

# THE OLD CHAIN OF ROCKS BRIDGE INSPECTION & LOAD RATING



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**HORNER & SHIFRIN**  
**MARCH 8, 2018**



Mississippi

34

270

270

270

RiverView Dr

Mississippi

Chouteau Island

Old Chain of Rocks Bridge

W Chain of Rocks Rd

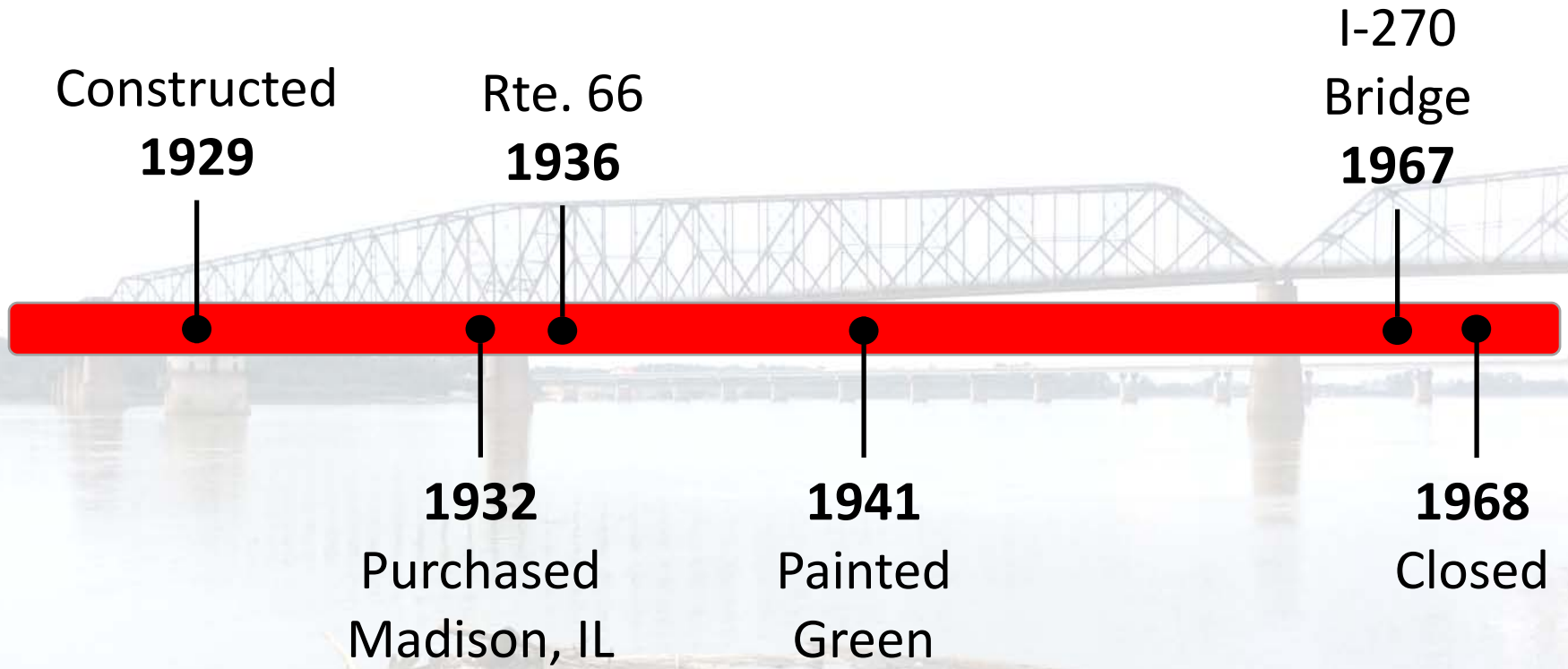
W Chain of Rocks Rd



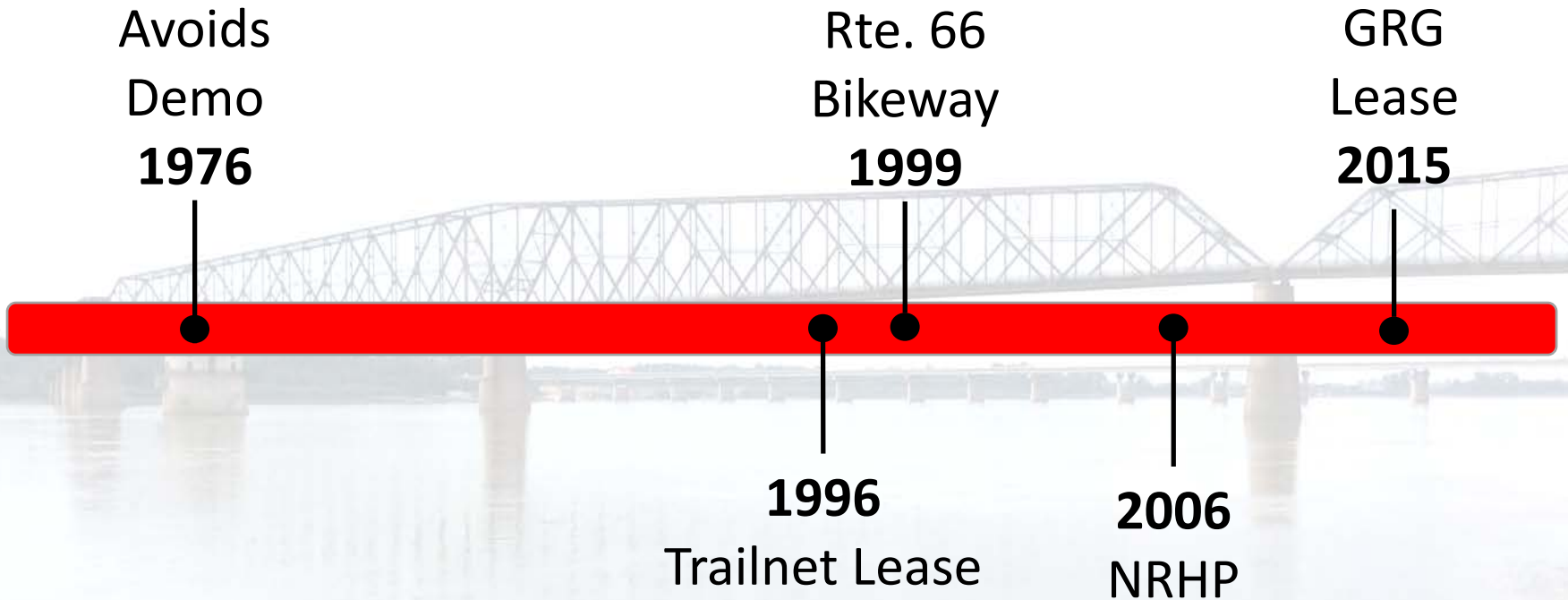
# CHAIN OF ROCKS



# HISTORY TIMELINE



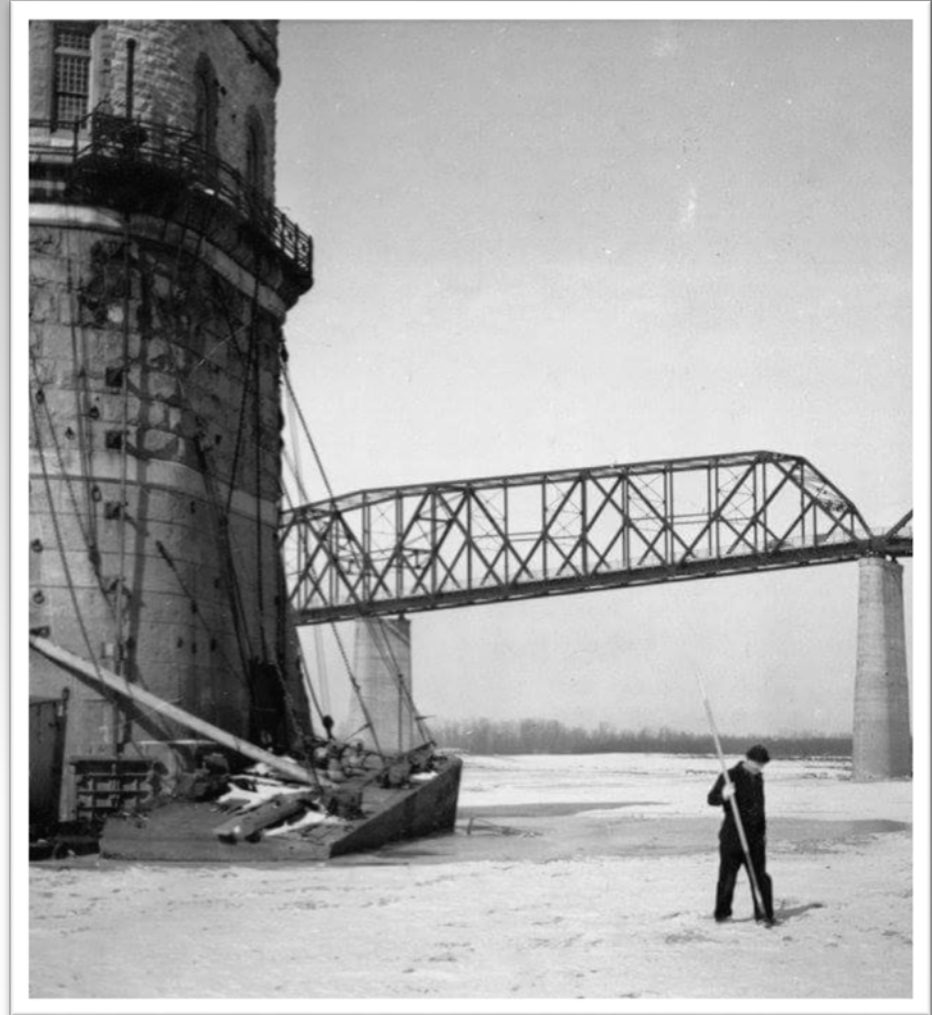
# HISTORY TIMELINE



# CONSTRUCTION



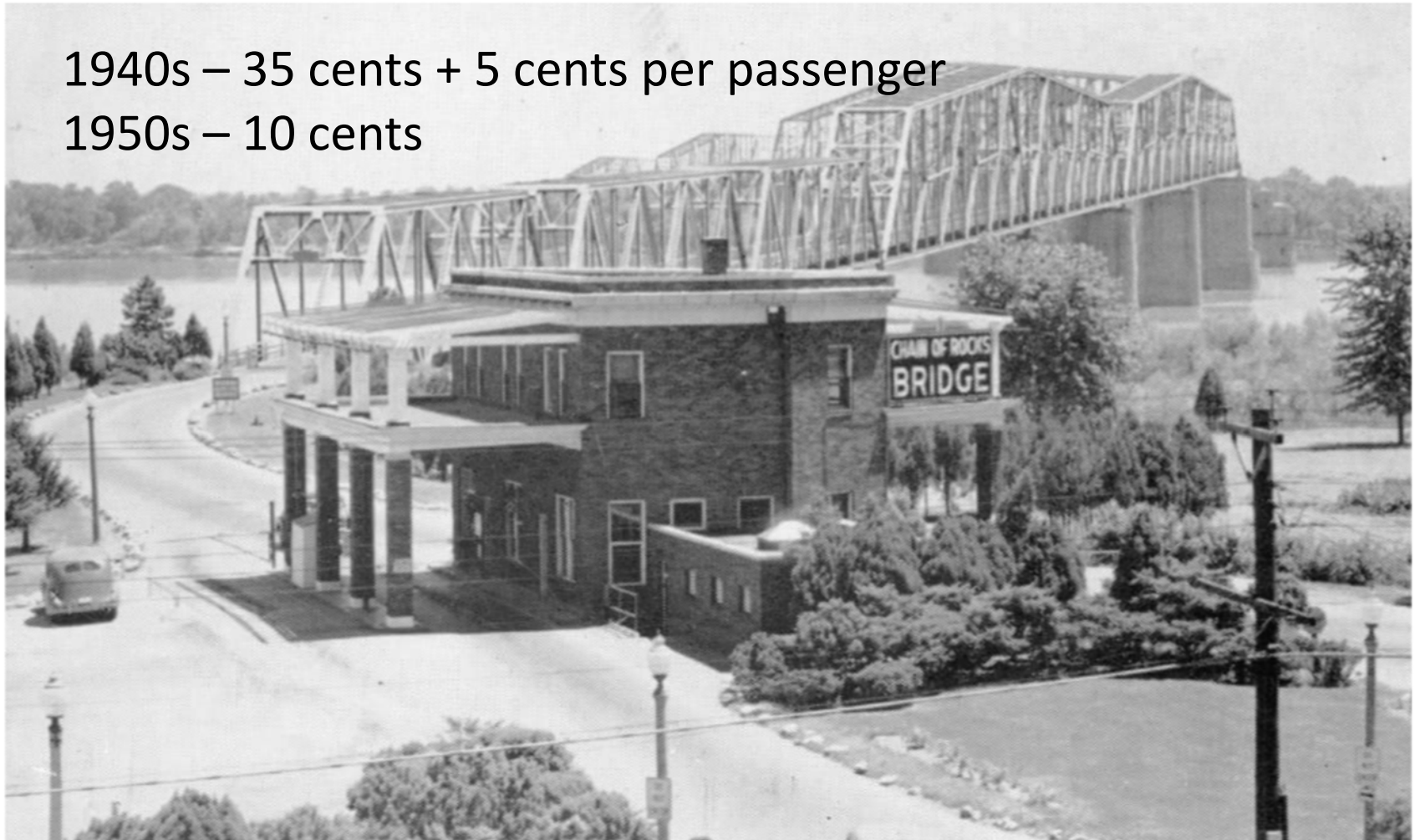
# WATER INTAKE STRUCTURES



# TOLL BOOTH

1940s – 35 cents + 5 cents per passenger

1950s – 10 cents





# ADVERTISEMENT

**ST. LOUIS**  
And Main Routes thru  
Central United States

**ST. LOUIS**  
And Main Routes thru  
Central United States

**CHAIN OF ROCKS  
ROUTE**

For Local and Through  
Traffic crossing the  
Mississippi River at  
**ST. LOUIS**

BRIDGE TOLL RATES  
Passenger Car and Occupants—25¢  
Trucks—40¢ Low Commutation Rates

THIS folder is for the convenience  
of motorists of the United States  
who cross the Mississippi River at  
St. Louis.  
The best routes to, through, and  
around the city are shown.  
Additional copies will be mailed to  
you and your friends upon request.

