Over-Height Vehicle Collision
Assessment and Repair Methodology

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Prestressed Concrete Standards Engineer

Oregon Department of Transportation

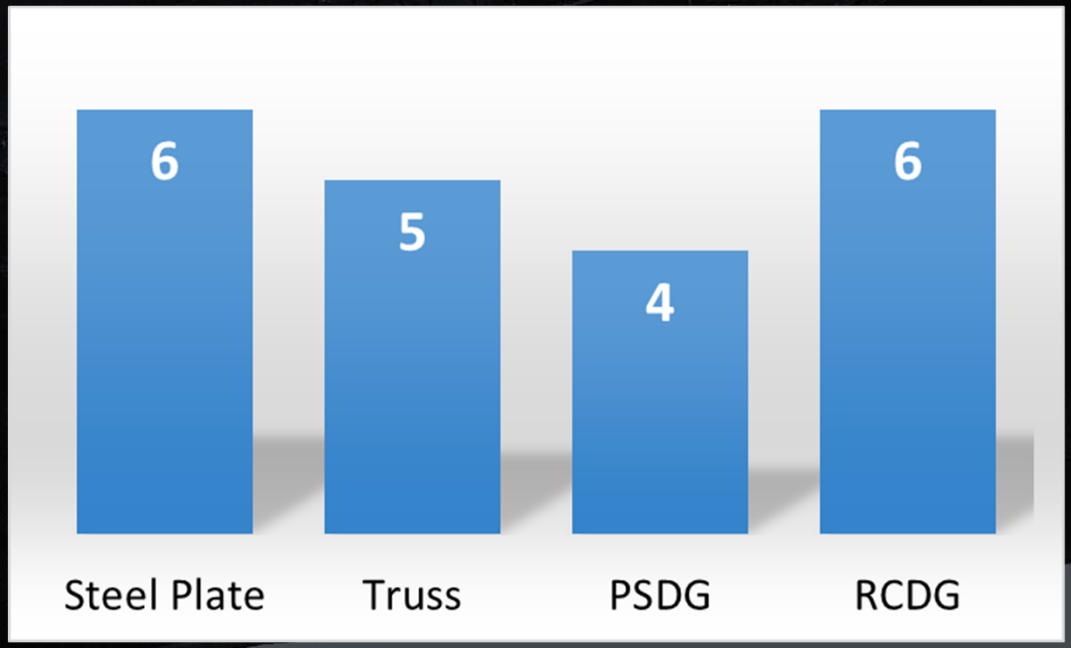
STATE OF OREGON 1859

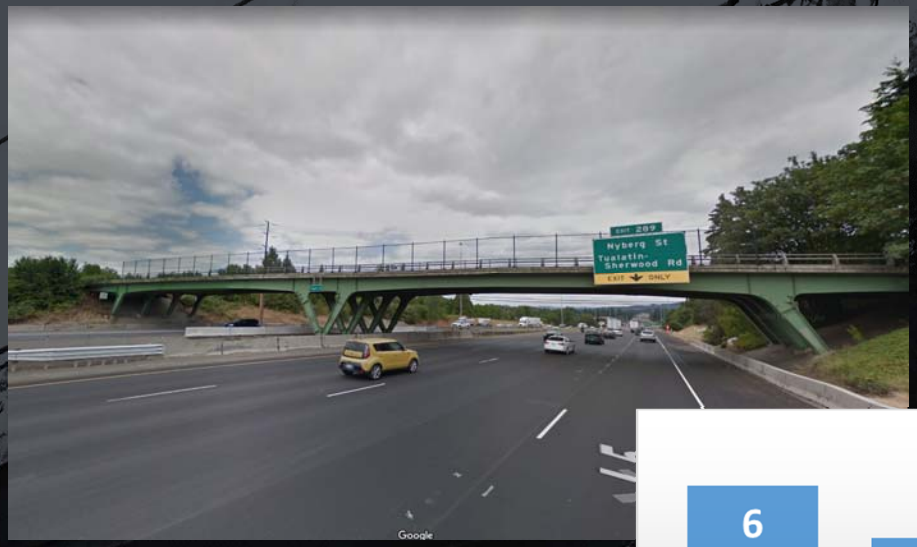
SCOPE

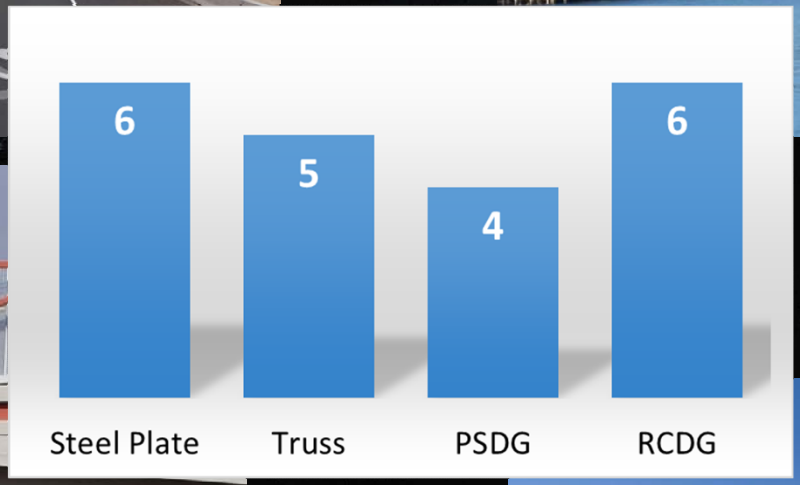
- Past incident
- Damage level
- Repair or replace
- Guideline development
- Reference materials

PAST INCIDENT

- State Bridge Engineer's Collection
- 21 Bridges (2007 – 2018)




Exit 289
Nyberg St
Tualatin-
Sherwood Rd
EXIT ONLY
Google


6
5
4
6
Steel Plate
Truss
PSDG
RCDG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Nyberg St
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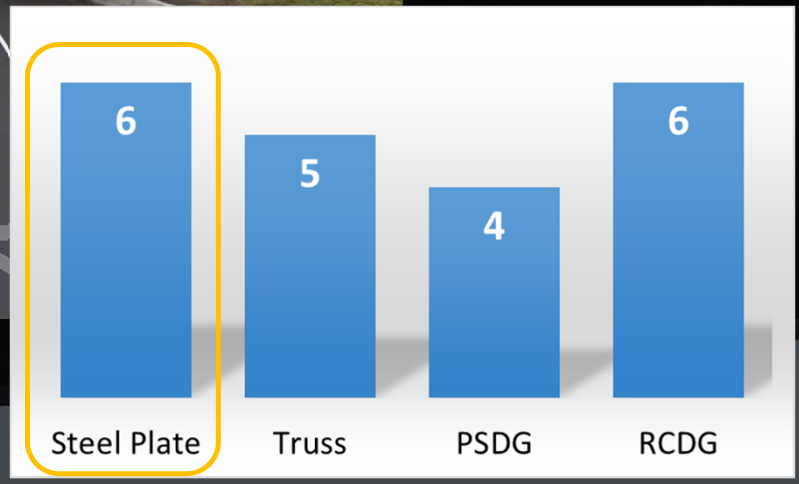
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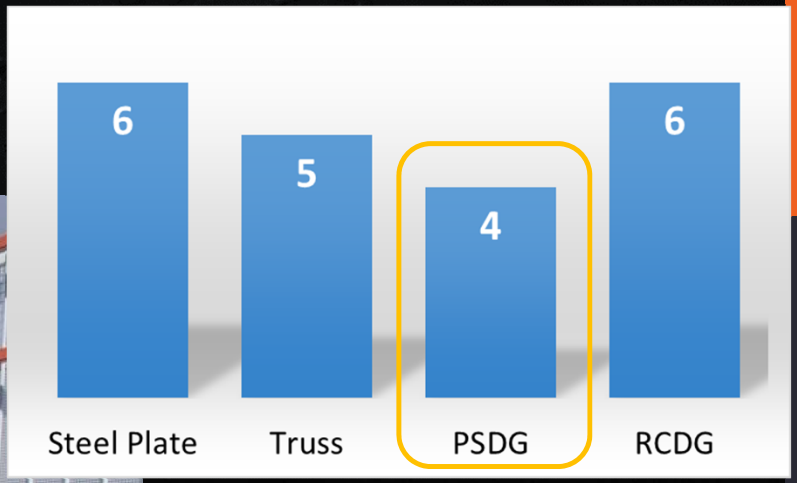
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6
5
4
6
Steel Plate
Truss
PSDG
RCDG
99E

DAMAGE LEVEL – STEEL GIRDERS

- Minor
- Moderate
- Severe

DAMAGE LEVEL – STEEL GIRDERS

- Minor - no repair or minimal repair
  - Paint scrapes
  - Small nicks or gouges
  - Small girder web out of plumb

Hwy 162 Culver Rd

DAMAGE LEVEL – STEEL GIRDERS

- Minor - no repair or minimal repair
  - Paint scrapes
  - Small nicks or gouges
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Hwy 162 Culver Rd

DAMAGE LEVEL – STEEL GIRDERS

- Moderate - repair or partial replacement
  - Moderate flange bends
  - Moderate girder web out of plumb
  - Tearing of web and flange

