

Construction of Sprigg Street Bridge Over Active Sinkholes

An Adventure
From Hellish Geology
To Award Winning Bridge

Jim McCleish, PE

**Vice President
Horner & Shifrin**

Stan Polivick, PE

**Public Works Department
City of Cape Girardeau**

Telling Our Bridge Story

- Sink Hole History
- Design Work
- Construction Phase
- Summary
- Lessons Learned



Best To Start at the Beginning

In the Beginning Was God

..... the land was separated from the water...

But Scripture does not describe all the details...

Karst“Let’s see what dey gonna do with this !”

In Original Aramaic, a loose translation...

“Do Not Build A Bridge Here”

The Almighty only put the karst in certain places
..... mostly to confound engineers

One of those places was
southeast Cape Girardeau,
where a road would cross a creek,
requiring a bridge

That bridge became
The South Sprigg St. Bridge

Thousands of years later... 2007
in SE Cape Girardeau
near the S. Sprigg Street Bridge

.... Sink Holes happen.....

...all at once

19 of 'em....

all over the place !!!

LOCATION OF 19 SINKHOLES & LAND SUBSIDENCE
ALONG CAPE LaCROIX CREEK





Sinkhole History

- Road Repaired
- Holes Formed Again
- We Repaired Road Again
- Holes Formed Again

OMG!!! WE GIVE UP



WHAT NOW ???

- Bridge & Road Must Be Replaced
- How To Pay For It Hhhmmmmm ???
- River Flood Event 2013
 - Federal Disaster Declaration
 - FHWA Emergency Relief Funding

