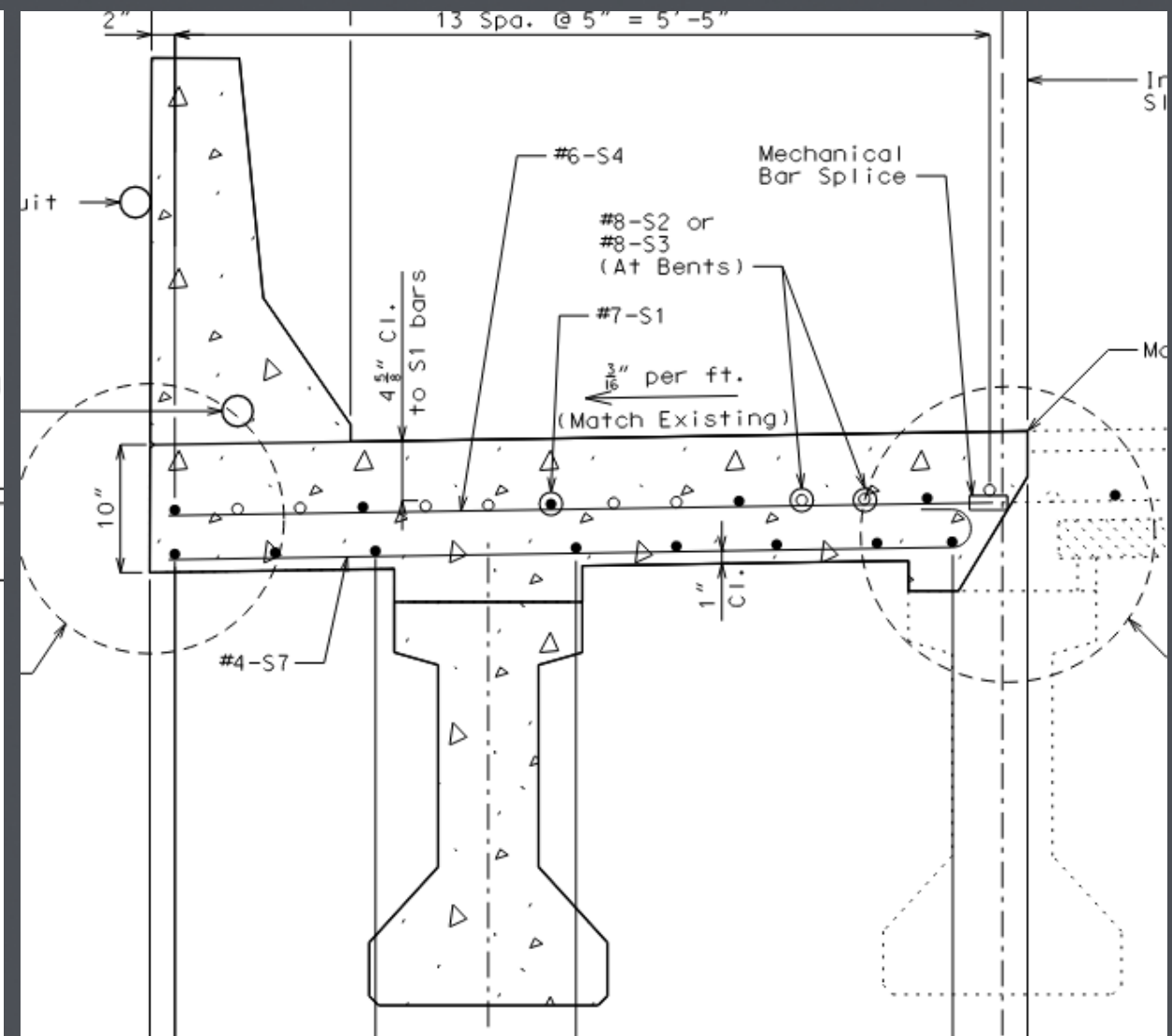
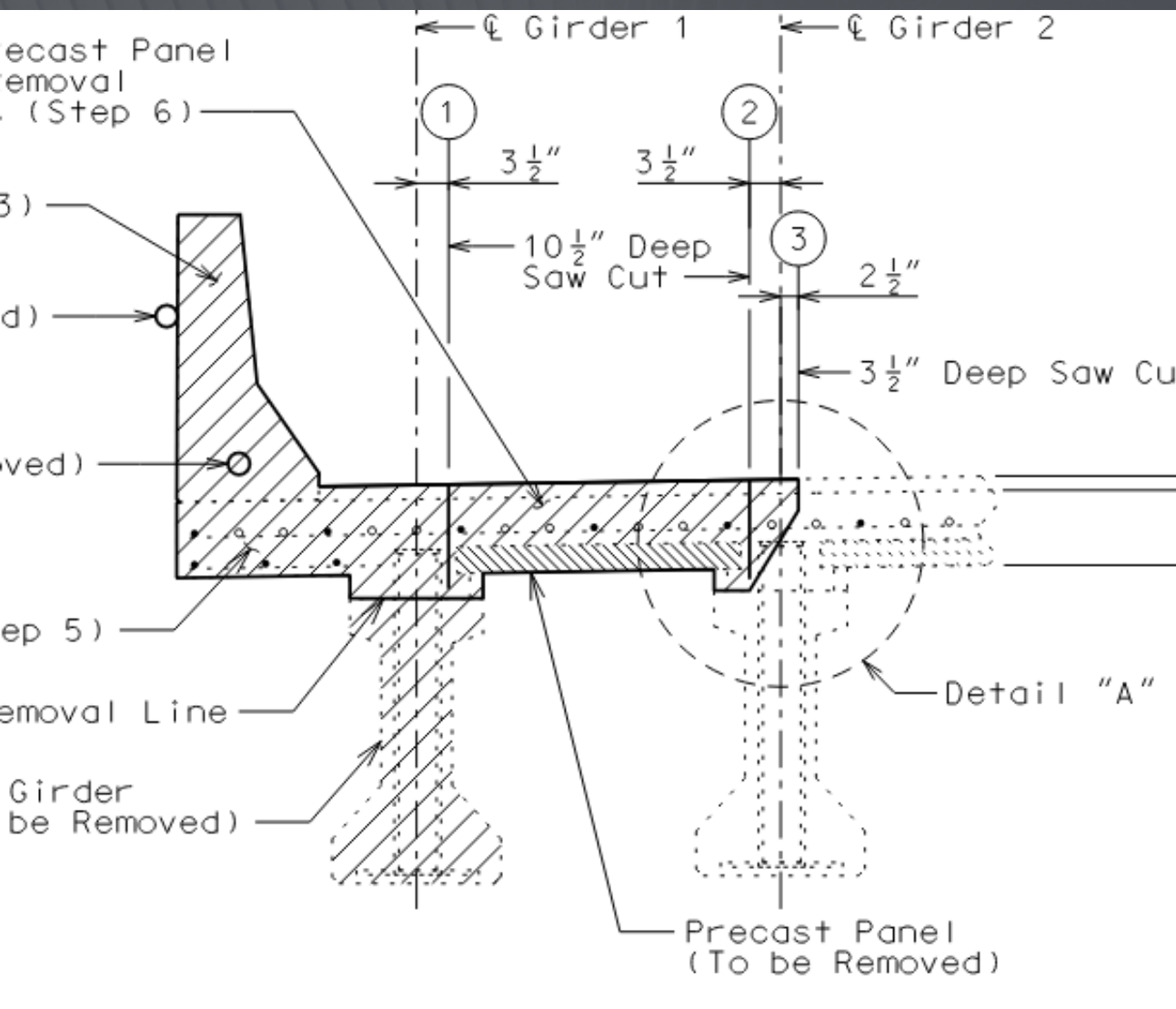
A1006: I-270 over I-44
G1 Span 3 Collision Damage
Looking West