Morrison Ramp

DAMAGE LEVEL – STEEL GIRDERS

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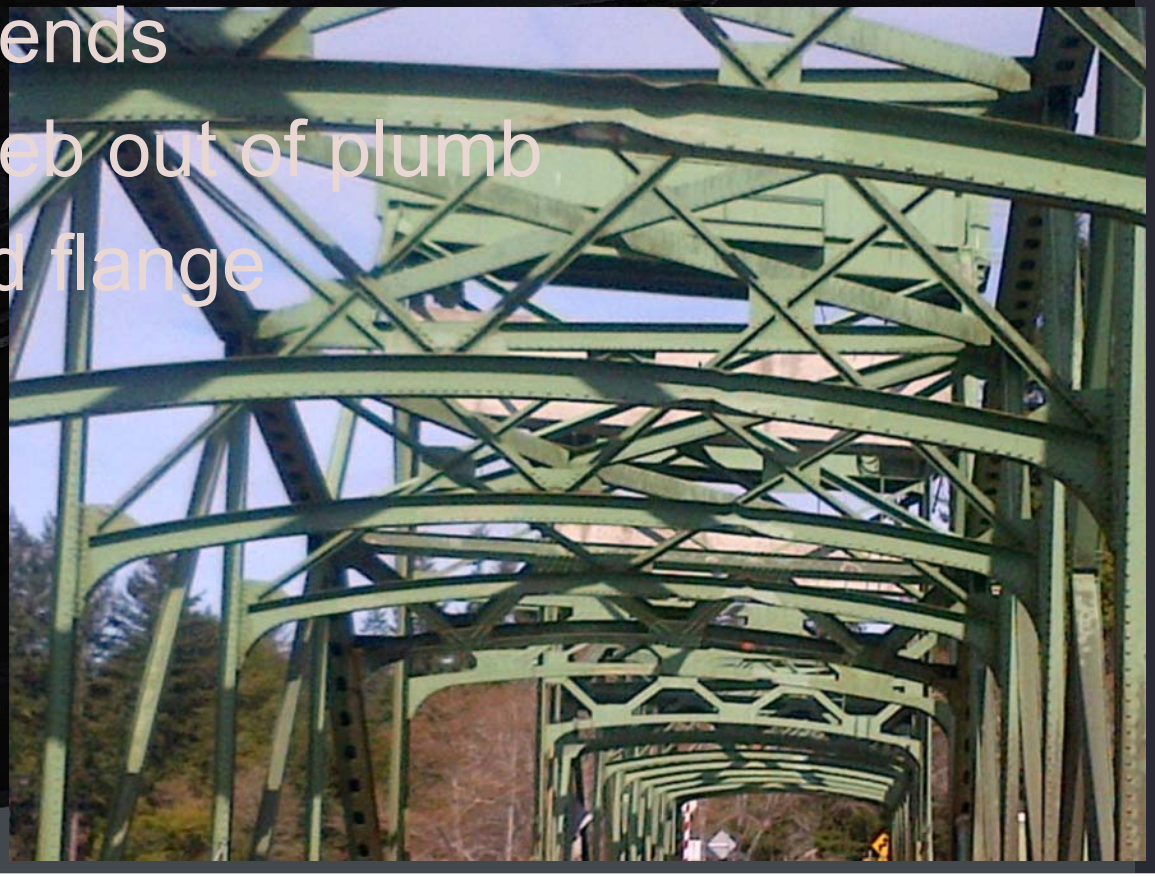
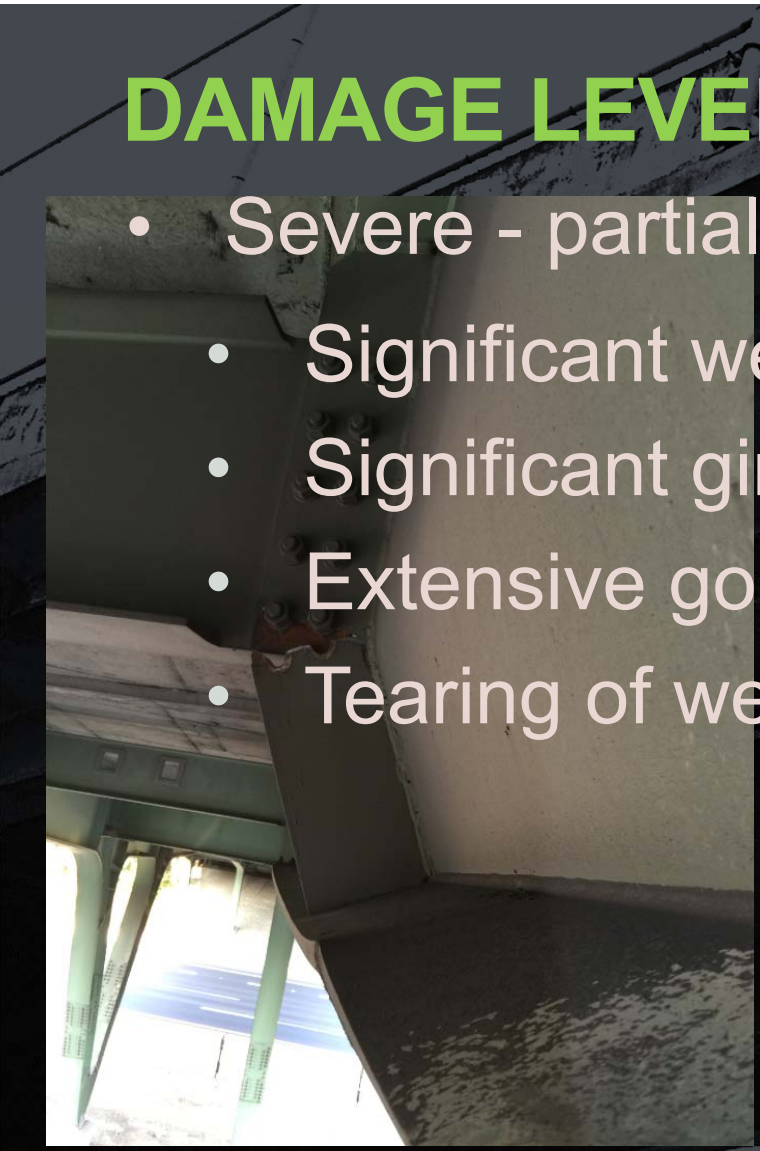
  - Moderate girder web out of plumb
  - Tearing of web and flange

Chandler Bridge



DAMAGE LEVEL – STEEL GIRDERS

- Severe - partial or full replacement
  - Significant web and flange bends
  - Significant girder web out of plumb
  - Extensive gouges
  - Tearing of web and flange



SW Sagert Rd over I-5

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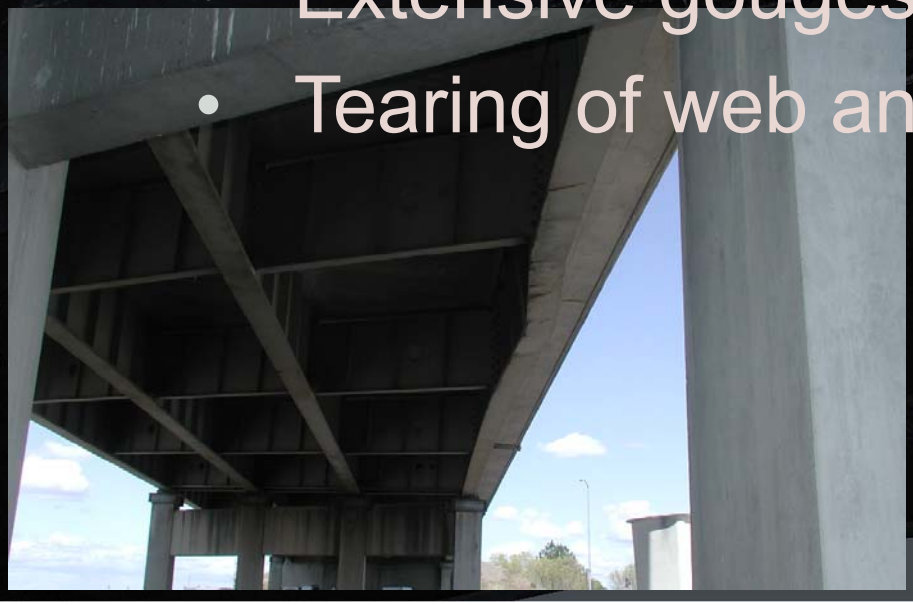

N Ontario IC

DAMAGE LEVEL – CONCRETE GIRDERS

- Minor
- Moderate
- Severe

DAMAGE LEVEL – CONCRETE GIRDERS

- Minor - no repair or minimal repair
  - Minor concrete spalling
  - Partially exposed rebar or strands
  - Not through cracks

Barbur Blvd over I-5

DAMAGE LEVEL – CONCRETE GIRDERS

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  - Minor concrete spalling
  - Partially exposed rebar or strands
  - Not through cracks

Hwy 1 over McAndrews

DAMAGE LEVEL – CONCRETE GIRDERS

- Moderate - repair or partial replacement
  - Moderate concrete spalling
  - Exposed rebar or strands
  - Through cracks
  - Less than 25%? of rebar or strands severed

Hwy 1 over McAndrews

DAMAGE LEVEL – CONCRETE GIRDERS

- Moderate - repair or partial replacement
  - Moderate concrete spalling
  - Exposed rebar or strands
  - Through cracks
  - Less than 25%? of rebar or strands severed

Boardman IC

DAMAGE LEVEL – CONCRETE GIRDERS

- Severe - partial or full replacement
  - Large area of concrete spalling
  - Exposed rebar or strands
  - Large through cracks
  - More than 25%? of rebar or strands severed

Saginaw Br

DAMAGE LEVEL – CONCRETE GIRDERS

- Severe - partial or full replacement
  - Large area of concrete spalling
  - Exposed rebar or strands
  - Large through cracks
  - More than 25%? of rebar or strands severed