*John R. Scott*  
President  
Chain of Rocks Bridge

## CHAIN OF ROCKS-KINGSHIGHWAY BRIDGE

*"St. Louis' Most Beautiful Gateway"*

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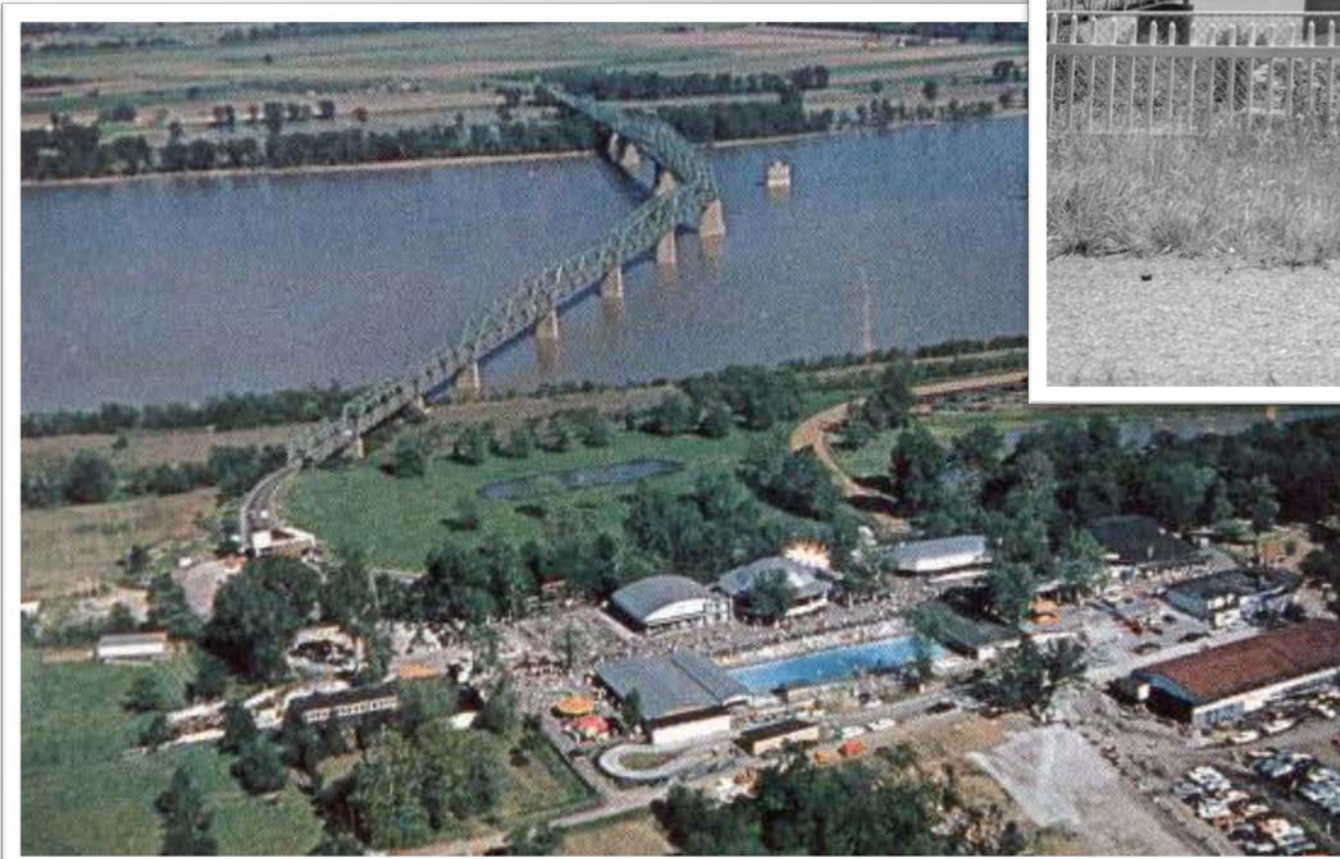
Eliminates traffic congestion. Avoid the maze of switch tracks on the East side.  
Paved and illuminated roads all the way.

**Direct Route to Northern Illinois, Chicago and the East**

To St. Louis, keep straight ahead at Mitchell from Illinois Highway 4 and U. S. 66—from Illinois Highway 3 turn right. Direct connections over Riverview Drive, Broadway and Kingshighway Boulevard to U. S. Highways 40, 50, 61, 66.

DRIVE IN COMFORT AND SAFETY—USE CHAIN OF ROCKS-KINGSHIGHWAY BRIDGE

# A DESTINATION



# AMENITIES

- Illinois parking
- Lookout
- Rest area
- Bike racks
- Benches
- Displays



# EAGLE DAYS

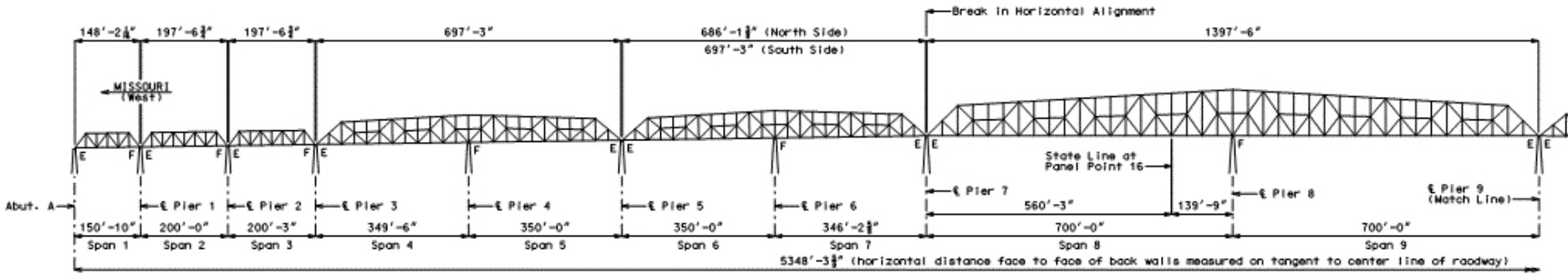


# NATIONAL ICON

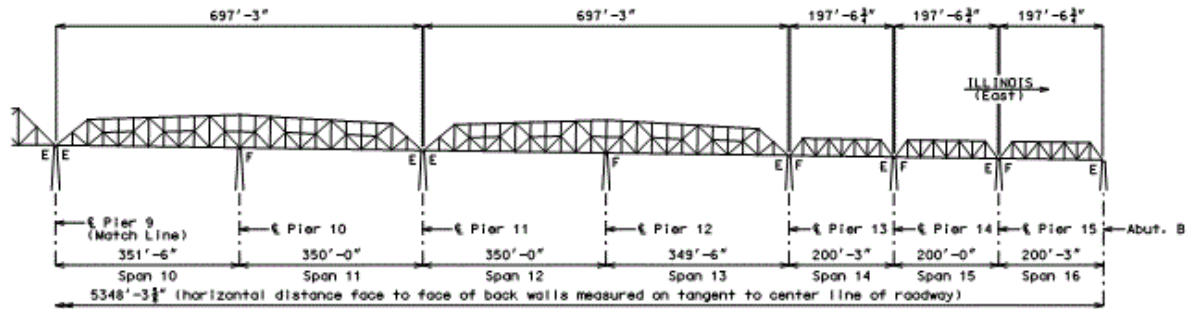
- **St. Louis 250<sup>th</sup> Birthday**
- **Movies filmed**
- **Rte. 66 attraction**
  - **International visitors**
  - **Historic cars**
  - **Motorcycles**