A1006: I-270 over I-44
G1 Span 3 Collision Damage



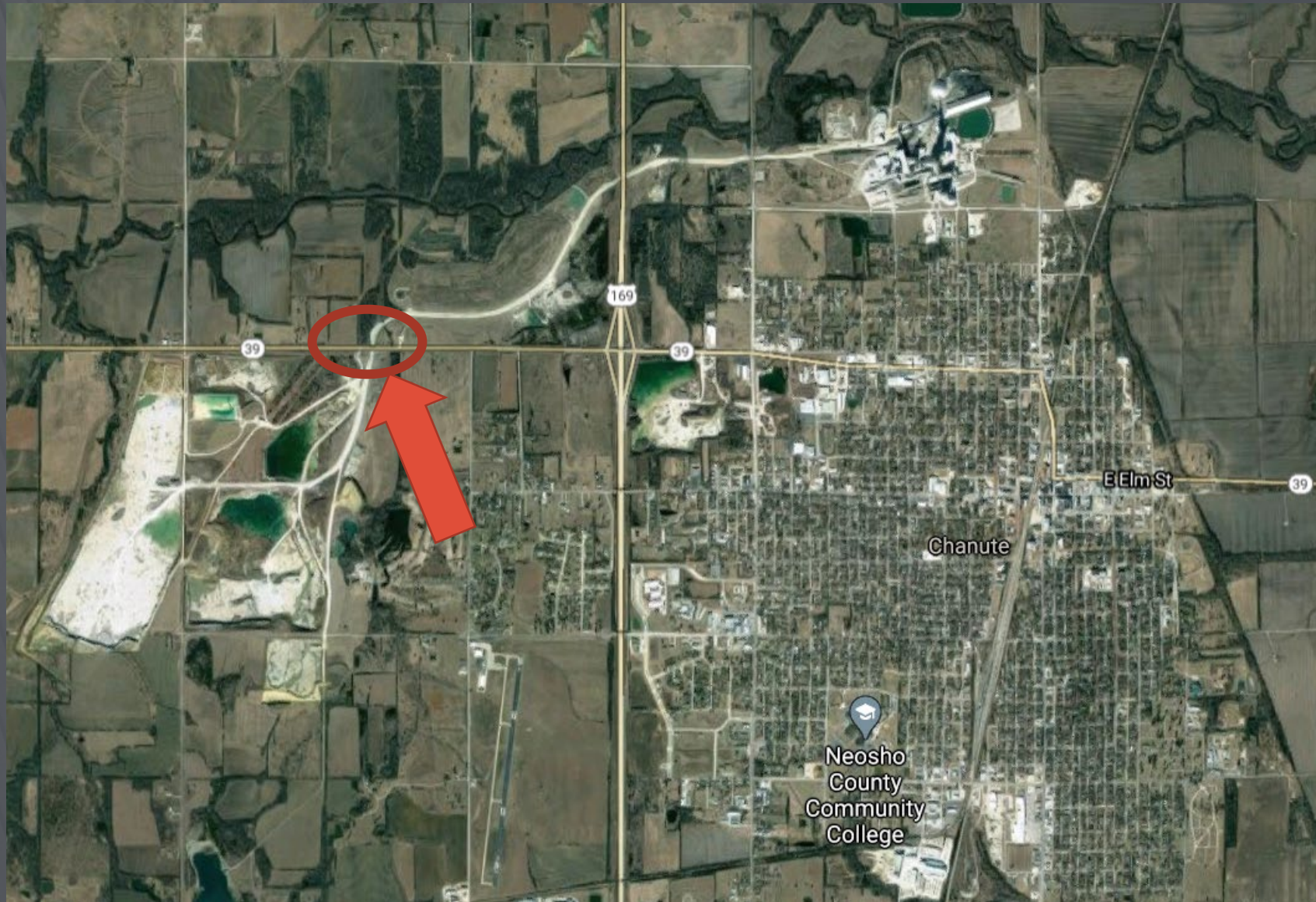
GBA





KDOT
K-39 Bridge Hit
Chanute, KS

GBA



K-39 Bridge over Lone
Star Haul Road:

- NW corner of Chanute
- Just West of US-169





- Slab bridge with a ~~2 column pier~~ 1 column pier

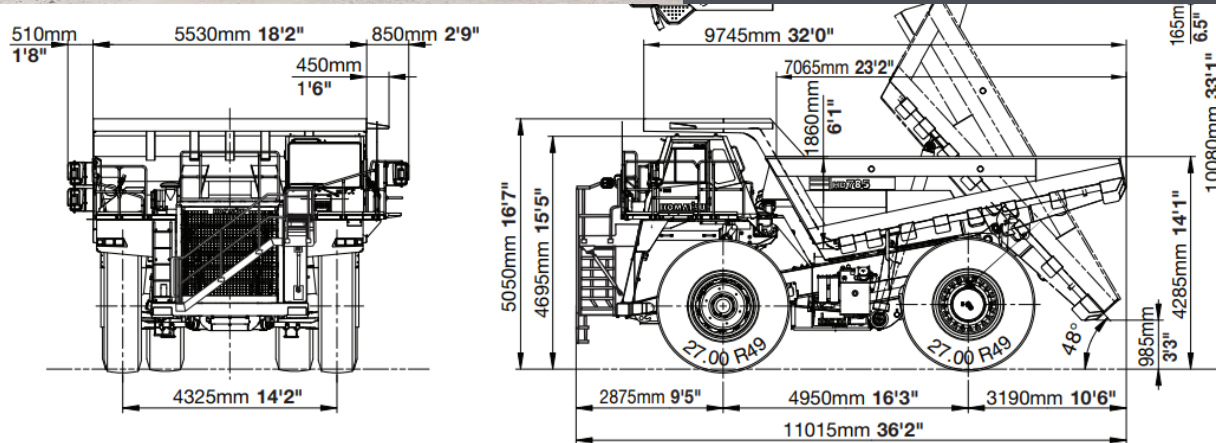


- Column concrete completely broken
- More than half of column steel broken



100 Ton Rock Truck

- 150,000 lb empty weight
- 350,000 lb loaded weight
- F250 and 6' step ladder for scale...

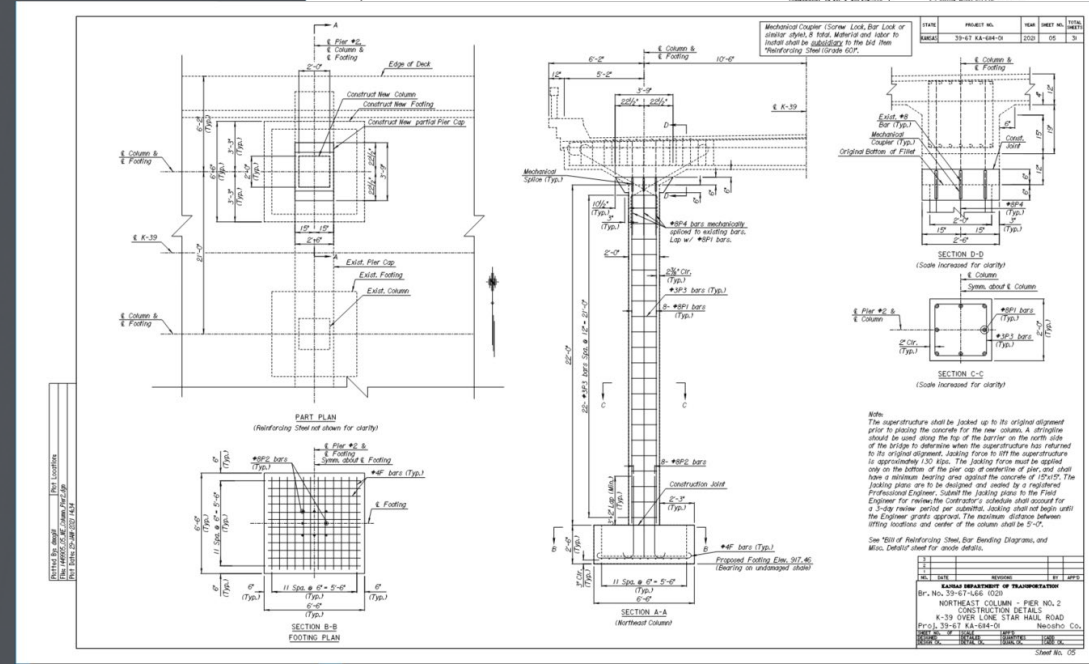
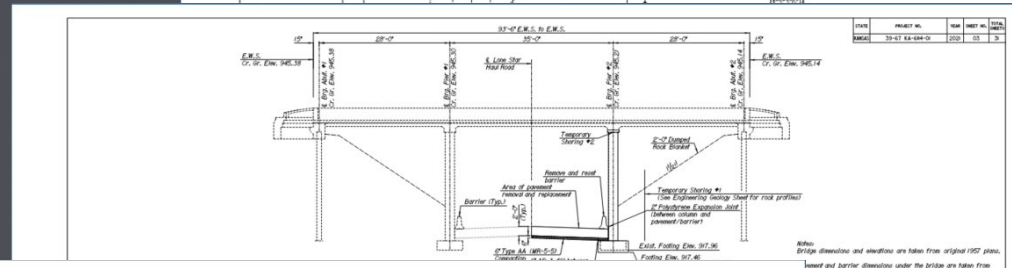
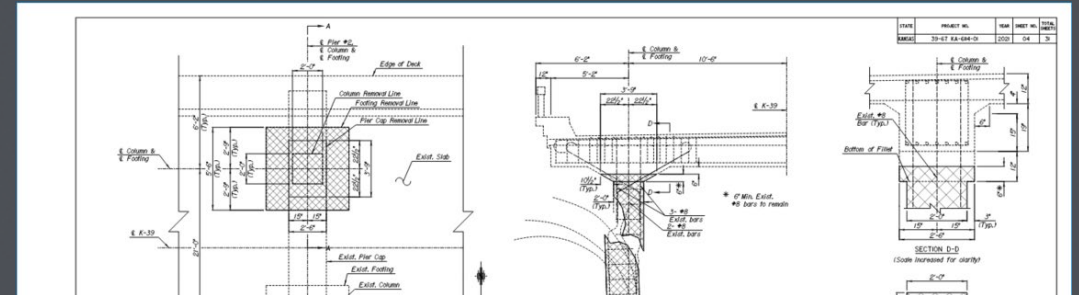