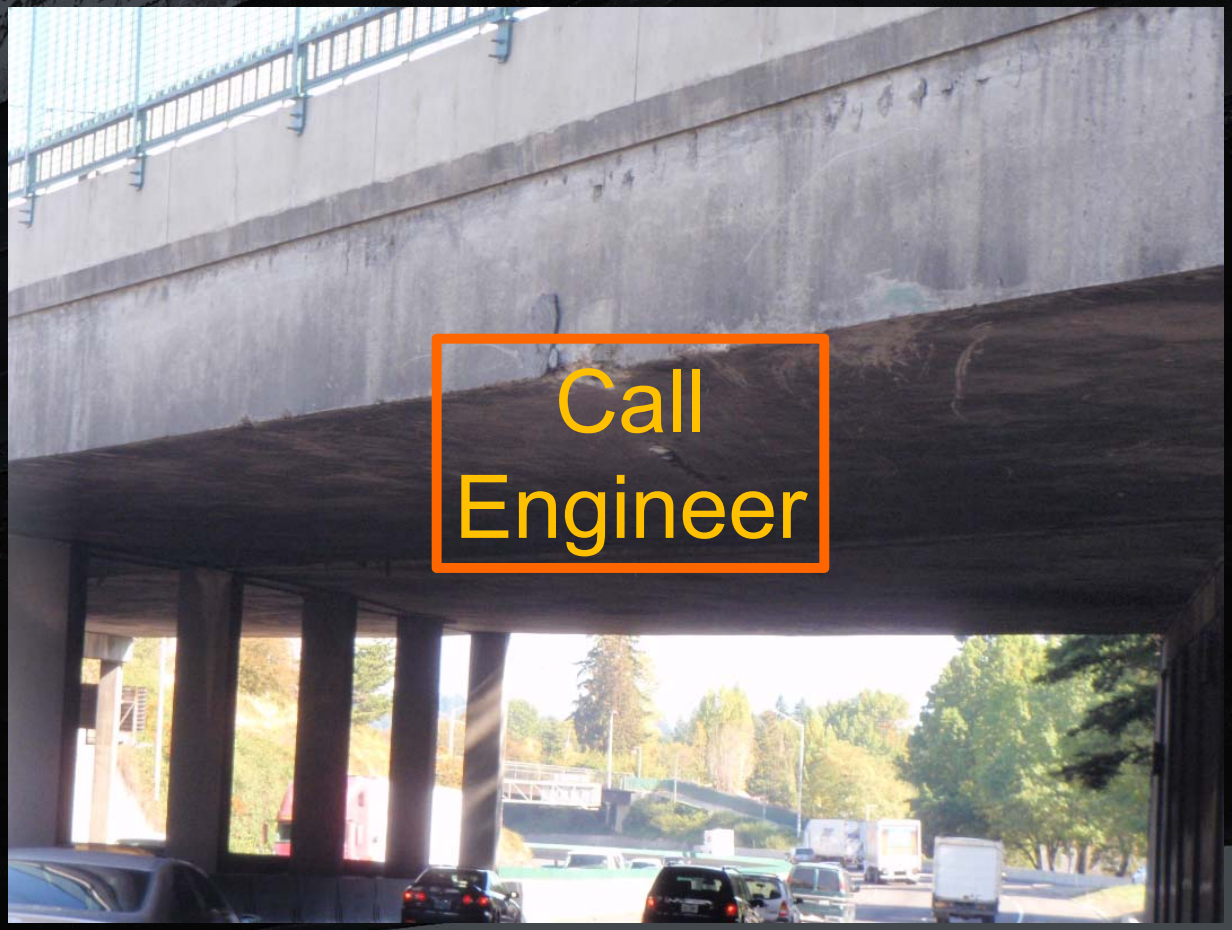
Hwy 37 over Hwy 102 at Banks

DAMAGE LEVEL – CONCRETE GIRDERS

- Severe - partial or full replacement

Hwy 37 over Hwy 102 at Banks

INCIDENT RESPONSE



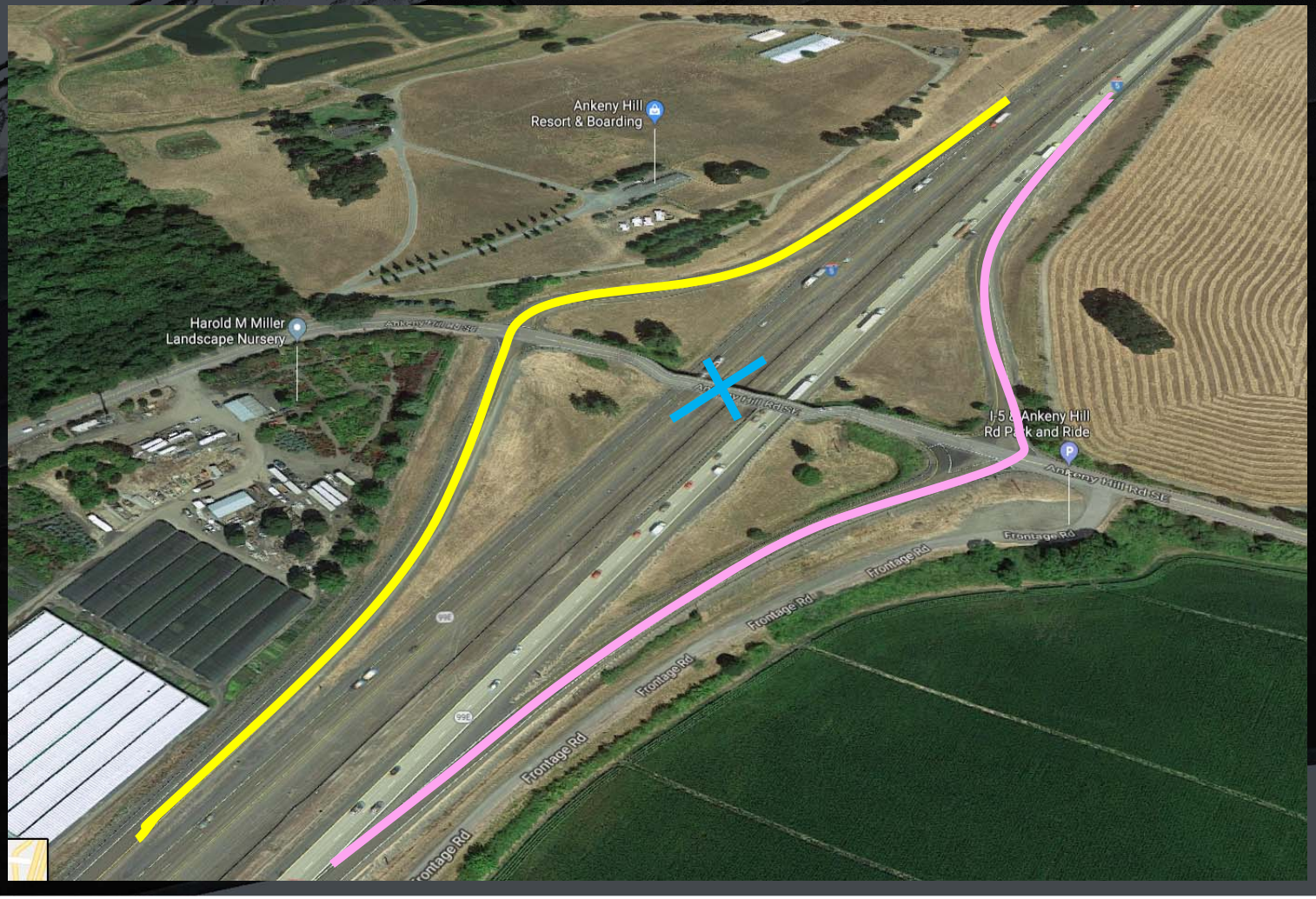
INCIDENT RESPONSE

Hwy 37 over Hwy 102 at Banks

INCIDENT RESPONSE

- Detour
- Partial or full closure
- Cleanup
- Catching net
- Shoring

DETOUR


Ankeny Hill
Resort & Boarding
Harold M Miller
Landscape Nursery
Ankeny Hill Rd SE
I-5 & Ankeny Hill
Rd Park and Ride
Frontage Rd
Frontage Rd
Frontage Rd
Frontage Rd
Frontage Rd
Frontage Rd
99E

CLOSURE


Ankeny Hill
Resort & Boarding
Ankeny Hill Rd SE
Ankeny Hill Rd SE
Ankeny Hill
I-5 & Ankeny Hill
Rd Park and Ride
Frontage Rd
Frontage Rd

CLOSURE

CLOSURE

INCIDENT RESPONSE

- Detour
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Conventional Reinforced Concrete or Steel