# BRIDGE ELEVATION

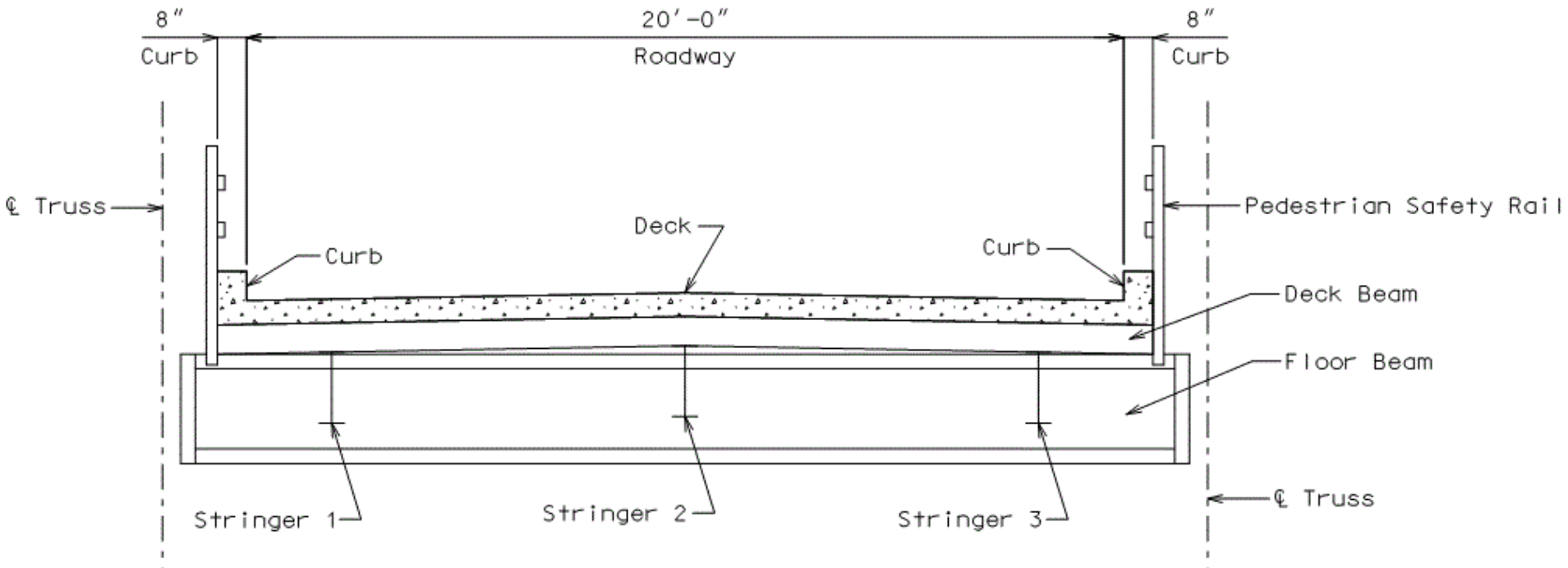


PARTIAL ELEVATION



PARTIAL ELEVATION

# BRIDGE SECTION



TYPICAL CROSS SECTION

# 22-DEGREE BEND





# ILLINOIS APPROACH





**GATE**



**ROADWAY**

# DECK BEAMS & STRINGER



# STRINGER CONNECTION



A close-up photograph of a heavy-duty steel floor beam connection. The steel is heavily rusted and dark brown. The connection is made using numerous rivets. In the background, a truss structure is visible, consisting of several interconnected steel beams forming a triangular pattern. The lighting is bright, highlighting the textures of the rust and the metallic surfaces.