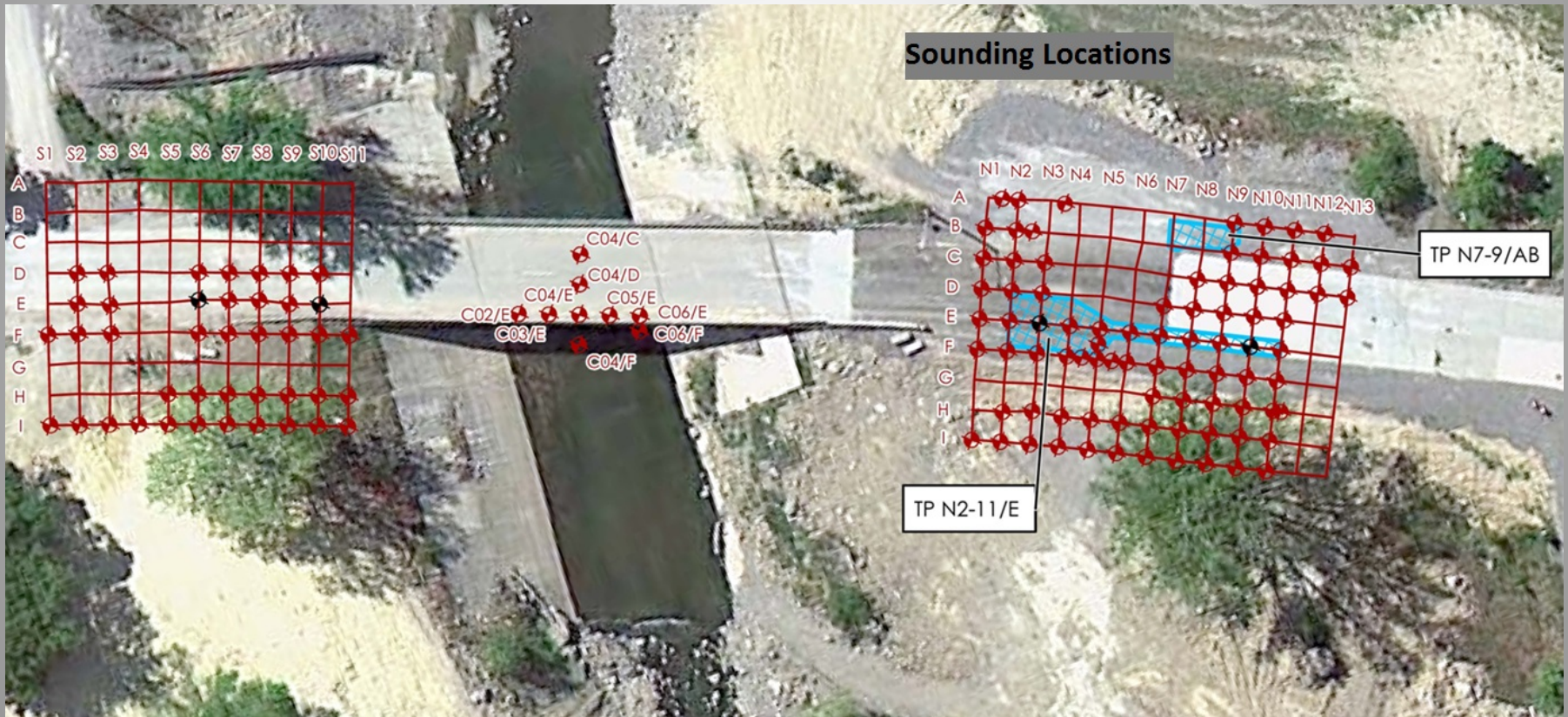


Design

- ER Funding Approved May 2014
- Horner & Shifrin begins design work on the project in September 2014
- H&S used Stantec for the geotechnical investigation... begin work Oct 2014

Design

- Geo tech
 - Needed to map the bedrock surface
 - Find what was available for foundations



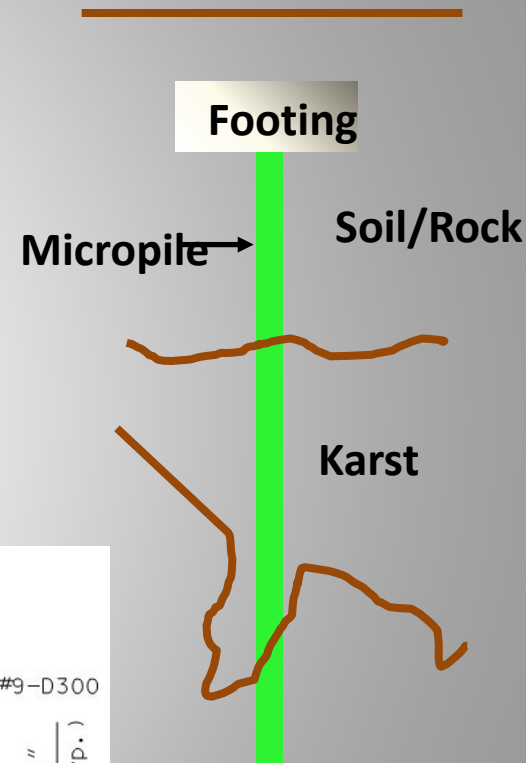
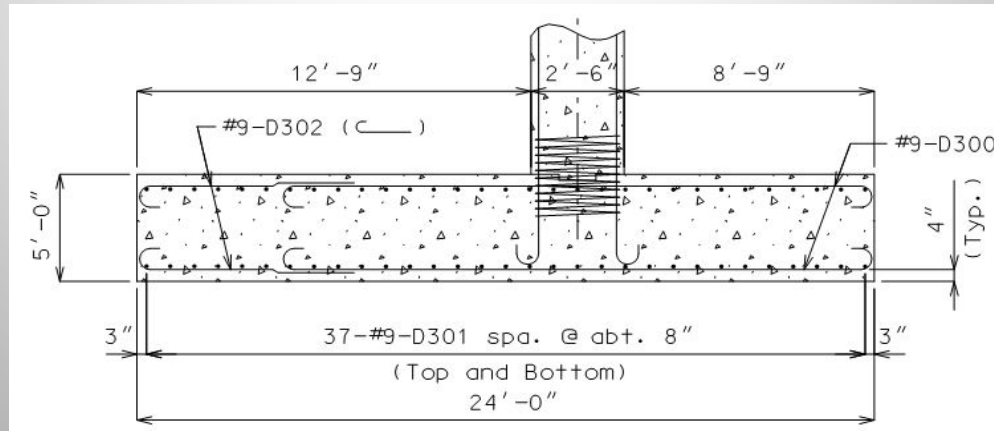
Design



- Do we try to save the old bridge?
- Do we choose a new alignment?
- Do we choose a new location for the bridge?
- What to do with sink holes?