vs

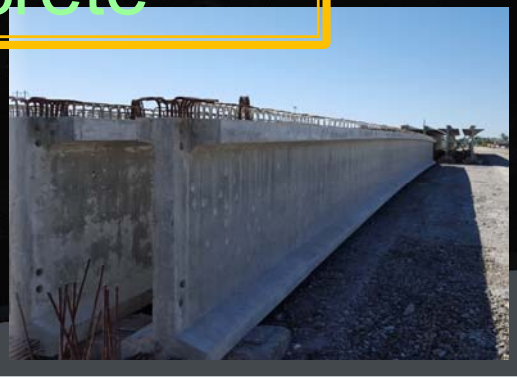
Prestressed Concrete

SHORING

Conventional Reinforced Concrete or Steel

vs

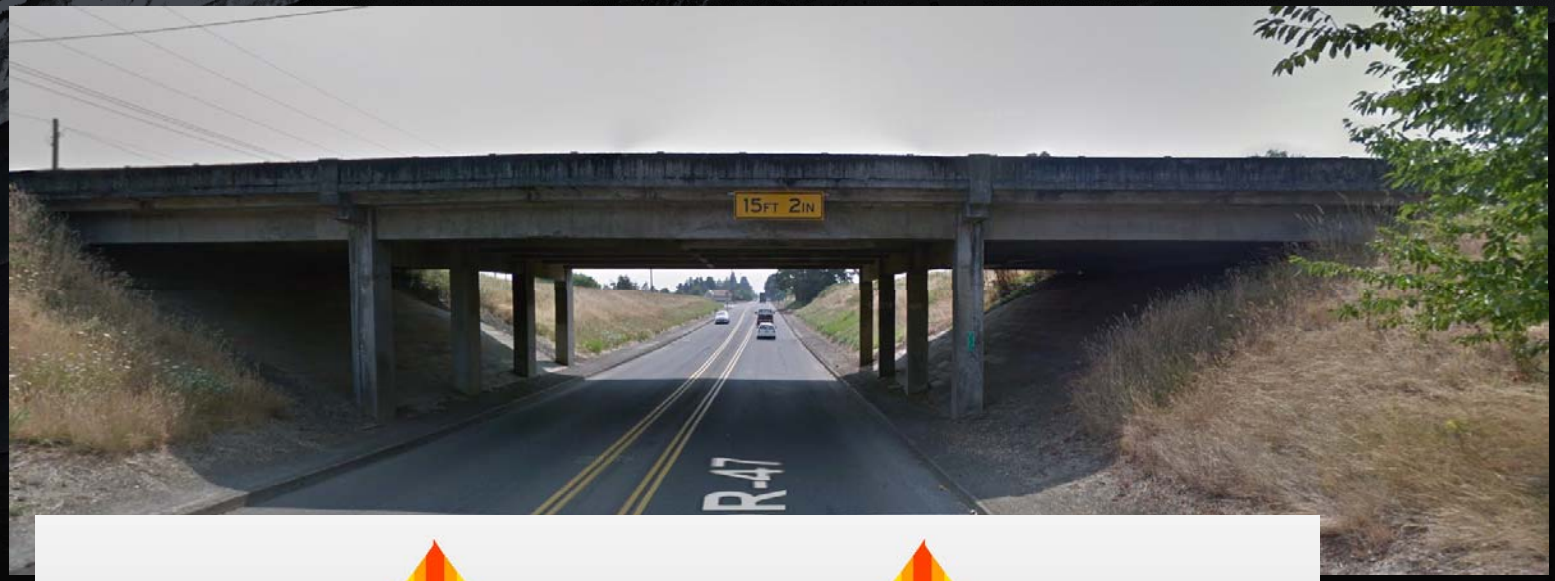
Prestressed Concrete



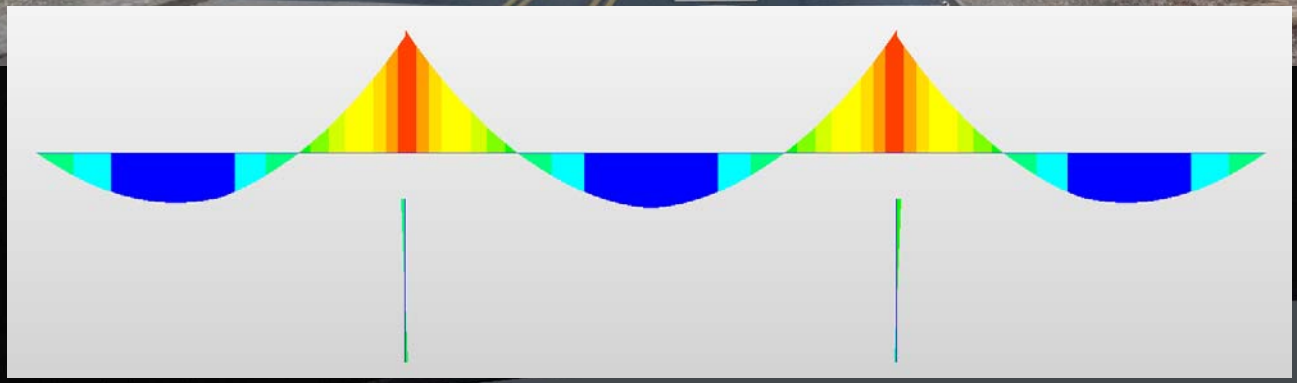
SHORING

Hwy 37 over Hwy 102 at Banks

RCDG or Steel vs PSDG

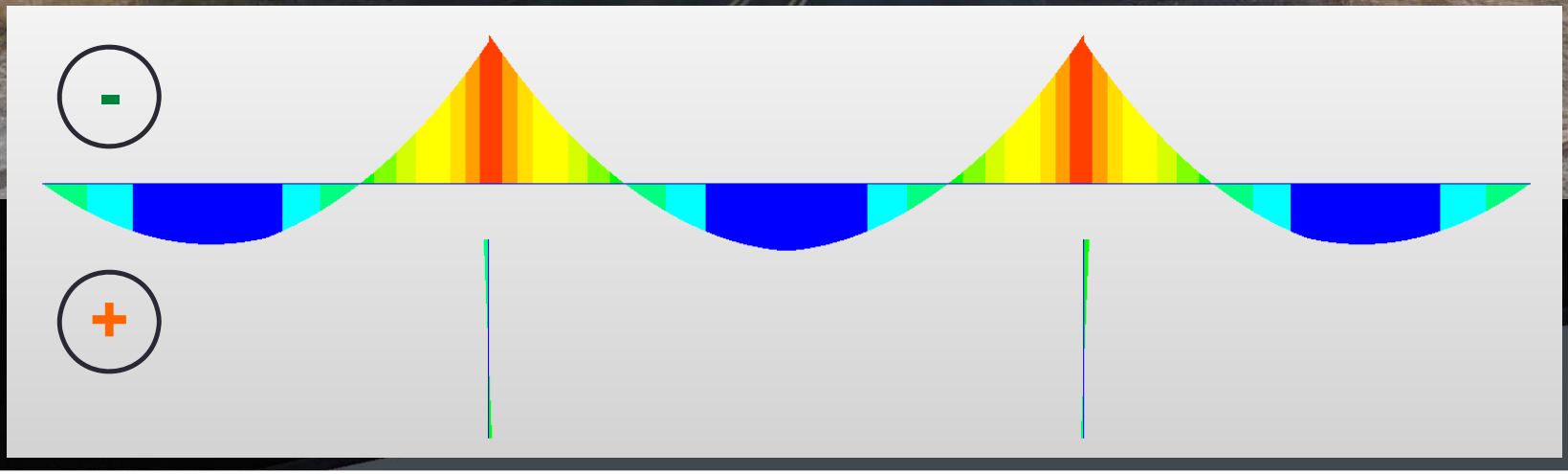


Bending Moment



BENDING MOMENT

Concrete – Strong in Compression, Weak in Tension

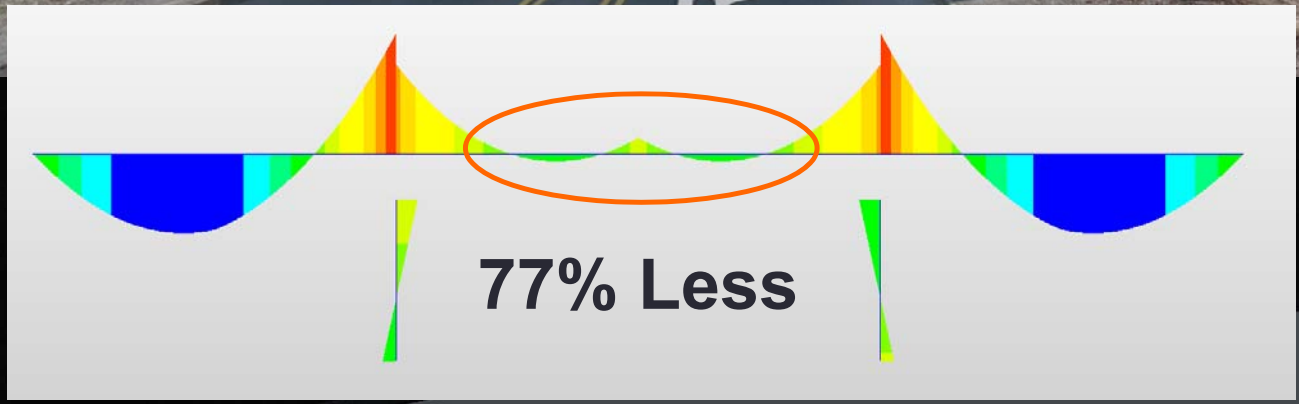


SHORING

Hwy 37 over Hwy 102 at Banks

RCDG or Steel vs PSDG

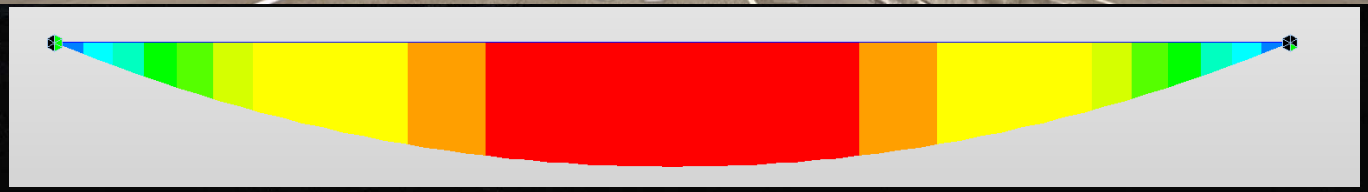
Bending Moment



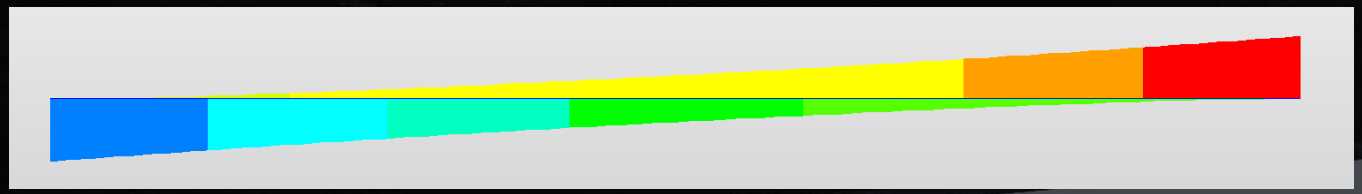
SHORING

RCDG or Steel vs PSDG

Bending Moment



Shear



SHORING

RCDG or Steel vs PSDG

Bending Moment

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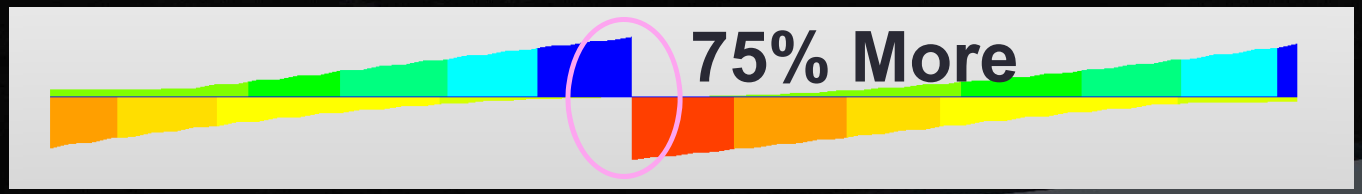
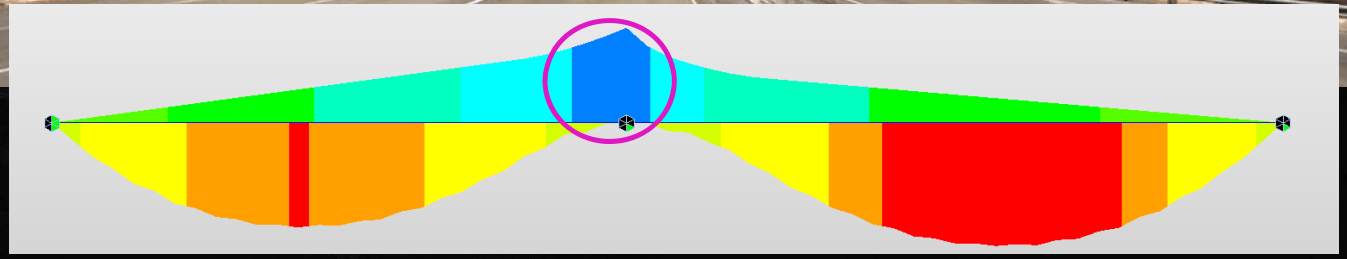


SHORING

RCDG or Steel vs PSDG

Bending Moment



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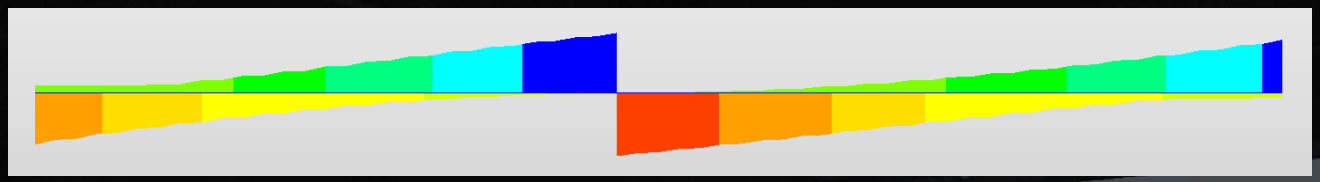
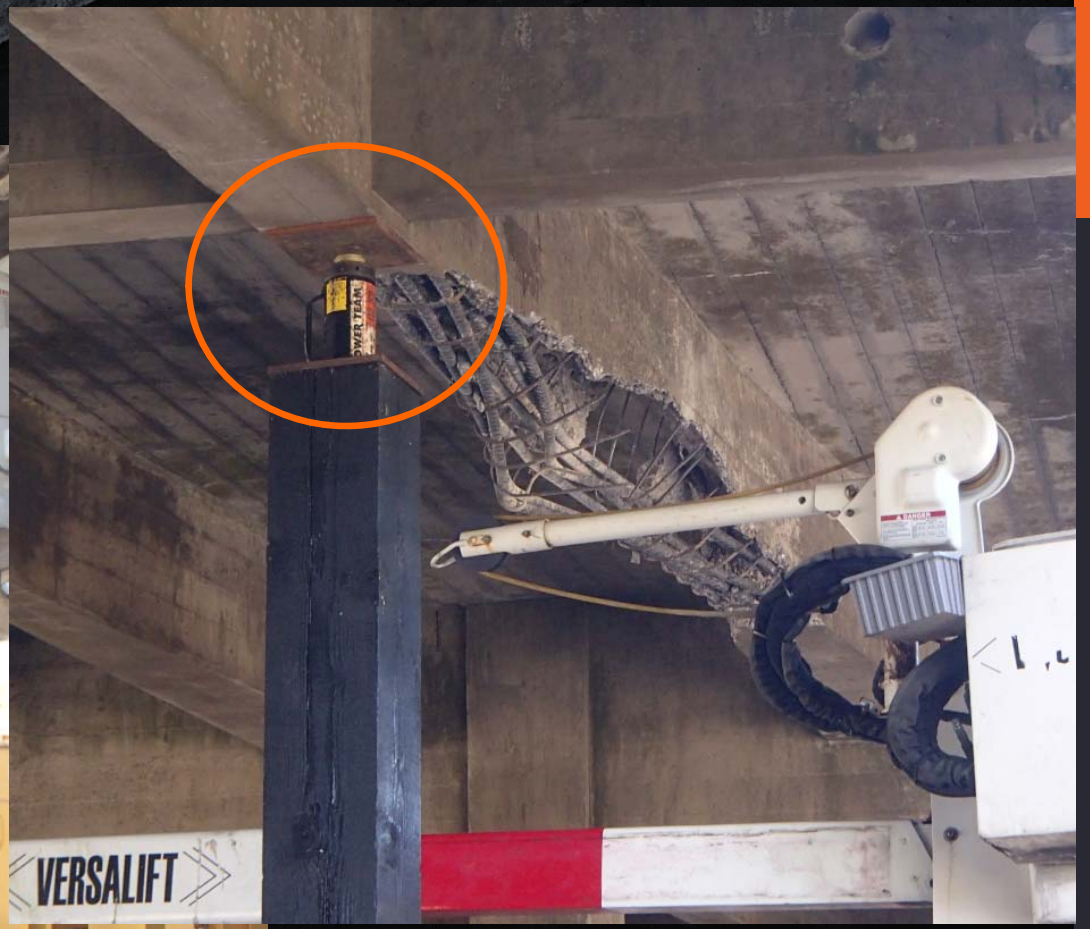


