

# Sheetpile Bulkhead Collapse

## Hutchinson Island Ferry Landing Savannah, Georgia

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Vice President/Senior Consultant

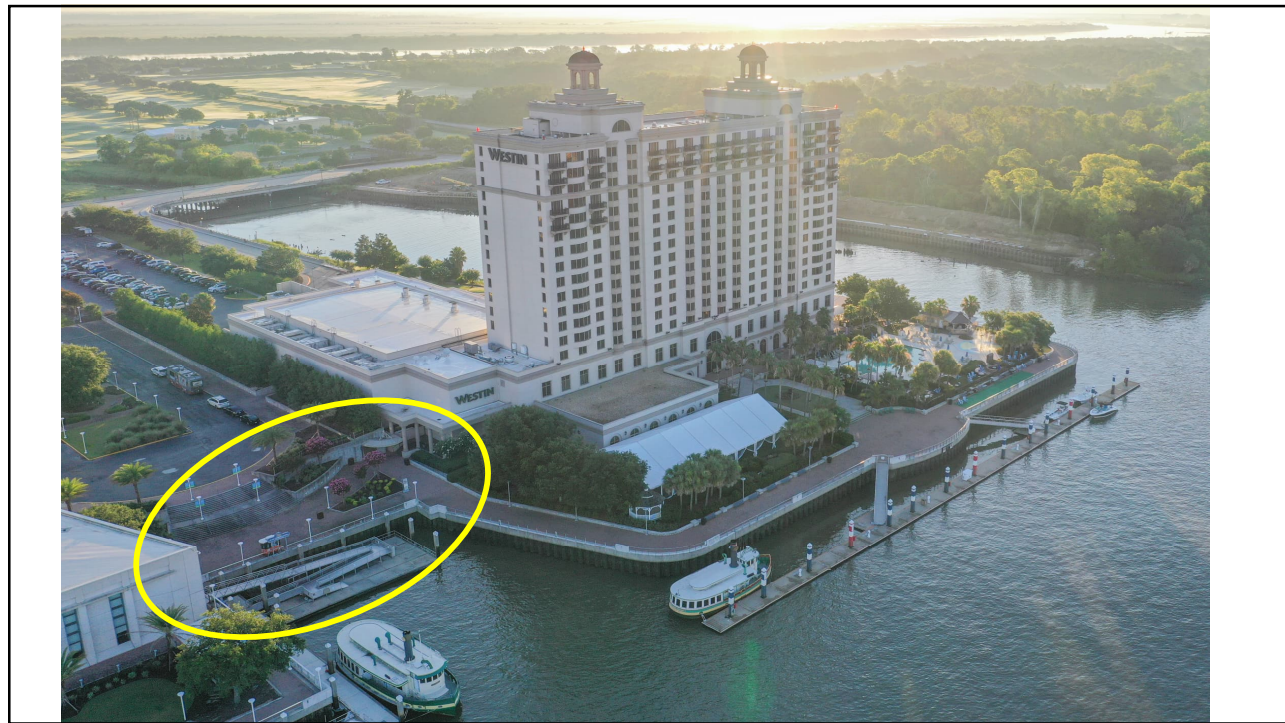


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Ferry - a primary transportation between downtown and Hutchinson Island

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## Outline

- What Happened?
  - Collapse Process & Emergency Response
- Why Happened?
  - Background & Original Construction
  - Cause of Failure & Earthquake Effect
- What to Do?
  - Repair Options
- Summary