Design

- What type of foundation to use?
 - Micro piles
 - Spread Footings
 - Drilled Shafts
- Lots of design items to think through.



Design

- Determination -
 - Replace The Bridge
 - Set Footings On Bedrock
 - Span Over The Sink Hole Areas
 - New Bridge – 3 Spans,
 - 385 Ft Total Length



For reference the old bridge about 150 ft long

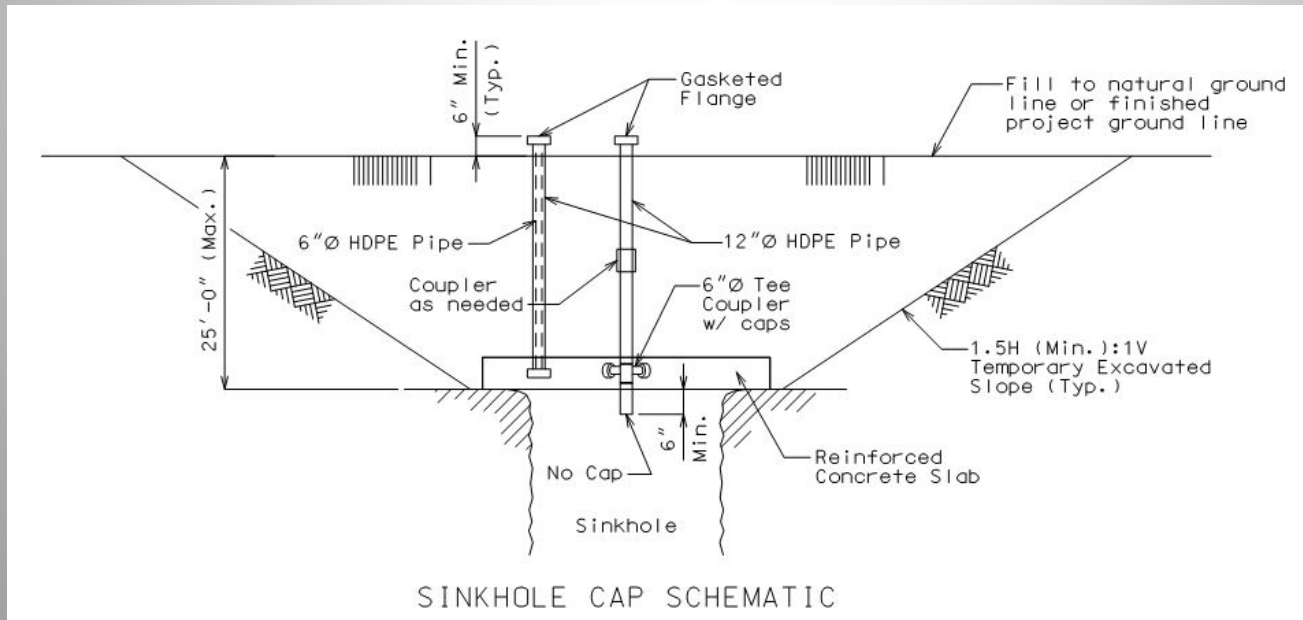
Design

- Geotech investigation Round 2!



Design

- What About Them Big Ol' Holes ???
- Clean out the holes and crevices
- Fill crevices: boulders, top with concrete
- Then cast concrete caps with lots of steel



Design

- **Schedule**

- Disaster Declaration regulations control the ER funds
Require construction contract signed by Sept. 30, 2015.
- City requested and got 1 year time extension to Sept 2016 to be under construction

- **Bids opened July 2016**

- **Construction begins Sept 2016**

Construction

- Whooo Hooo
 - Here we go finally getting to the work

- UH -OH
- Large sinkholes....

- **Really**....



