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 !!!
Sinkhole History

• Road Repaired
• Holes Formed ....... Again
• We Repaired Road ....... Again
• Holes Formed .... Again
O M G!!! WE GIVE UP

ROAD CLOSED IN 2013
WHAT NOW ???

• Bridge & Road Must Be Replaced

• How To Pay For It .... Hhhmmmmmm ???

• 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
• 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
  – 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 extra 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
Construction

• Now We Get Into The Hard Stuff

• Bent 3
  – Sinkhole Caps First
  – Then The Footing
BENT 3
Footing
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

Footing must span this hole

Time for another hole cap!
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
Ok ...... Back To Work
Extry Big Sink Hole

• Decided to set sheet pile wall to close it off
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
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
Construction of Sprigg Street Bridge Over Active Sinkholes

THANK YOU FOR YOUR ATTENTION

QUESTIONS ??