# FLOOR BEAM CONNECTION



**SIDE OF TRUSS**



**BEARING**



# INSPECTION ACCESS

## PROBLEMS

- Load restriction
- Geometry restriction
- Mississippi River
- Swampy land

## SOLUTIONS

- Towable Manlift
- Suspended Scaffolding
- Tracked Bucket Vehicle



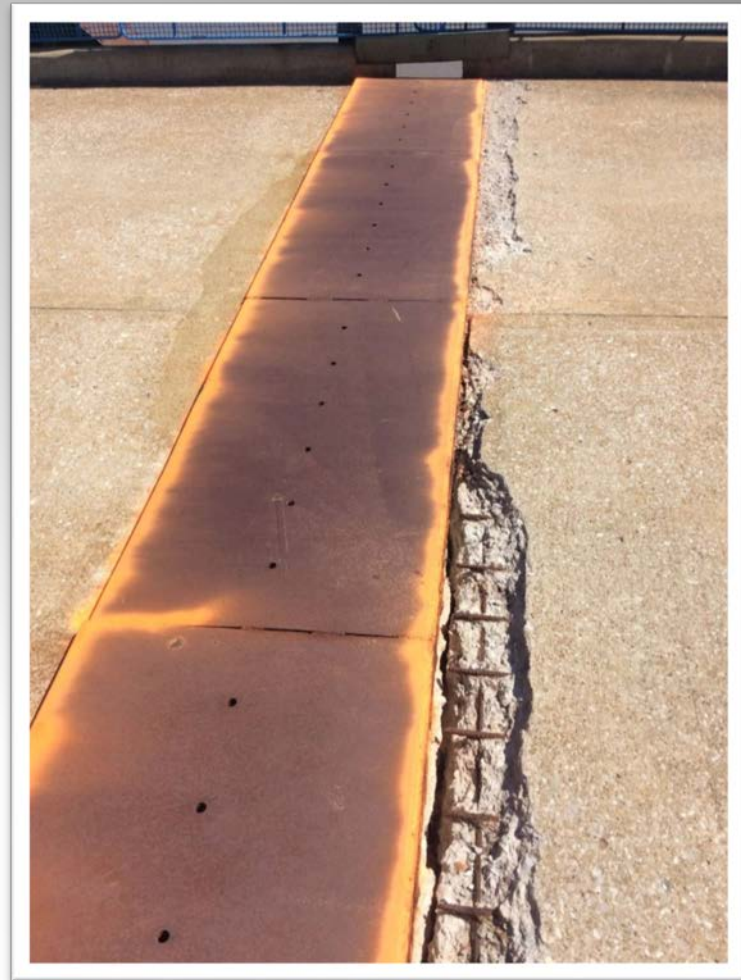




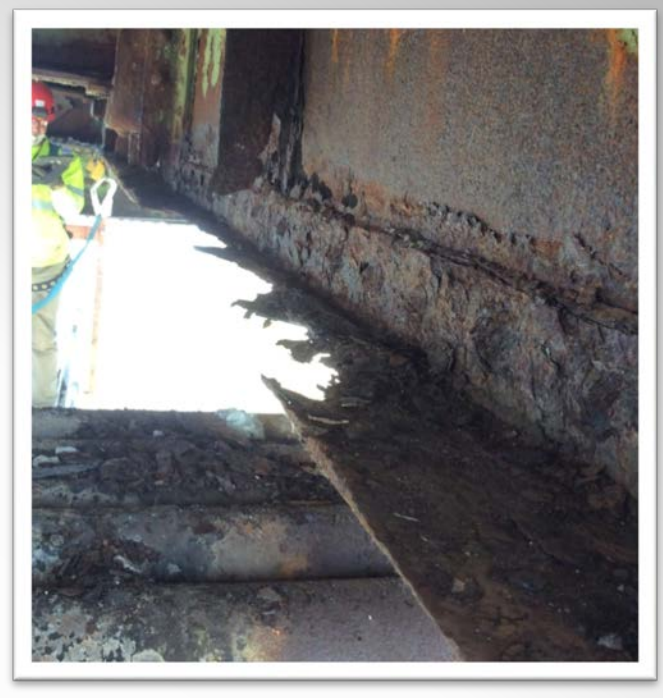






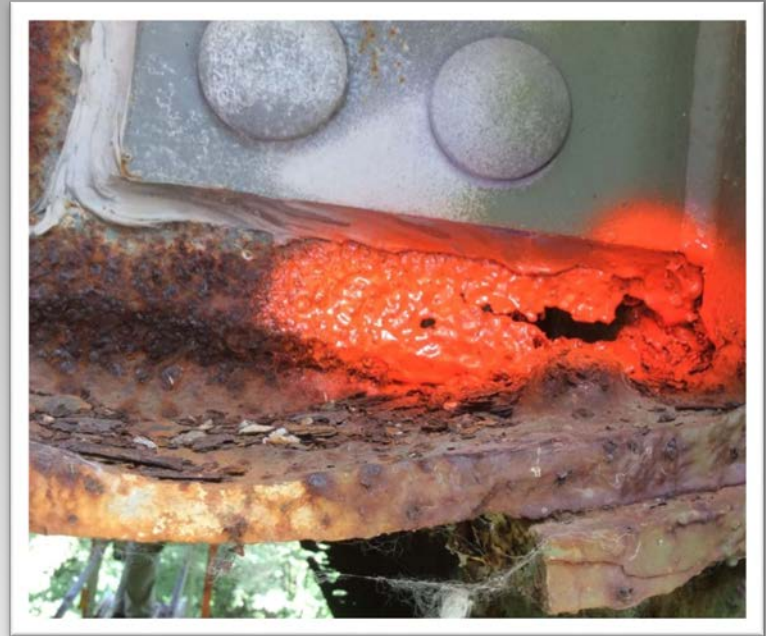




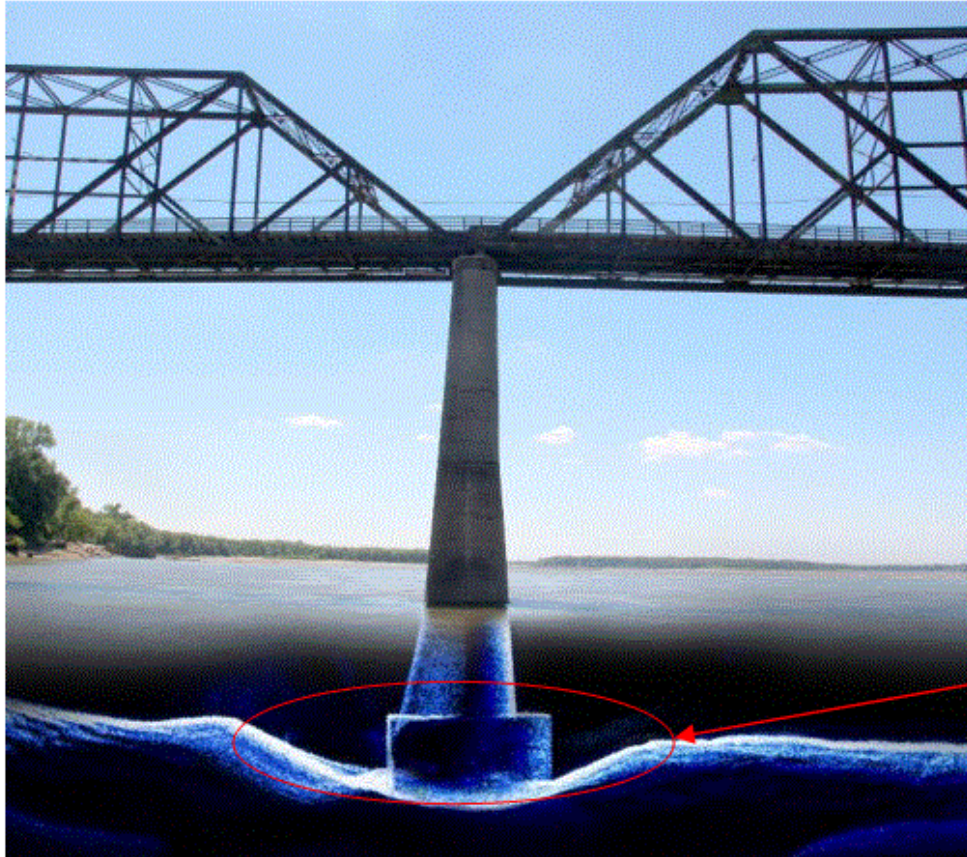








# ACOUSTIC IMAGING



## Pier 9 Upstream (North) Face

There is a scour cone at the upstream (north) nose measuring up to 10 ft. deep x 25 ft. radius. The footing / step-out is exposed up to 10 ft. vertically at the upstream (north) face of the pier. The exposed footing / step-out concrete does not exhibit signs of deterioration.