- Damage to truck...
- Toy version is less than \$50 on ebay...



Project Schedule:

- 1/14/21 – Bridge Hit
- 1/15/21 – KDOT contacts GBA
- 1/15/21 – Field visit with KDOT
- 1/22/21 – Conceptual plan due (delivered 1/19/21)
- 1/25/21 – 90% Plans to KDOT
- 1/29/21 – Final Plans for bid
- 2/5/21 – Contract Awarded (with completion deadline 3/31/21)



Notes:
 Temporary Shoring #2 shall be in place prior to beginning the removal of the existing column and footing. Temporary Shoring #2 shall support the structure of the bottom of the pier cap until it is clear to the column as is practical. The maximum distance between shoring location and center of the column shall be 5'-0".

When:
 Temporary Shoring #2 shall be in place prior to beginning the removal of the existing column and footing. Temporary Shoring #2 shall support the structure of the bottom of the pier cap until it is clear to the column as is practical. The maximum distance between shoring location and center of the column shall be 5'-0".

Notes:
 Bridge dimensions and materials are taken from original 1952 plans. Pier and barrier dimensions under the bridge are taken from plan 2006 plans.

Notes:
 Work of existing pavement is required in order to reconstruct the new footing. Dimensions and quantities shown for pavement shall be approximate and the contractor shall coordinate with the KDOT's existing pavement. The contractor shall coordinate with the KDOT's existing pavement. The contractor shall coordinate with the KDOT's existing pavement. The contractor shall coordinate with the KDOT's existing pavement.

Notes:
 Existing pavement pin sheets included in this set of plans for use of existing pavement.

Notes:
 When barrier sections shall be removed and must be replaced with smooth pavement removal and reconstruction for new footing structure. Payment for removal and reworking of barrier sections included in the bid item "Bridge Repair". See existing pavement to sheets included in this set of plans for details of barrier section to pavement.

Notes:
 If the barrier is used, the wall shall be related to its final condition, SUBMITTAL to other sheets.