PAST INCIDENT – SHORING RCDG

Hwy 37 over Hwy 102 at MP 49.09

- 2016
- Banks

SHORING



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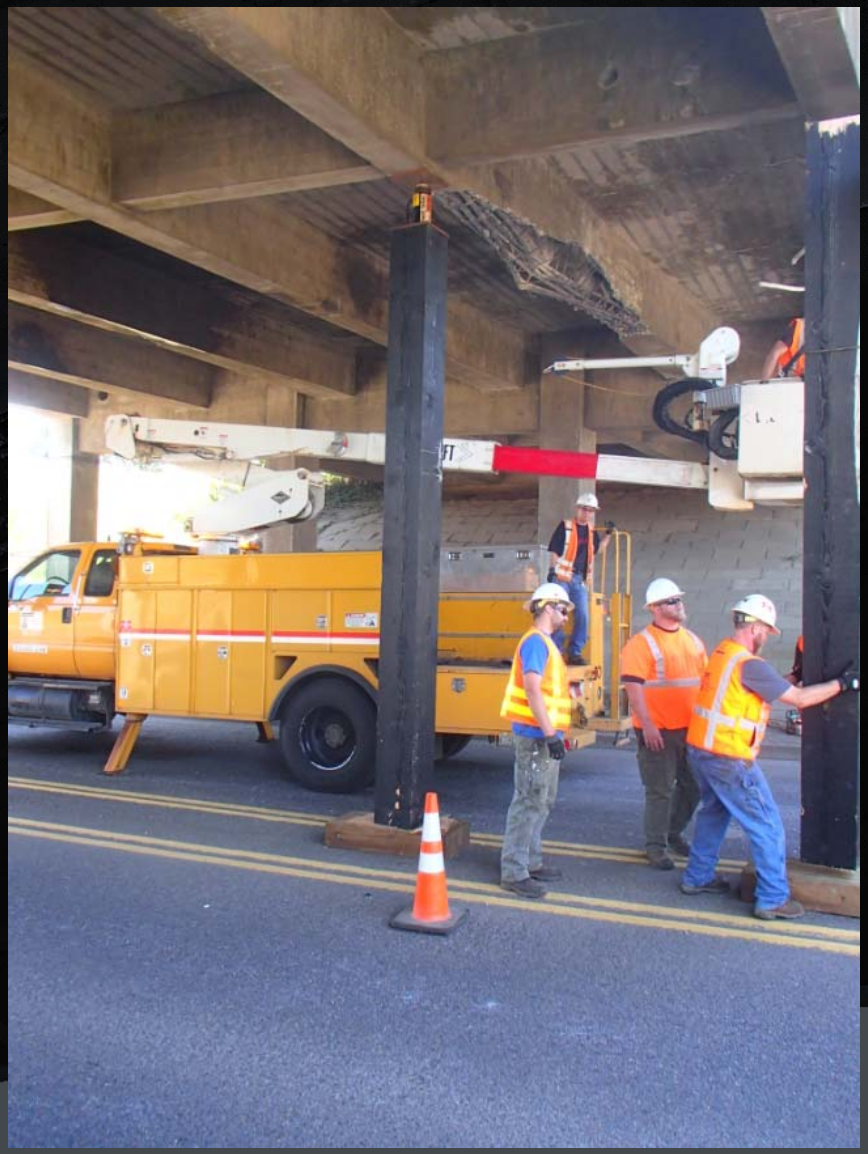
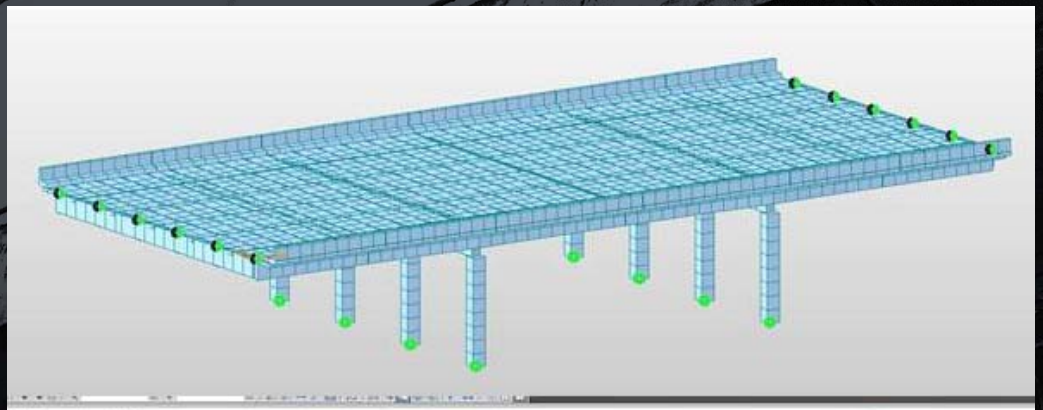
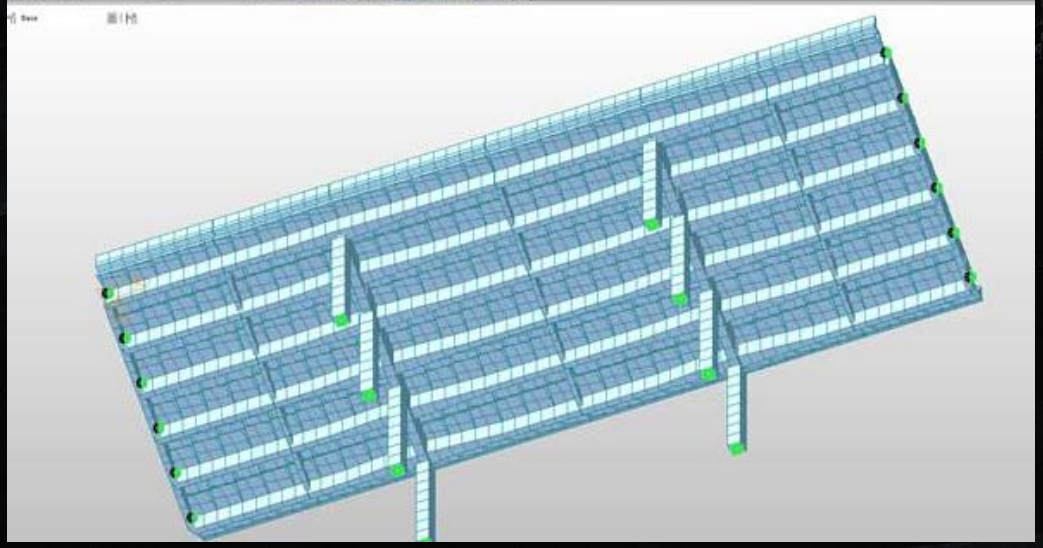
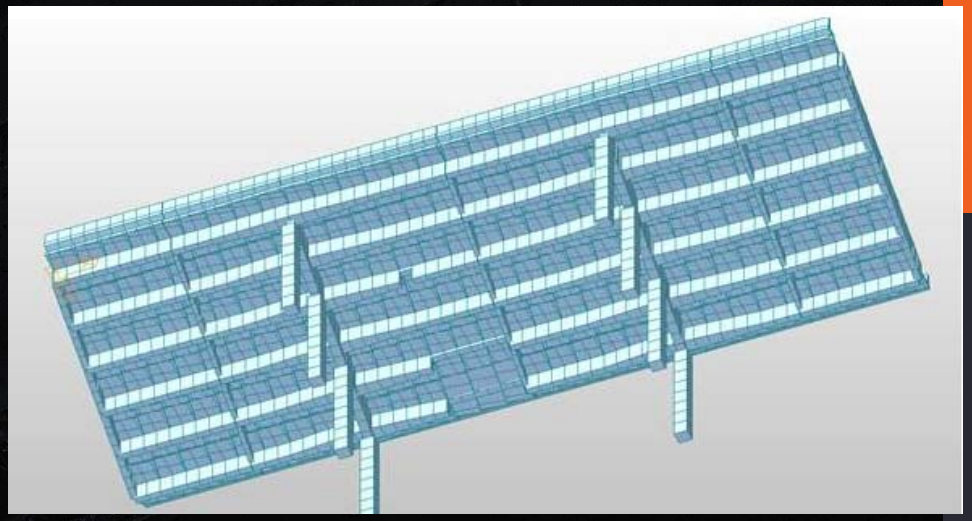


DAMAGE ASSESSMENT







Geometric Properties

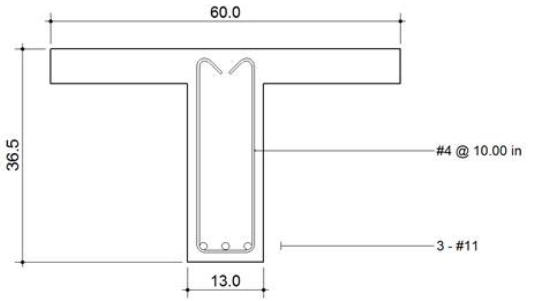
	Gross Conc.	Trans (n=8.80)
Area (in^2)	756.5	793.0
Inertia (in^4)	94660.8	110349.6
y_t (in)	12.6	13.5
y_b (in)	23.9	23.0
S_t (in^3)	7533.5	8148.6
S_b (in^3)	3955.0	4806.6

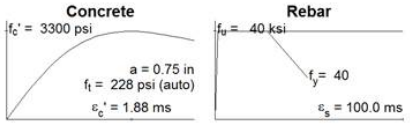
Crack Spacing

2 x dist + 0.1 d_b /ρ

Loading (N,M,V + dN,dM,dV)

0.0 , -0.0 , 0.0 + 0.0 , 1.0 , 0.0



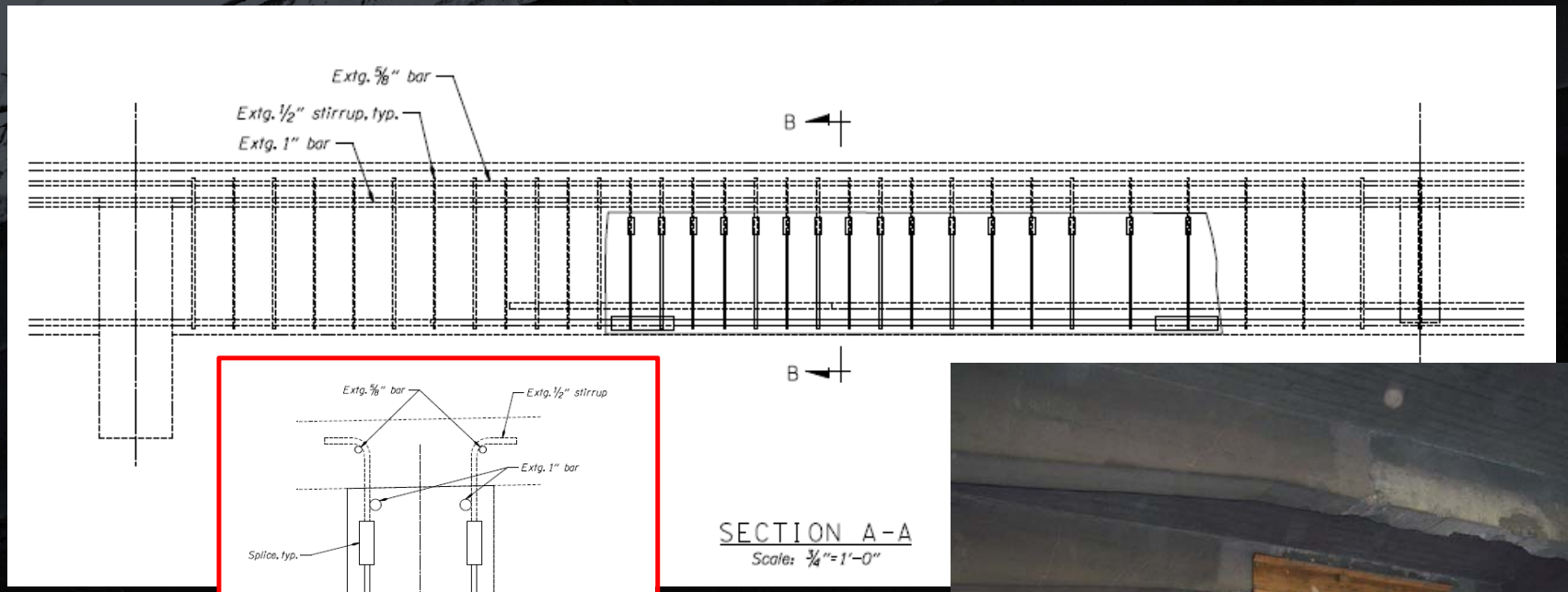


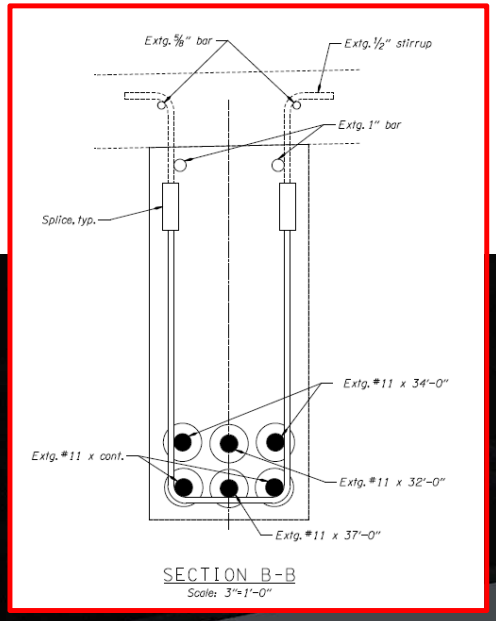
All dimensions in inches
Clear cover to transverse reinforcement = 1.50 in