WL Elev. 405.6

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Area of local scour

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Channel Bottom

# INSPECTION RECORDKEEPING

## PROBLEMS

- Note organization
- Pen & paper
- Camera
- Weather

## SOLUTIONS

- iPad
- Geographical Information System (GIS)
  - Database

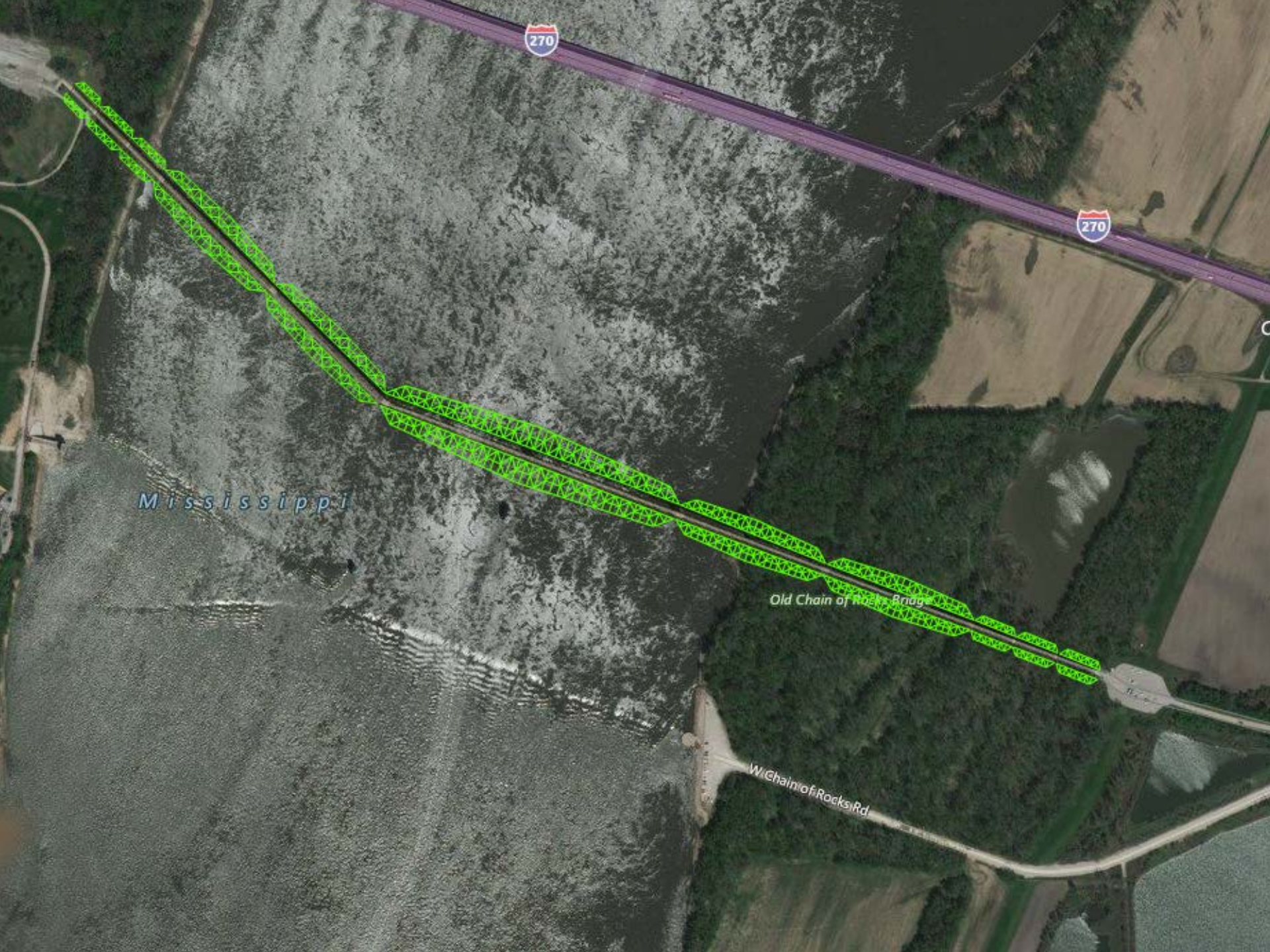
270

270

Mississippi

Old Chain of Rocks Bridge

W Chain of Rocks Rd





M i s s i s s i p p i

Chouteau Island

Old Chain of Rocks Bridge

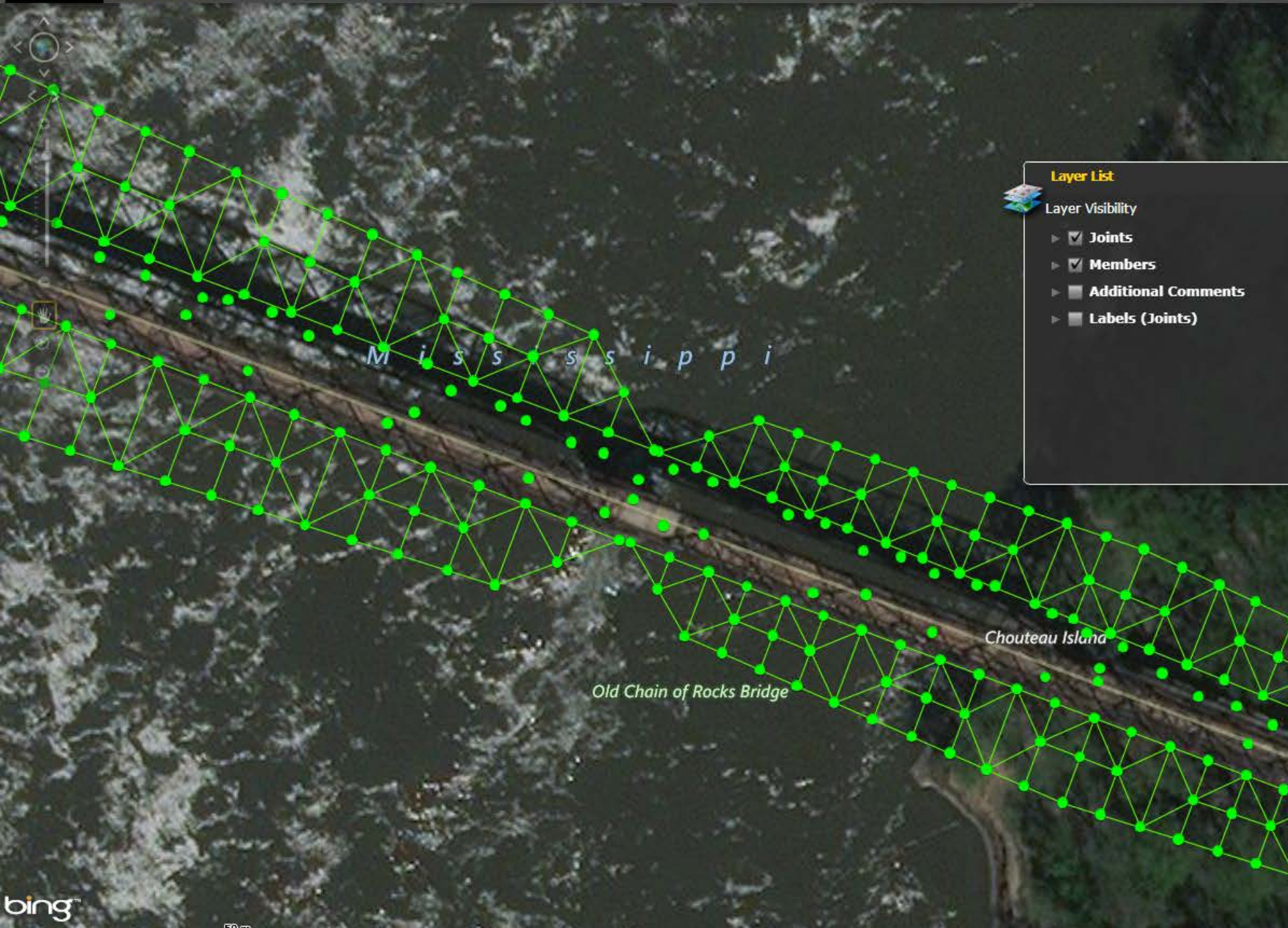




### Layer List

Layer Visibility

- Joints
- Members
- Additional Comments
- Labels (Joints)



### Layer List

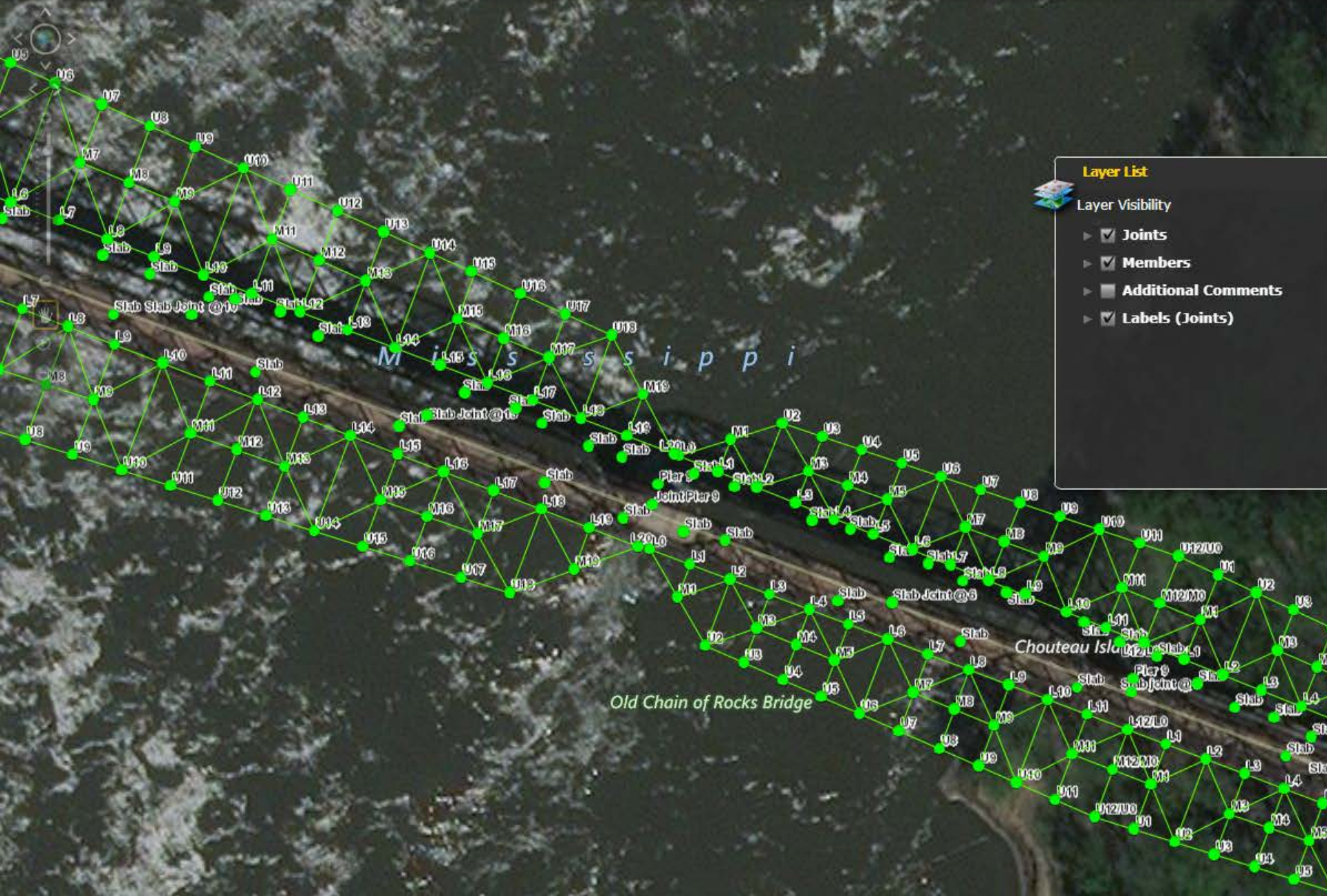
Layer Visibility

- ▶  Joints
- ▶  Members
- ▶  Additional Comments
- ▶  Labels (Joints)