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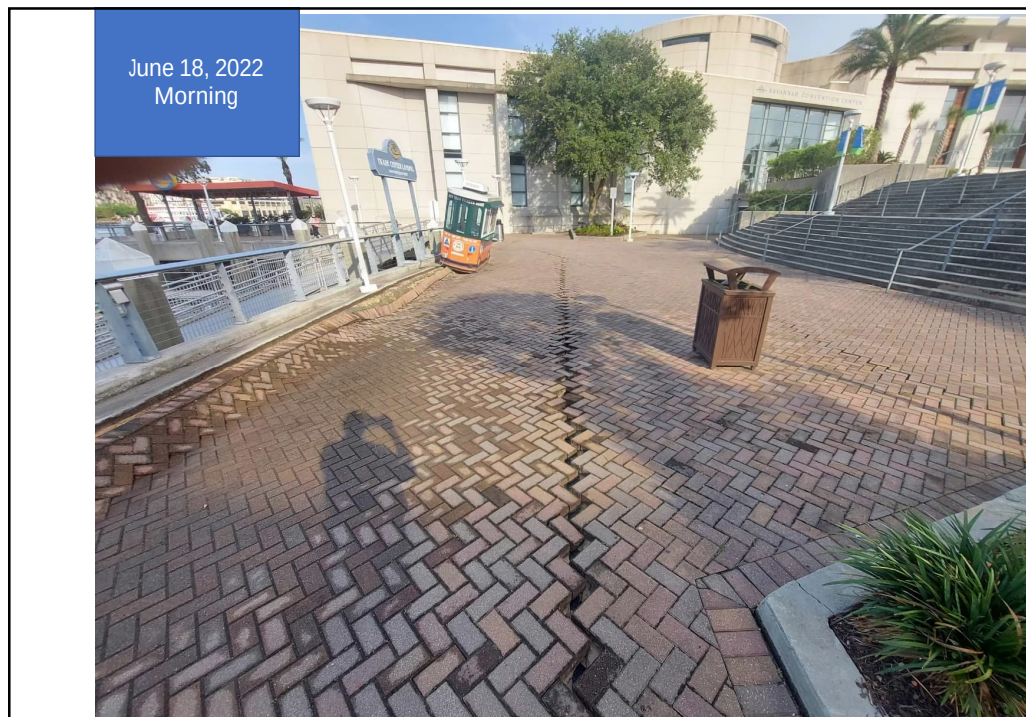


## What happened?

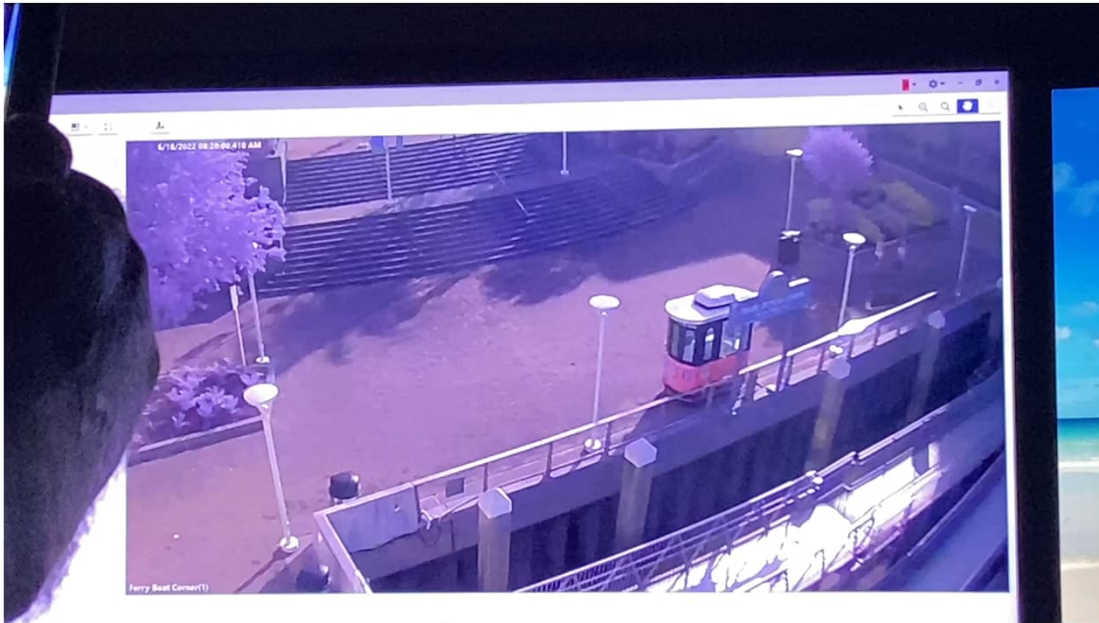
### Sequence of events

- June 18, 2022, Saturday;
- After 8:00 am, the Ferry operator saw the movement of the bulkhead and cracks on the pavement;
- City of Savannah staff called Terracon and Collins to the site.
- Earlier, around 4 am. A 3.9 magnitude earthquake struck near Metter, Georgia.
- Some people in Statesboro and Savannah felt the shock.