PosBendSection

TP **2016/7/8**

REPAIR OPTION – CONCRETE GIRDERS





REPAIR OPTION – CONCRETE GIRDERS

- Preloading
- Effectiveness of patch

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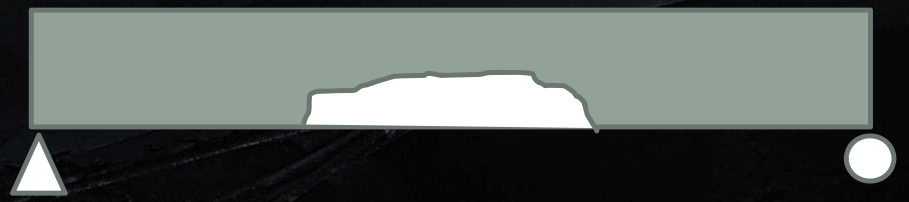

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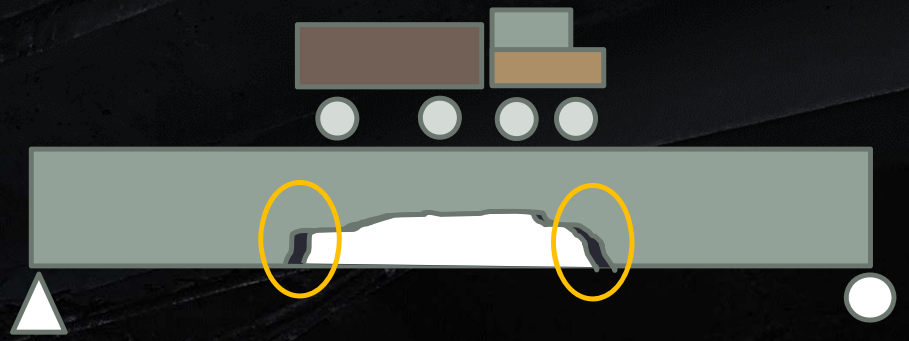

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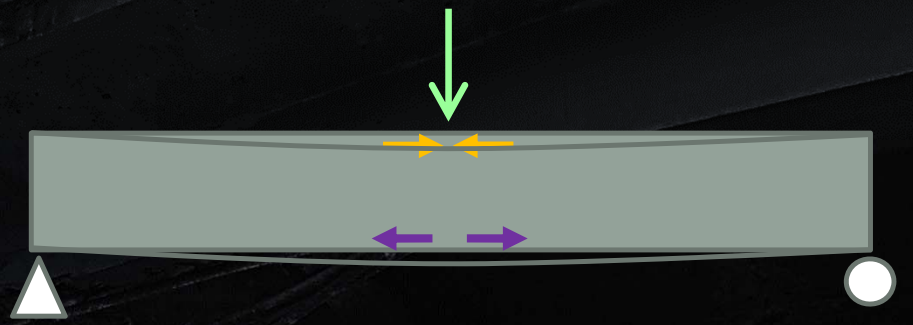

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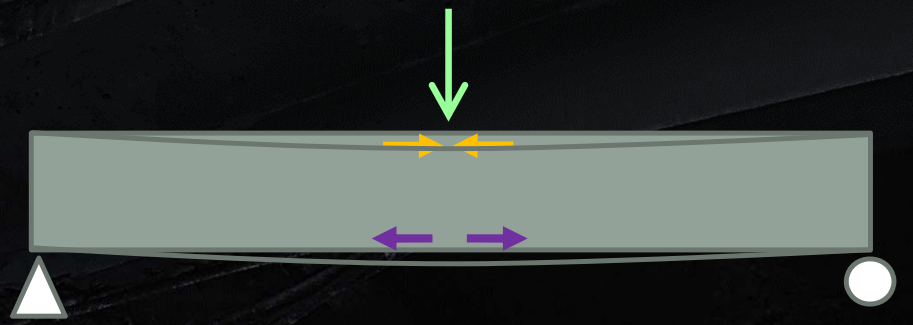

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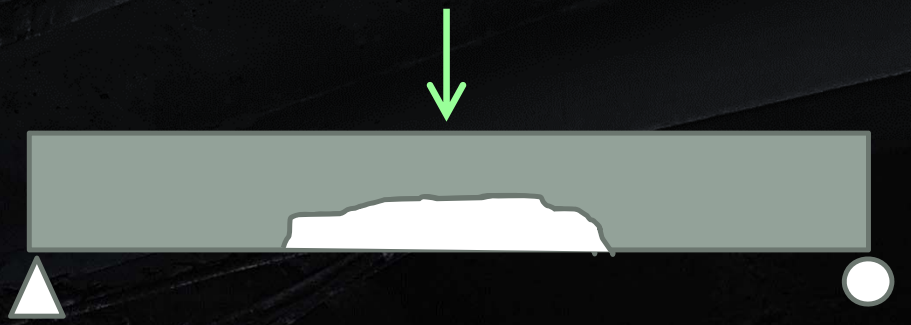

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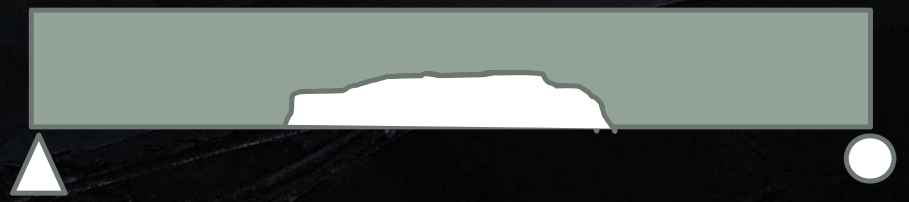

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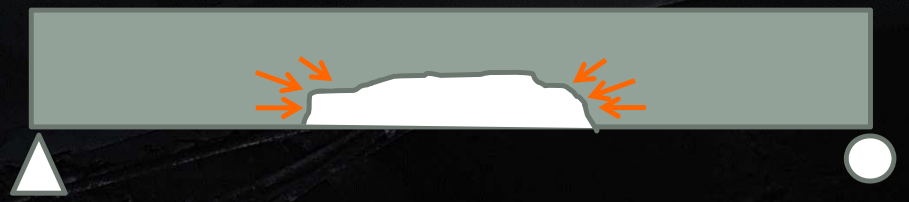

REPAIR OPTION – CONCRETE GIRDERS

- Preloading
- Effectiveness of patch
- Splicing rebar, mechanical couplers
- Splicing prestressed strands, GRABB-IT

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GRABB-IT® CABLE SPLICE
SUGGESTED INSTALLATION TORQUE VALUES

GRADE	CABLE DIA.	CABLE 70% ULTIMATE (LBS)	CABLE ULTIMATE STRENGTH (LBS)	GRABB-IT® TORQUE VALUES LUBRICATED IN-LBS	GRABB-IT® TORQUE VALUES LUBRICATED FT-LBS
250 K	3/8"	14000	20000	1575	131
	7/16"	18900	27000	2126	177
	1/2"	25200	36000	2835	236
270 K	3/8"	16100	23000	1811	151
	7/16"	21700	31000	2441	203
	1/2"	28900	41300	3252	271

GRABB-IT® CABLE SPLICE
SUGGESTED INSTALLATION TORQUE VALUES

GRADE	CABLE DIA.	CABLE 80% ULTIMATE (LBS)	CABLE ULTIMATE STRENGTH (LBS)	GRABB-IT® TORQUE VALUES LUBRICATED IN-LBS	GRABB-IT® TORQUE VALUES LUBRICATED FT-LBS
250 K	3/8"	16000	20000	1800	150
	7/16"	21600	27000	2430	203
	1/2"	28800	36000	3240	270
270 K	3/8"	18400	23000	2070	173
	7/16"	24800	31000	2790	233
	1/2"	33000	41300	3713	309

GRABB-IT® CABLE SPLICE
SUGGESTED INSTALLATION TORQUE VALUES

CABLE LOAD (LBS)	CABLE PROOF LOAD (LBS)	CABLE TENSILE STRESS (LBS)	GRABB-IT® TORQUE VALUES LUBRICATED IN-LBS	GRABB-IT® TORQUE VALUES LUBRICATED FT-LBS
1000	105000	133000	113	09
2000	105000	133000	225	19
3000	105000	133000	338	28
4000	105000	133000	450	38
5000	105000	133000	563	47
10000	105000	133000	1125	94
15000	105000	133000	1688	141
20000	105000	133000	2250	188
25000	105000	133000	2813	234
30000	105000	133000	3375	281
35000	105000	133000	3938	328
40000	105000	133000	4500	375
45000	105000	133000	5063	422
50000	105000	133000	5625	469

REPLACE OPTION – CONCRETE GIRDERS

- Cutout girders
- Formwork
- Falsework
- Closure pour plan

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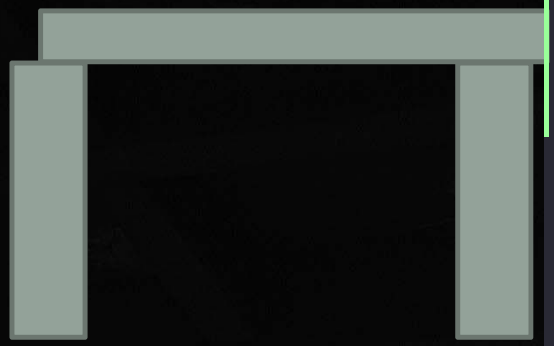

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- Falsework
- Closure pour plan