Mississippi

Chouteau Island

Old Chain of Rocks Bridge

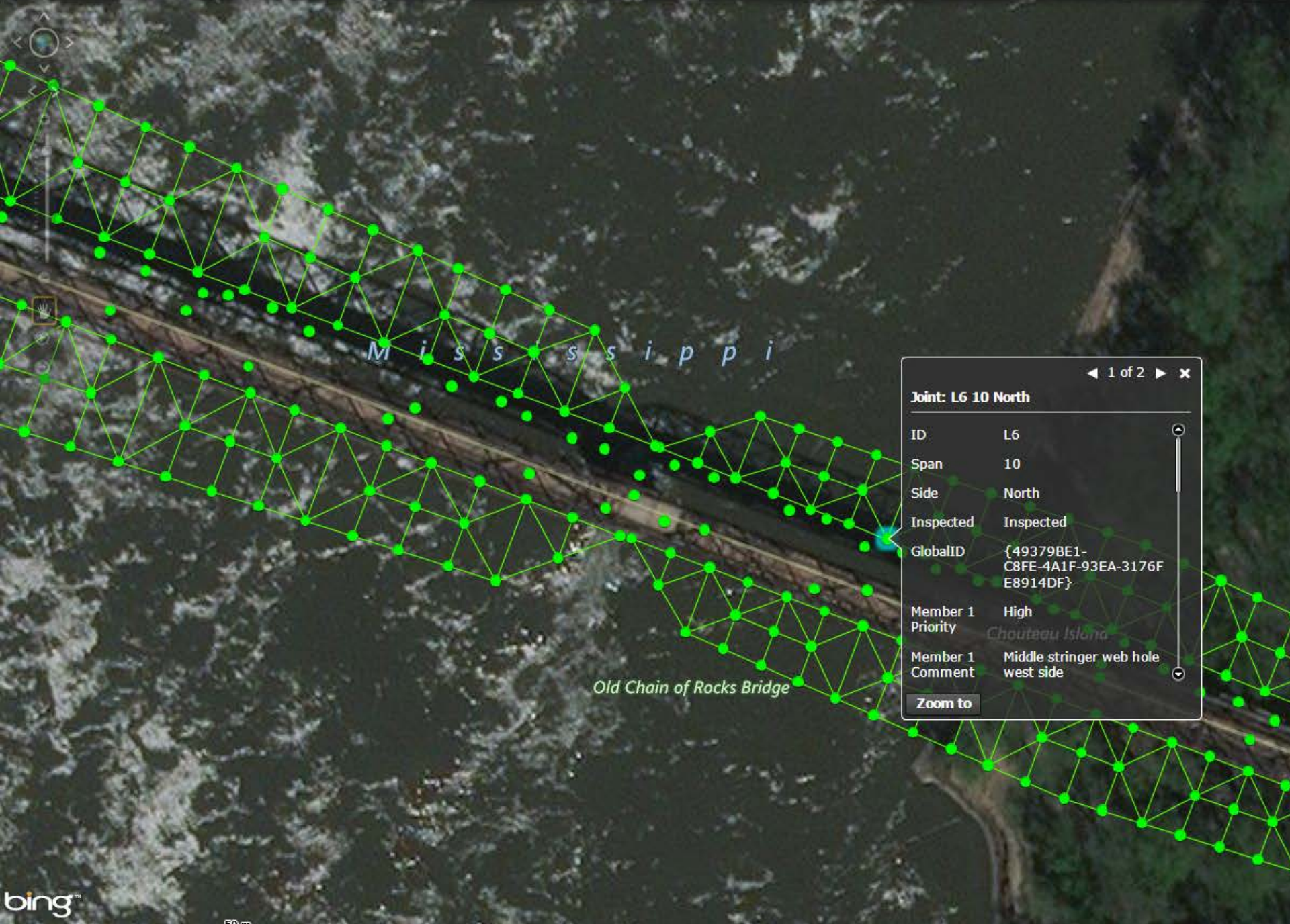


Layer List



Layer Visibility

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Mississippi

Old Chain of Rocks Bridge

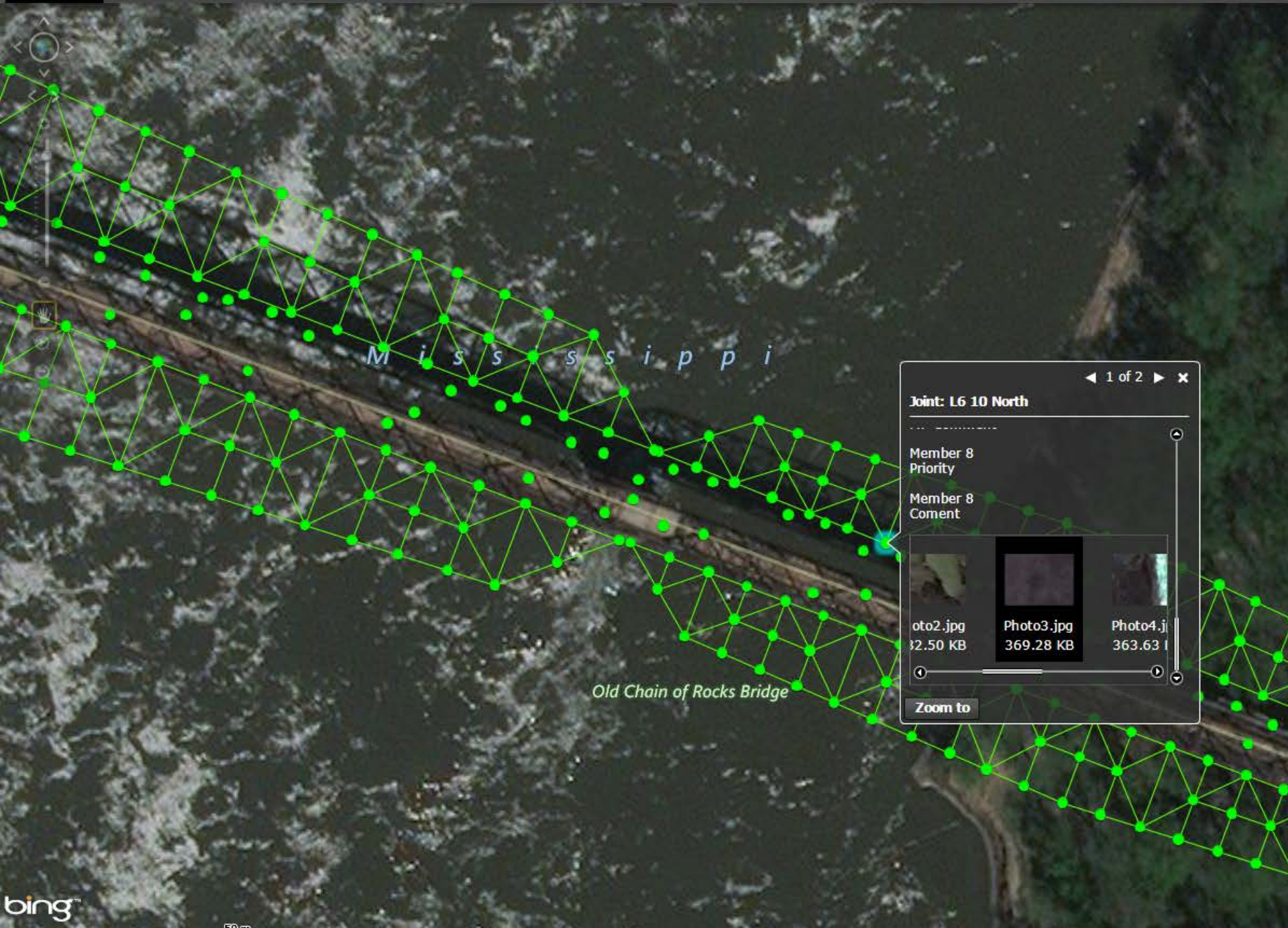
Chouteau Island

◀ 1 of 2 ▶ ✕

**Joint: L6 10 North**

ID	L6
Span	10
Side	North
Inspected	Inspected
GlobalID	{49379BE1-C8FE-4A1F-93EA-3176FE8914DF}
Member 1 Priority	High
Member 1 Comment	Middle stringer web hole west side