Notes:
 The superstructure shall be jacked up to its original alignment prior to placing the concrete for the new system. A strapping shall be used across the top of the barrier on the north side of the bridge to determine when the superstructure has returned to its original alignment. Lifting force to lift the superstructure is approximately 150 kips. The jacking force must be applied only on the bottom of the pier cap at construction of pier and shall have a minimum bearing area against the concrete of 150sqft. The jacking plates are to be designed and reviewed by a registered Professional Engineer. Submit the jacking plans to the Field Engineer for review. The Contractor's solution shall account for a 3-day maintenance period per submittal. Lifting shall not begin until the Engineer grants approval. The maximum distance between lifting locations and center of the column shall be 5'-0".

Notes:
 See "Bid" of Reinforcing Steel, Bar Bending Diagrams, and Misc. Fabricated steel for more details.



Putting it back together:

- Pavement removal
- Excavated for new footing
- Temporary soil nail wall
- Pour new footing
- H-pile struts with jacks
- Straighten/couple rebar
- Pour new column



Lift the bridge back to original profile before pouring the new column



K-39 was closed during construction. This caused problems for other projects...



MoDOT
Route J/NN over Route 60
Springfield, MO

A8303 Greene Co 10-5--23

Rte J over US 60

Collision damage looking west

Girder 1 Spall 1

Approx 8 ft from MSE wall



2023.10. 5

GBA

DATE PREPARED 11/3/2023	
ROUTE 60	STATE MO
DISTRICT BR	SHEET NO. 3
COUNTY GREENE	
JOB NO. J SUM0050	
CONTRACT ID.	

PROJECT NO.

BRIDGE NO.
A83031

DESCRIPTION	DATE

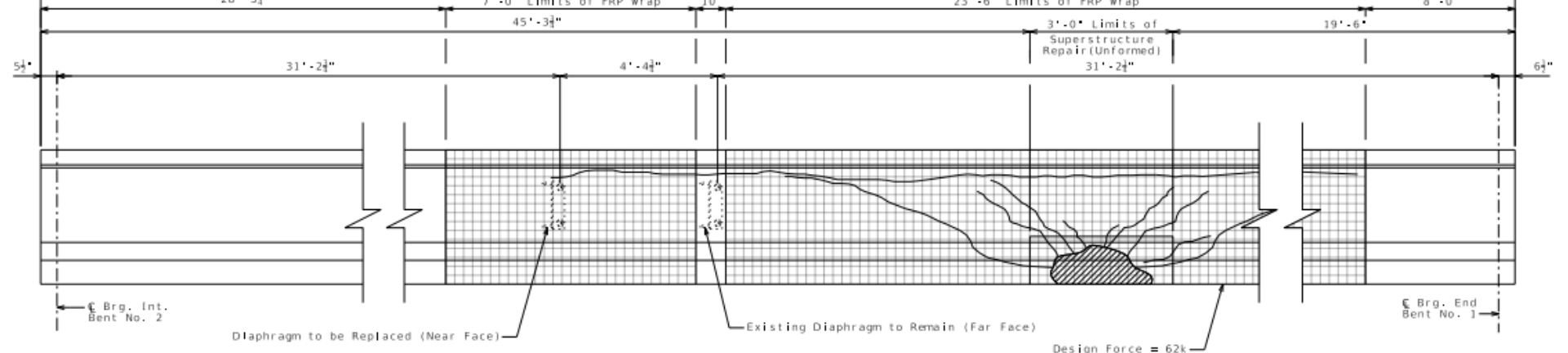
MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION

105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

GBA
9801 Penny Blvd, Ste 300
Lenexa, KS 66228
913-492-0400
GBA.com

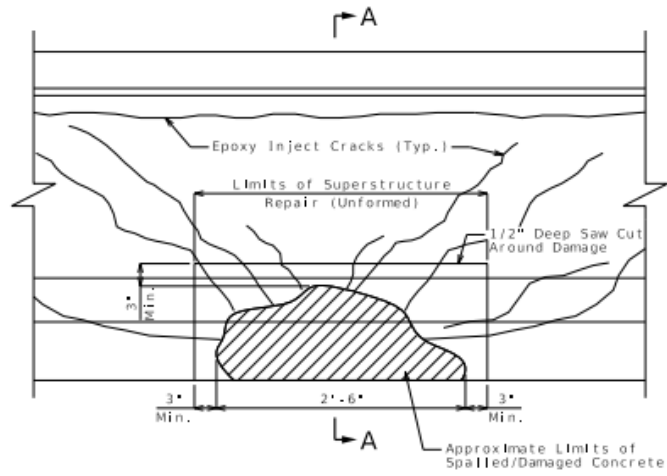
GEORGE BUTLER ASSOCIATES, INC.
P.E., ENGINEER 009133
ARCHITECT 000212
P.L.S. LAND SURVEYOR 000559