REPLACE OPTION – CONCRETE GIRDERS

- Cutout girders
- Formwork
- Falsework
- Closure pour plan

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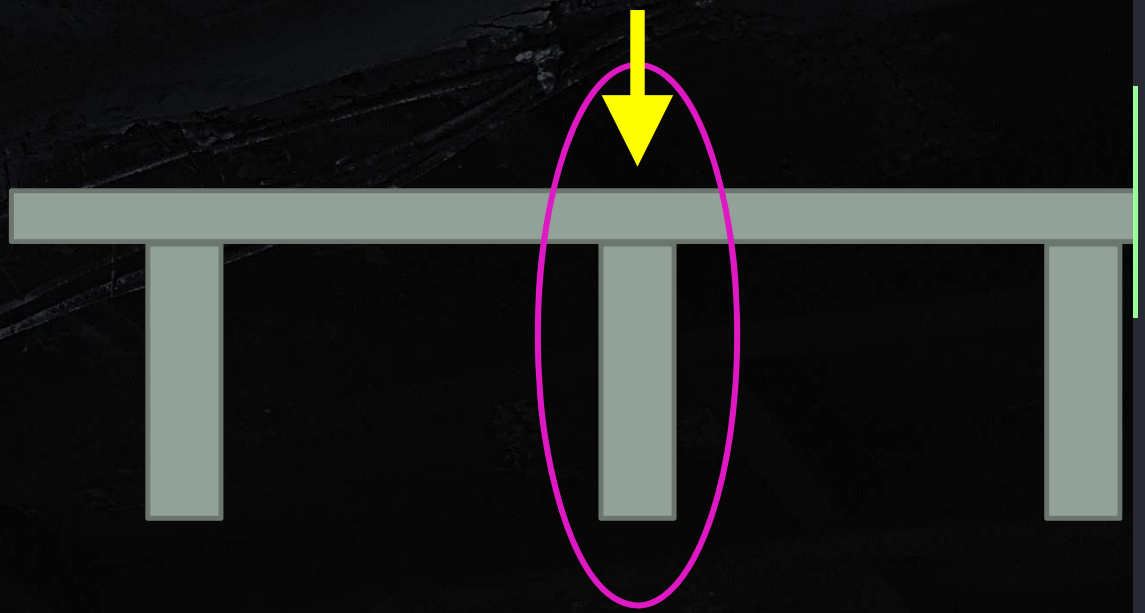
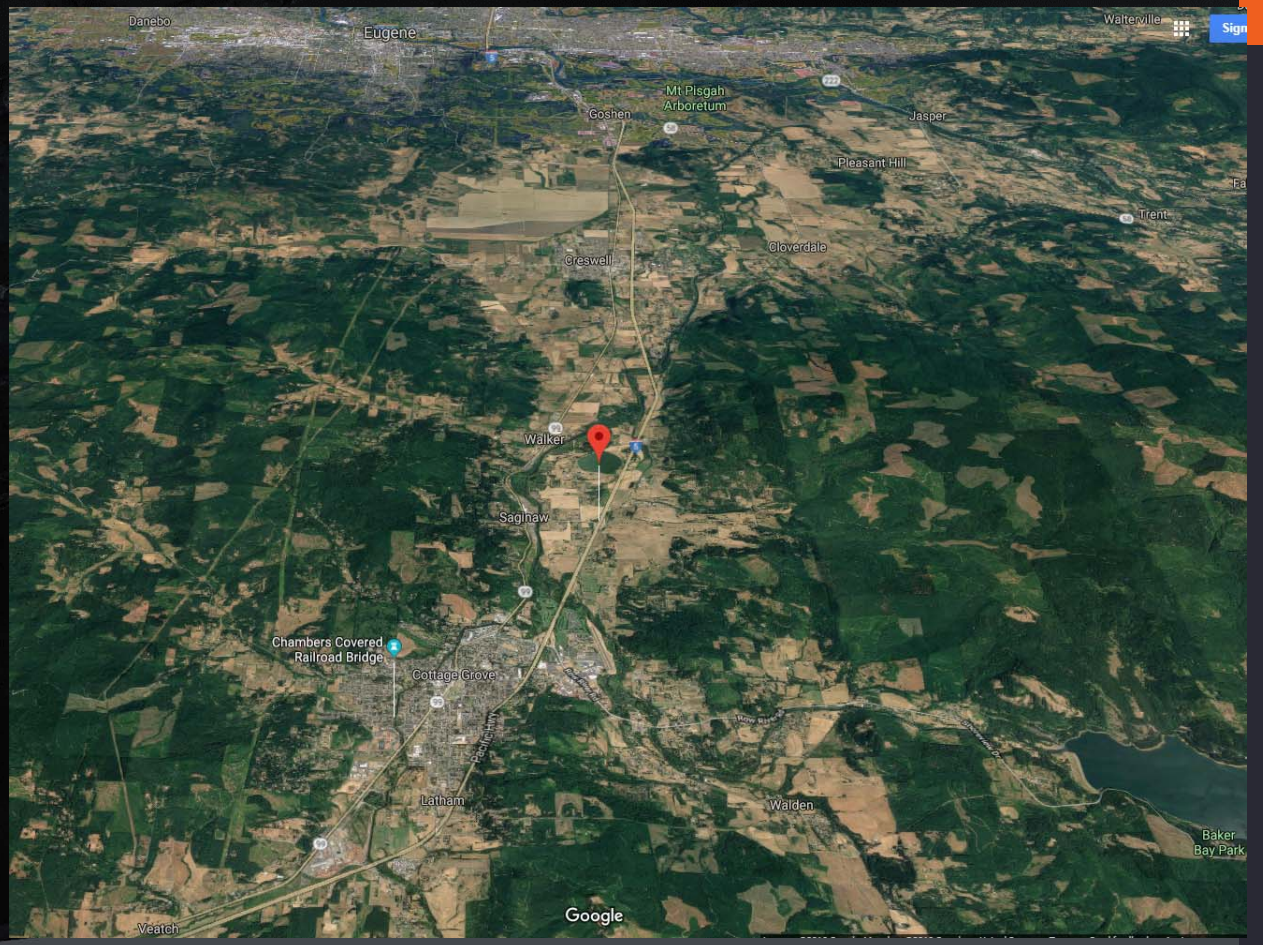


PAST INCIDENT – REPLACED RCDG

Saginaw Bridge

- 2008
- South of Eugene




14 FEET
10 INCHES


05/26/2009

PAST INCIDENT – REPLACED RCDG

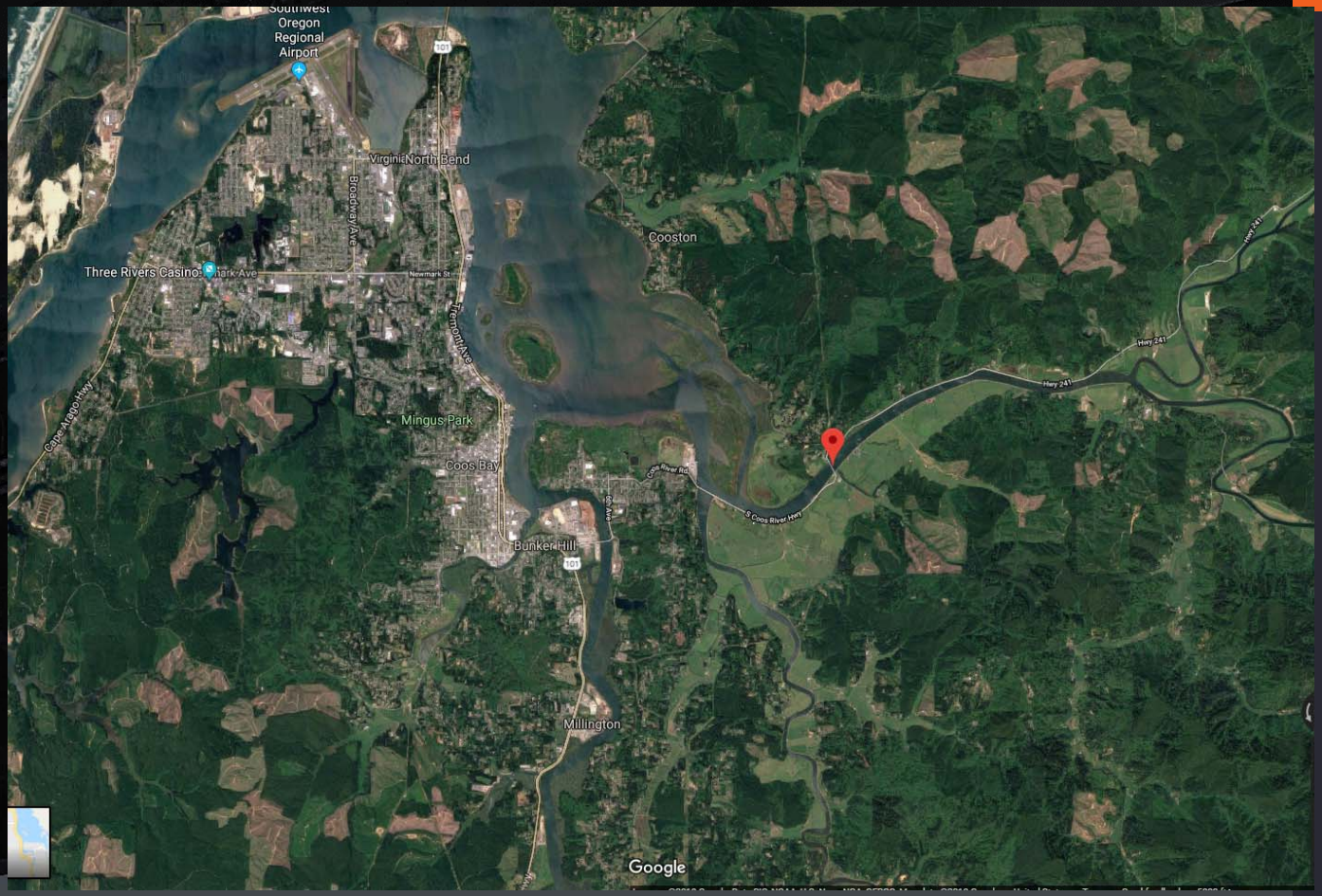
REPAIR OPTION – STEEL GIRDERS

- Localized repair or replacement
- Flame straightening
- Hot mechanical straightening
- Cold mechanical straightening

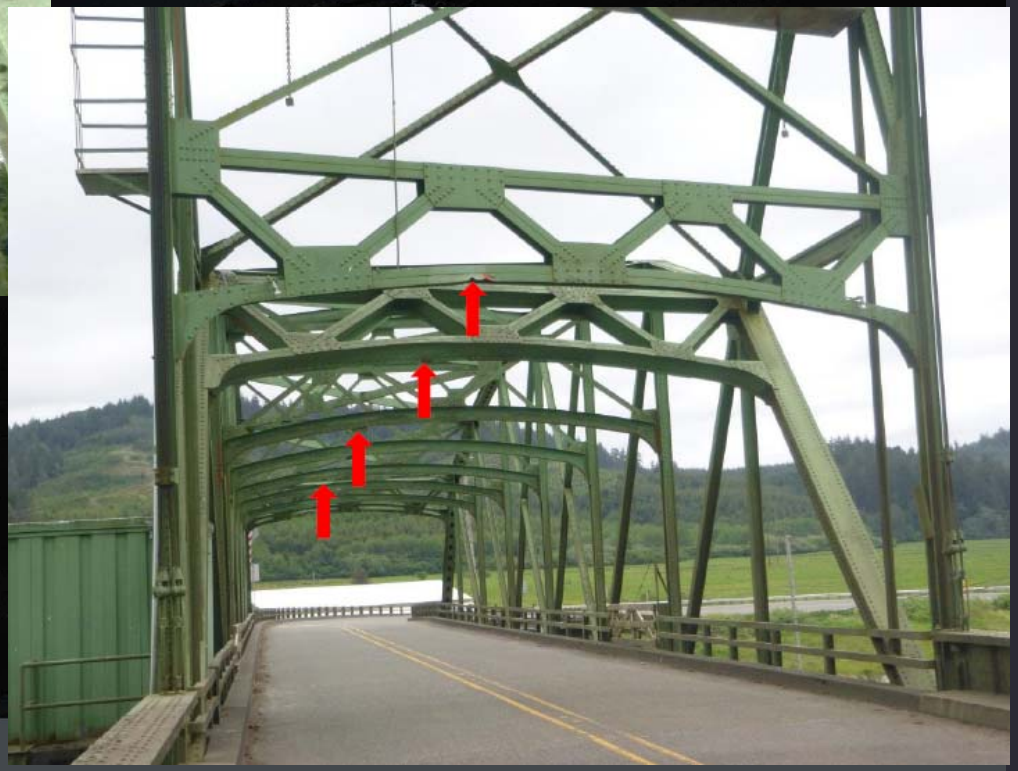
PAST INCIDENT – REPAIR BY BOLTING

Chandler Bridge

- 2013
- Coos Bay




Lakeside
Templeton
Hauser
North Bend
Cooston
Mingus Park
Coos Bay
Bunker Hill
Millington
Google