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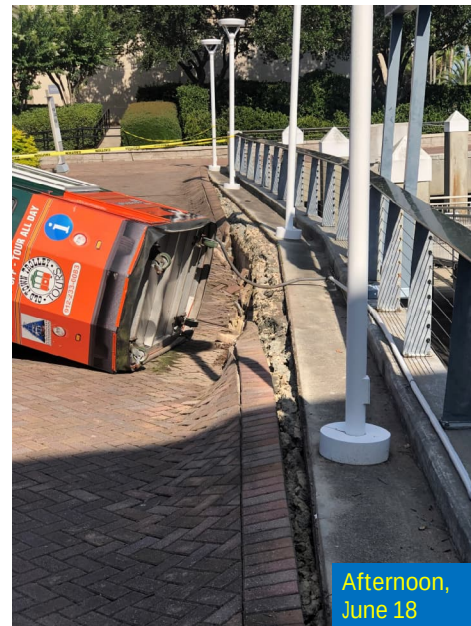
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- Morning of June 18, we installed crack meters to monitor the movements;
- By the afternoon of June 18, the bulkhead moved about another foot, damaged the crack meters and toppled the ticket stand.



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- Is the Savannah Convention Center safe? – Yes.
- Is Westin Hotel safe? – Yes.
- Is the walkway between the Hotel and the Convention Center safe? – not outside, but yes inside.
- Is the Ferry Operation safe? – Was not a question on Saturday, but I became concerned on Sunday (June 19) due to the failing bulkhead pushing the floating dock-Had to be relocated and the floating dock disconnected.

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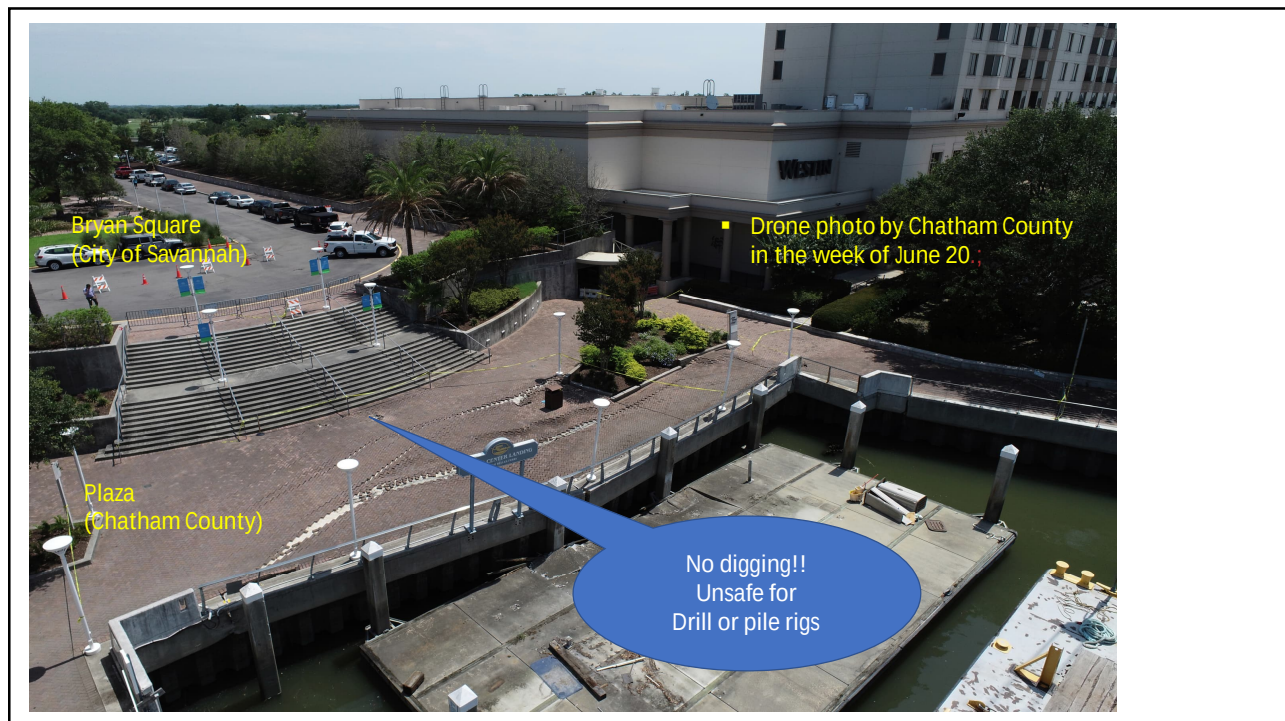