We mean extry large sinkholes









Construction

- With Fierce Determination We Attack The Holes
- Bent 1 is On South Creek Bank
- Bent 2 is At The North Creek Bank
- They Go In Without A Lot Of Trouble



Bent 1 & Bent 2



Construction

- Now We Get Into The Hard Stuff
- Bent 3
 - Sinkhole Caps First
 - Then The Footing

BENT 3



BENT 3



BENT 3



BENT 3 Footings



Bent 3 and Hole Caps



Bent 4

- Digging out for Bent 4 we get a surprise
- A 60 inch sewer line was not identified to the design team

SURPRISE !!!!!

Looked at rerouting the line to creek

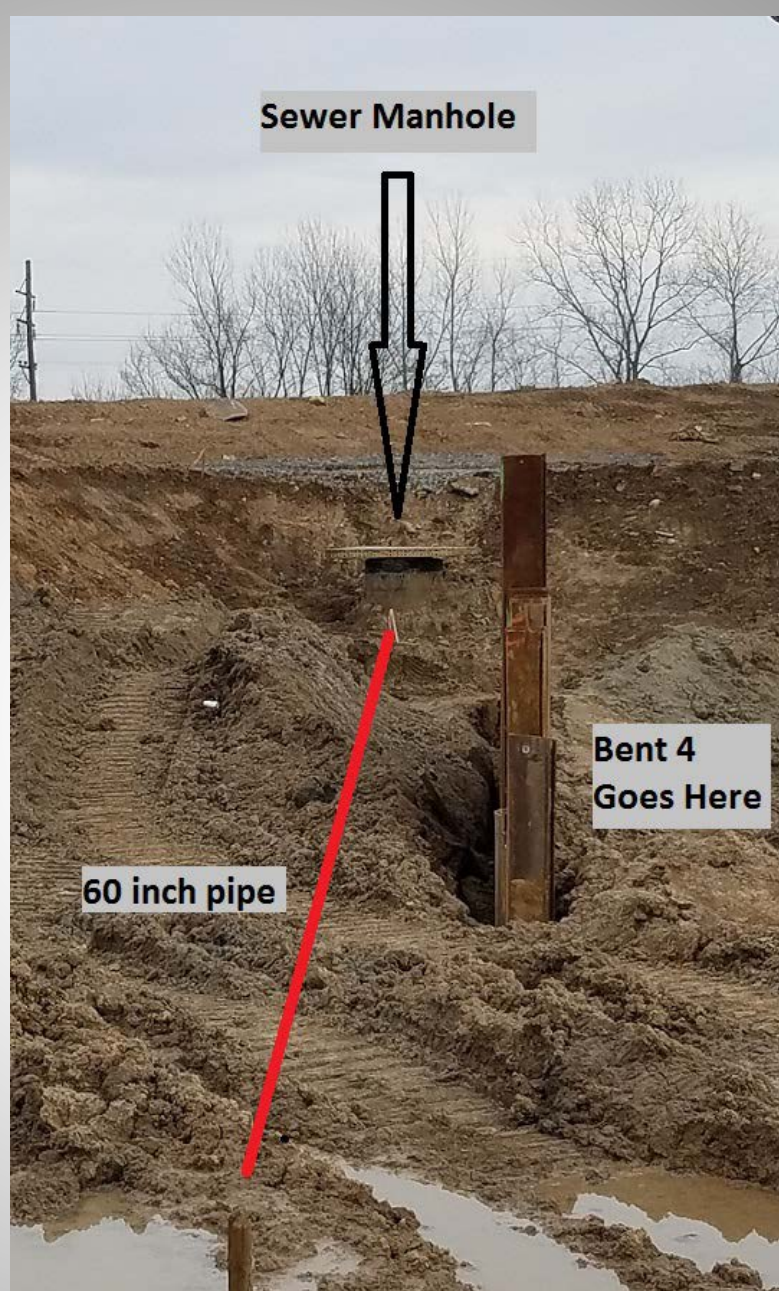
Looked at by pass pumping

Sewer Line Conflict

City maps not updated.
Did not show this pipe
OOPS !!!

Bent 4 sits very close

Set sheet piles to hold
soil and protect pipe



Bent 4

Footings
must span
this hole

Time for
another
hole cap !