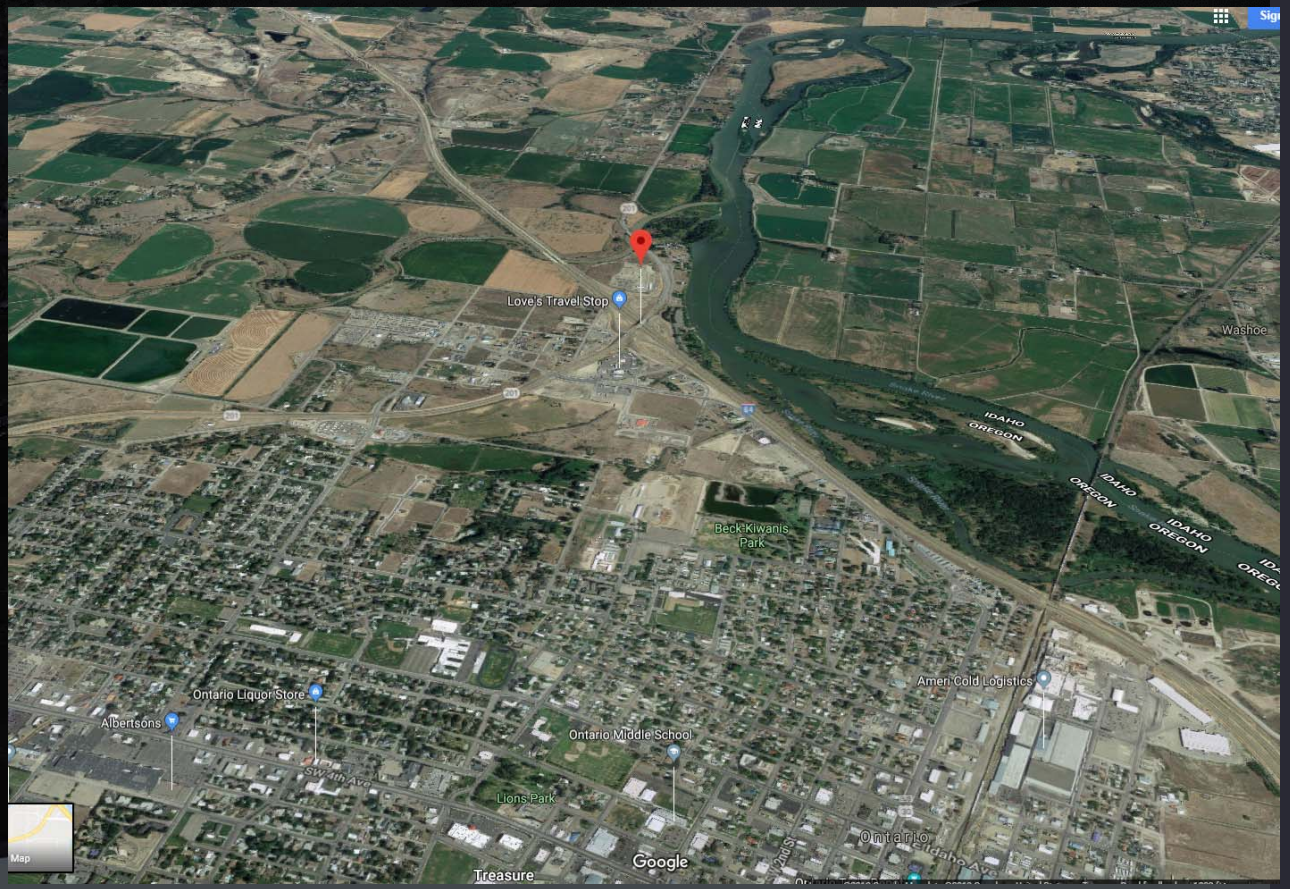


PAST INCIDENT – REPAIR BY BOLTING

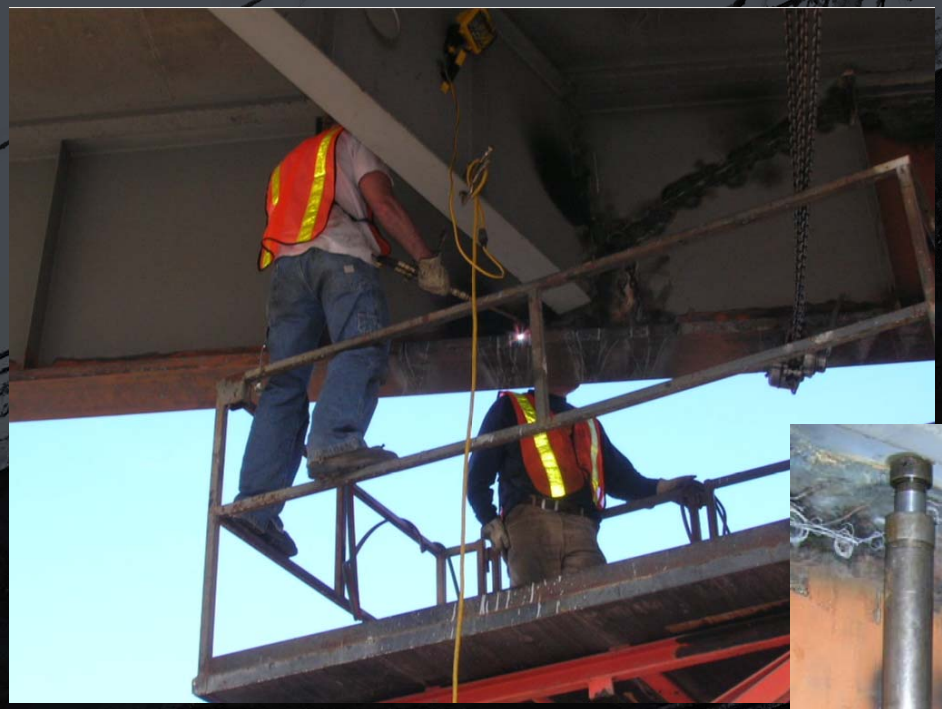
PAST INCIDENT – REPAIR THEN REPLACED

N Ontario Interchange

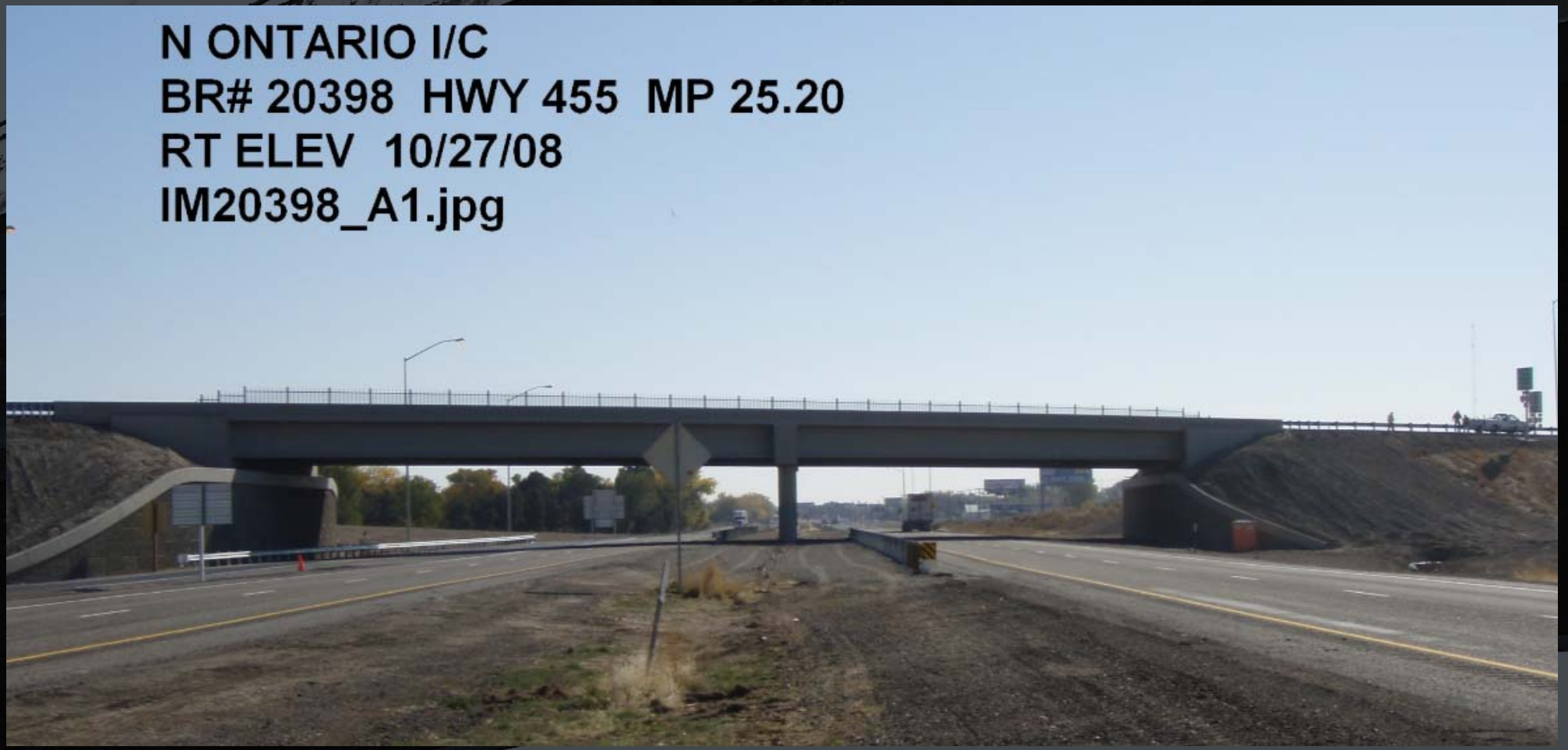
- 2007
- Ontario




IMPACT POINT
7/8 INCH WIDE CRACK
BR# 08635 GIRDER 1 SPAN 3 PRIOR TO REPAIR



PAST INCIDENT – REPAIR THEN REPLACED



OTHER STATE AGENCIES

- Washing State DOT
- Iowa DOT
- Pennsylvania DOT
- Texas DOT
- Virginia DOT

WORK TO BE DONE

- Emergency Operations Plan
- Bridge Inspection Program Manual
- Bridge Design Manual
- Coordination with Crash Data Unit

REFERENCES

- NCHRP Report 226
- NCHRP Report 271
- NCHRP Report 280
- NCHRP 20-07 Task 307
- NCHRP Report 678
- Iowa DOT Emergency Response Manual


?
or
Comments

SB I-5 at MP 149
Equipment Pass