DUSTIN TREGHAGO
PROFESSIONAL ENGINEER
PE-2016012977

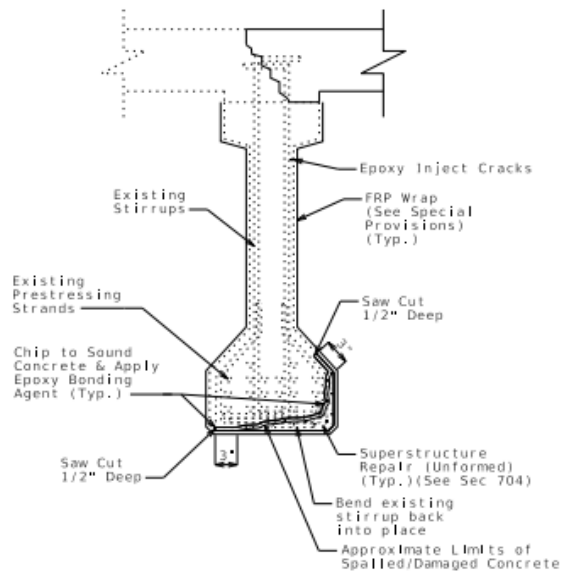


ELEVATION OF GIRDER NO. 2 IN SPAN (1-2)
(Looking West)

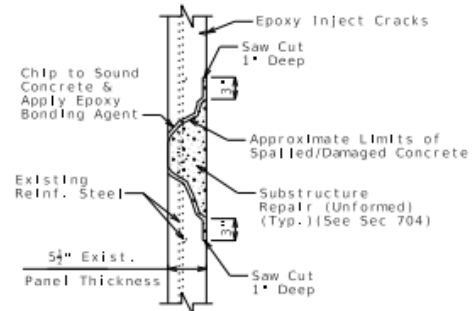
Notes:
Design Force is the factored shear force at any cross section in the limits of FRP wrap that shall be resisted entirely by the FRP Reinforcement.
See special provisions.



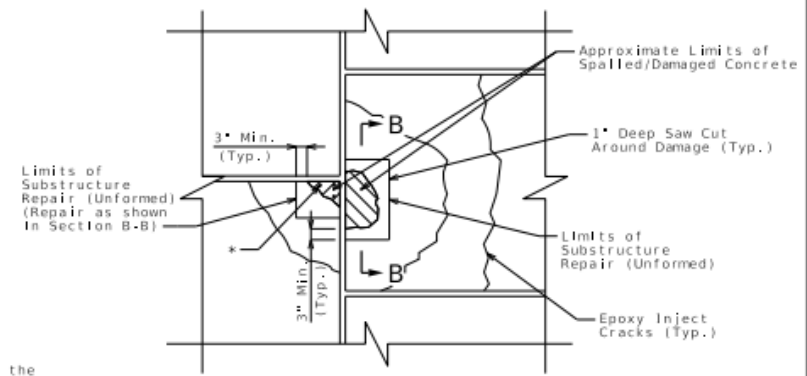
PART ELEVATION AT DAMAGED LOCATION OF GIRDER NO. 2 IN SPAN (1-2)



SECTION A-A



SECTION B-B



PART ELEVATION AT DAMAGED LOCATION OF MSE WALL A83521

Payment for all repairs and incidentals to the prestressed girder damage locations, complete in place, will be considered completely covered by the contract unit prices for Superstructure Repair (Unformed), Epoxy Pressure Injecting, and Fiber Reinforced Polymer Wrap.

Extreme care shall be taken when chipping to sound concrete and saw cutting of the prestressed girders as to not damage any prestressed strands or stirrups.

Live load not allowed on Girder No. 2 in Spans (1-2) & (2-3) during damage repairs.