Bent 4



Bent 4



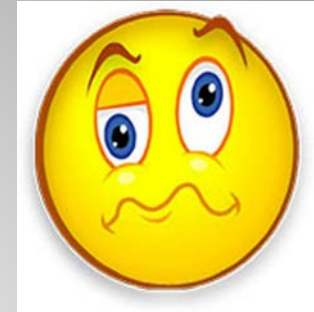
Bent 4 April 26th



Note this hole...we'll be back to it shortly



Time for Another Twist



- Mississippi River Flood of 2017
At Cape Gage Flood Stage is 32 ft
- River stage April 29 32.7 ft Cape Gage
 - Forecasting near record event at 48.5 ft on May 6
 - For Reference record stage is 48.9 ft ... set Jan 2016
- River stage May 2 40.9 ft
- River stage May 6 crests at 45.7 ft
.....Whew Thank Ye Jesus !!

Mississippi River Backwater Flooding

May 4, 2017



Muddy Mess After Water Recedes

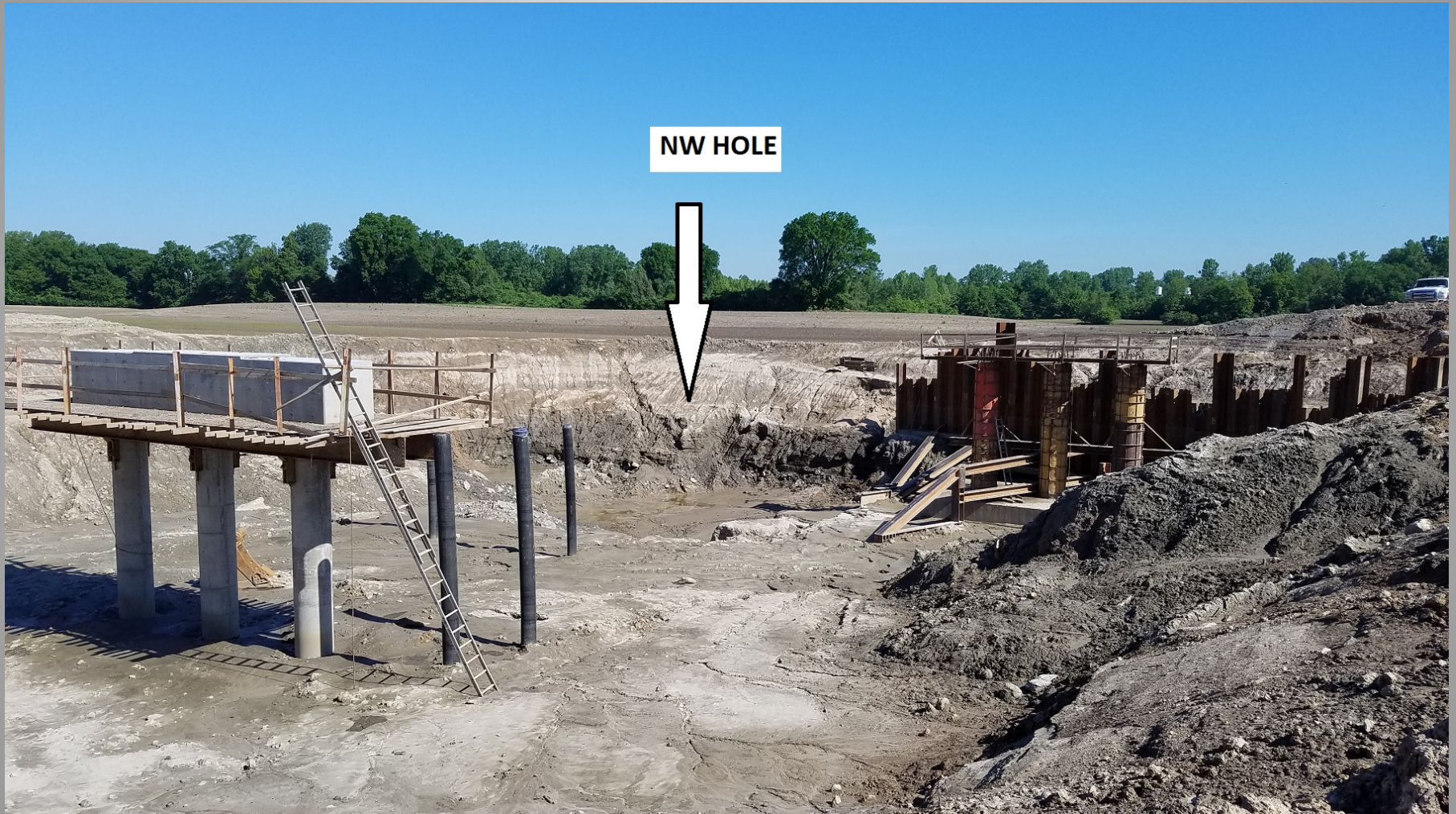
May 11



OkBack To Work



NW Hole



NW HOLE



Extry Big Sink Hole

- Decided to set sheet pile wall to close it off



NW Hole Sheet Piles



NW Hole Ready For Boulders



NW Hole Ready For Boulders



NW Hole Capped



Holes Done ...Now Build A Bridge

- Set Girders Span 2



Last Girder Set For Span 3



CAST DECK Aug 11, 2 A.M.



Pumper Truck ... Boomed Out !!



SUNRISE.... We still at it



DONE !!! 11:00 a.m.



Finishing Up

- Build Road Approaches At Each End
- Add Curbs, Guard Rails