**Zoom to**



◀ 1 of 2 ▶ ×

**Joint: L6 10 North**

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Member 8  
Priority

Member 8  
Coment

oto2.jpg 2.50 KB	Photo3.jpg 369.28 KB	Photo4.j 363.63 KB

Zoom to



Span	Truss	Location	Priority	Comment
12	North	Slab	low	Majority of patches bad between 4 and 0. Same location, 18 inches of deck edge bad. 125 sqft total
12	North	Slab	low	Patch at jt 4 sqft
12	North	Slab	low	75sqft bw 10and11 including parts of patches
12	North	Slab	low	Patch just west of 10. 2ft outside delam. 10sqft
12	North	Slab	low	6sqft bw patches bw 7and8
12	North	Slab	low	15 sqft near curb bw 4 and5
12	North	Slab	low	25 sqft bw 6 and 7. Note joint and patches.
12	South	Slab	low	No delaminations or patches between 0 and 4
12	South	Slab	low	40 sf patch west off 11 delaminated
12	South	Slab	medium	20 sf at joint at 6 which is cracked
12	South	Slab	low	5 sf at center bridge
12	South	Slab	low	Expansion joint plate is loose
12	South	Slab	low	6 sf 12 ft east of 6 at center bridge
13	North	Slab	low	5 sqft between 7 and 8
13	North	Slab	low	10sqft bw 2and3
13	North	Slab	low	40 sqft bw 8 and 9
13	South	Slab	low	15 sf patch delamination and 4 sf to east of patch
13	South	Slab	low	15 sf patch near 4 and 8 sf delaminated
13	South	Slab	low	40 sf patch delaminated at 6 and cracked
13	South	Slab	low	20 sf between 7&8
13	South	Slab	low	40 sf along gutter between 10 and 11
13	South	Slab	low	5 sf between 0 and 1
13	South	Slab	low	20 sf between 6&7
14	North	Slab	low	2.5 ft east side of exp. jt delam. 25sqft total
14	North	Slab	low	3sqft delam at jt
14	North	Slab	low	Just west of patch at 2, 2sqft delam.
14	South	Slab	low	20 sf at patch and adjacent to patch at 2
14	South	Slab	low	60 sf at 3 and to east, adjacent to patch
14	South	Slab	low	60 sf delamination at 0
14	South	Slab	low	Gutter debris build up holding moisture, needs biannual cleaning, typical Illinois approach.
14	South	Slab	low	250 sf delaminated between 4 and 8, some very bad. Large patch has cracks and discoloration
15	North	Slab	low	Patch bw 6 and 5 sounds delam. Also, 2 ft inward entire length of patch delam. 30 sq ft.
15	North	Slab	low	Several 1sqft Delams bw 5 and 0. 15 sqft total.
15	South	Slab	low	8 sf near 2 and at 3
16	North	Slab	low	Just west of pp 7, 30sqsf of slab delaminates 2 ft from curb
16	North	Slab	low	Just east of patch at pp 6, 4 sqft delam.
16	North	Slab	low	Patch at middle of open gate delam. SPReads to next patch east. Abt 100 sqft
16	North	Slab	low	1sqft delam halfway bw 5and 4, 3 ft off curb
16	North	Slab	low	Slab repair at exp joint delam. 25 sqft.
16	South	Slab	low	40 sf cracked and delaminated patch at joint
16	South	Slab	low	15 sf bad patch at 2
		Slab drain	high	Clogged with debris, typical many locations
		Bollards	low	Oddly placed
12	North	Curb	low	Curb popping and cracking at jt. Abt 3 ft.
13	North	Curb	low	3ft cracking at 10
All	North and South	Railing	low	Not straight railing alignment
4		Slab joint @ 6	high	Clean and seal. PRevious patch across joint has cracked. slab has dropped to west about half inch
5		Slab joint @ 0	high	Clean and seal
5		Slab joint @ 6	high	Clean and seal
6		Slab joint @ 6	high	Needs concrete repair, clean and seal
7		Slab joint @ 0	high	Clean and seal
7		Slab joint @ 6	high	Clean and seal. Patch across joint has cracked
8		Slab joint @ 5	high	Clean and seal. PRevious patch across joint has cracked
8		Slab joint @ 10	high	Some concrete cracks. Needs clean and sealed
8		Slab joint @ 15	high	Clean and seal
9		Slab joint @ 0	high	Clean and seal
9		Slab joint @ 5	high	Clean and seal joint
9		Slab joint @ 10	high	Clean and seal joint. PRevious patches cast across joint have cracked.
9		Slab joint @ 15	high	Concrete repair, clean and seal

# LOAD RATING

- **No existing load rating**
- **SAP 2000 2D model**
- **Gussets**
- **Pedestrian load rating**



# LOAD RATING - KEY ASSUMPTIONS

- **AASHTO equations**
- **Rating factor for allowable people**
- **180 pounds per person**
- **Rated for 50 psf pedestrian load**

# LOAD RATING – MODIFIED AASHTO Eq.

$$\text{Rating Factor} = \frac{\text{Capacity} - 1.3 (\text{DL})}{1.3 \text{ Ped}}$$

# LOAD RATING – PEDESTRIAN LOAD

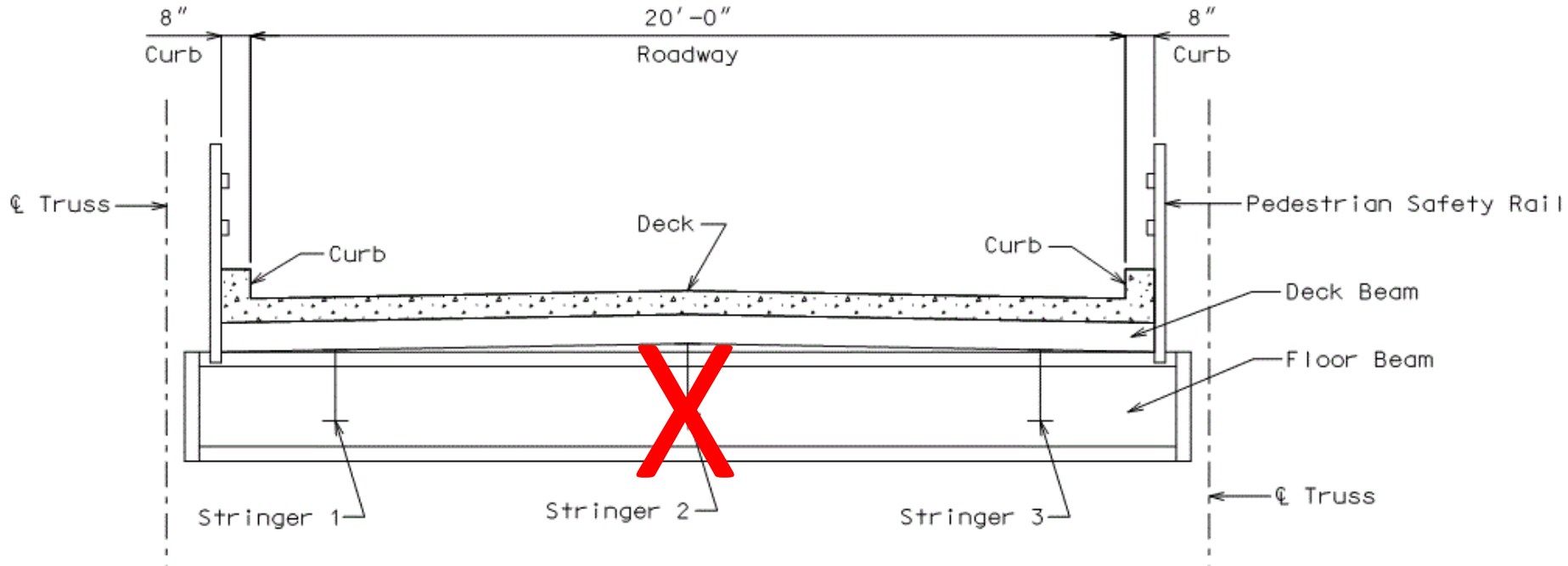


50 psf



100 psf

# LOAD RATING - RESULTS



TYPICAL CROSS SECTION

Note: Truss not shown. Truss width and height vary.

# LOAD RATING - RESULTS

- **As-found = 7500 pound personal vehicle**
- **After repairs = nearly H20 at 15 mph**
- **Pedestrian = 750 people/span after repairs**

# SUMMARY

- **Historically & futuristically significant**
- **Innovations facilitated inspections**
- **Ped bridges should be inspected and load rated**



# THE OLD CHAIN OF ROCKS BRIDGE INSPECTION & LOAD RATING



QUESTIONS?