*3/8"Ø x 3 1/2" threaded concrete lag screws at 6" maximum grid spacing (minimum of 3 screws) within the limits of spalled/damaged concrete. Screws shall be embedded a minimum of 2" into sound wall panel, have a minimum clearance of 1 1/2" to edges of panel, have a minimum clearance of 1" to each face of panel, be painted with protective coating, and be approved by the engineer prior to installation. The cost of all work associated with the installation of lag screws shall be completely covered by the contract unit price for Substructure Repair (Unformed).

Payment for all repairs and incidentals to the MSE wall damage locations, complete in place, will be considered completely covered by the contract unit prices for Substructure Repair (Unformed) and Epoxy Pressure Injecting.

DETAILS OF CONCRETE I-GIRDER AND MSE WALL REPAIR

Schedule

- Incident occurred on 10/6/2023
- GBA contacted on 10/9/2023
- NTP received on 10/11/2023
- Final PS&E 11/07/2023
- Advertised to contractors on 11/9/2023
- Had intermittent submittals to the District to allow expedited review time.



IDOT

Overhead Sign Impact

LaSalle, IL

GBA



<p>EXIT 79A</p> <p>INTERSTATE 39 51 SOUTH</p> <p>Bloomington Normal</p>	<p>EXIT 79B</p> <p>INTERSTATE 39 51 NORTH</p> <p>Rockford</p>
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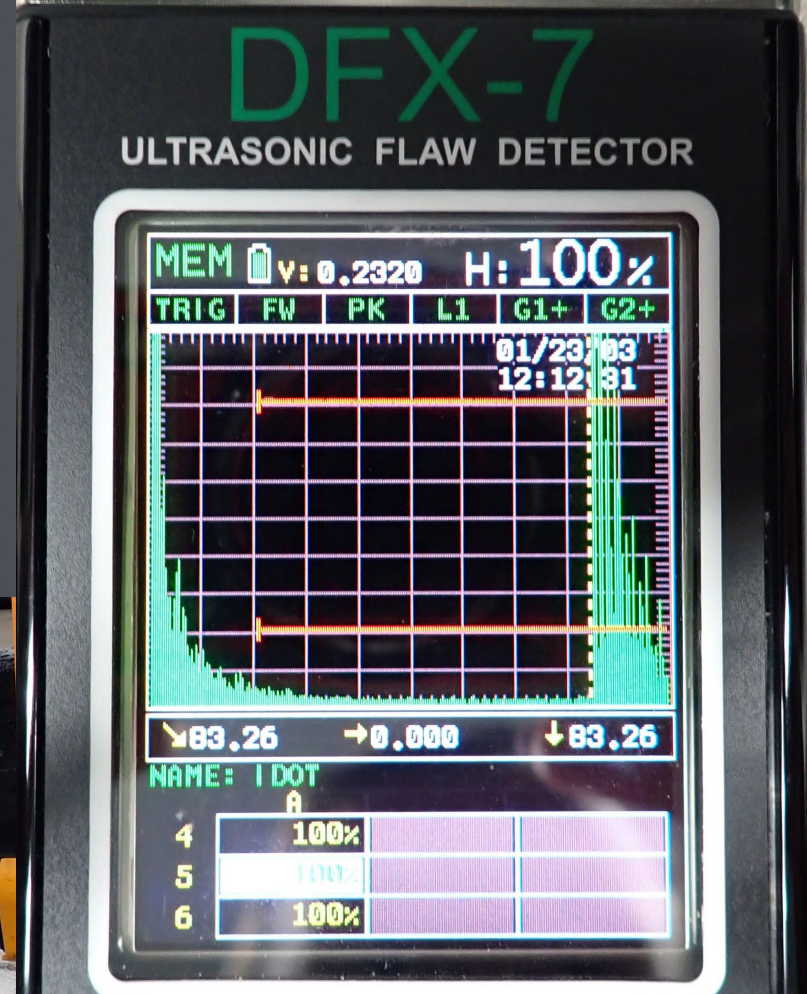


IDOT

Traffic Signal Impact

Carbondale, IL

GBA



GBA



MoDOT

Overhead Sign Impact

St. Louis, MO

GBA





GBA

**Thank you for Listening.
Questions?**

GBA