- Tie in Utilities
- Cleaning Up



North End Approach



Casting Curbs



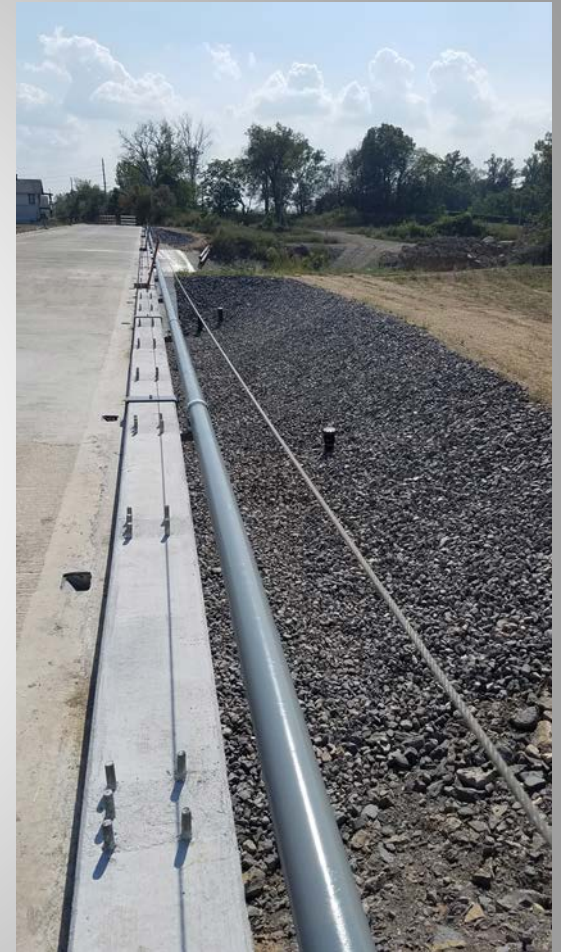
Guard Rails



New 12 inch water line



New Gas Line



GOT 'ER DUN



GOT 'ER DUN



An Award Winning Bridge !!!!



ACEC Engineering Excellence Award, Feb. 2018

Summary

- 10 Years 2007 To 2017
- \$6,017,500 Total Cost
 - Construction Cost \$4.9 Million
- A Year In Geotech And Design
- 13 Months In Construction
- Success From A Great Team Working Together

Lessons Learned

- **Geo-Tech work was incredibly valuable**
- **Flexibility was critical**
- **Prompt and wise decisions necessary**
- **Our team work was paramount to success**

Lessons Learned

- **Good communications critical**
- **The sinkhole caps are very effective**
- **Really should do a complete utility review**
- **The Old Aramaic wording is right**
“DO NOT build a bridge over karst”

From Hellish Geology to Award Winning Bridge

Horner & Shifrin ACEC Engineering Excellence Award 2018



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THANK YOU FOR YOUR
ATTENTION

QUESTIONS ??