- Next day, June 19, Sunday morning, Westin Hotel contacted me about noisy crushing sounds. The Bulkhead pushed the guide piles that crushed the floating dock;
- I determined that the floating dock was unsafe and ferry services had to stop. The transit authority called a contractor to disconnect the dock and remove the railing.

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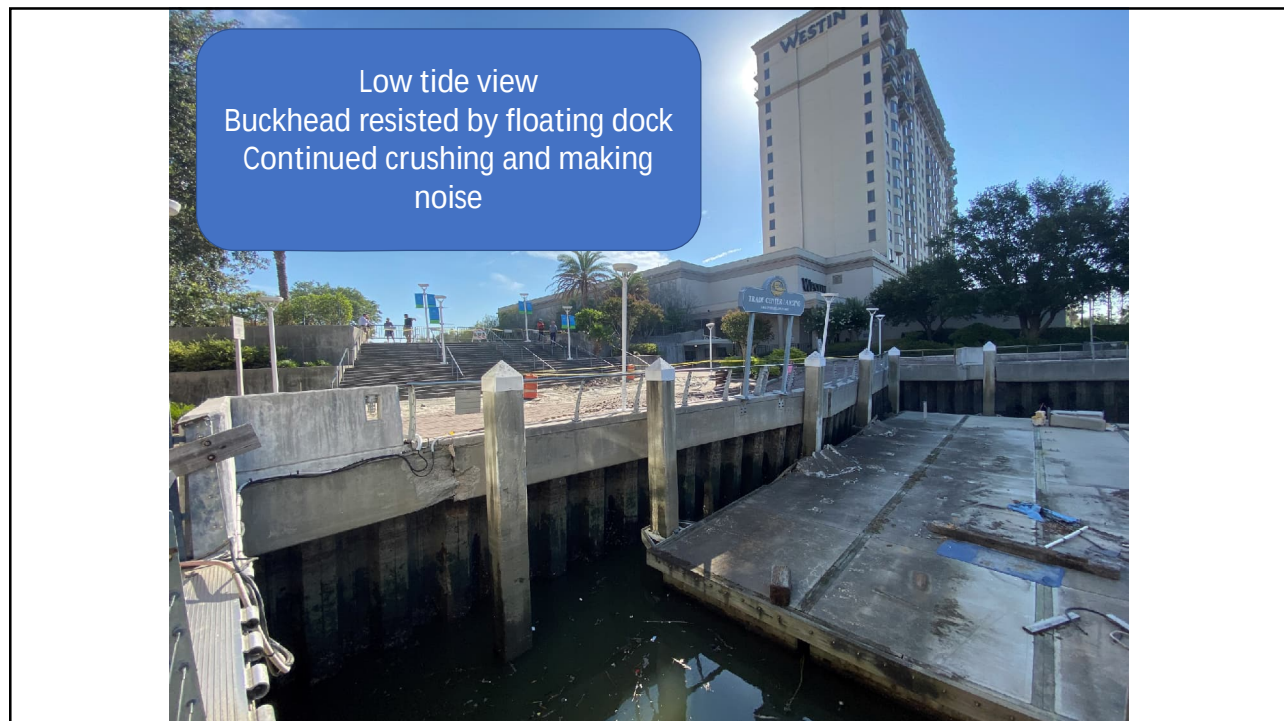


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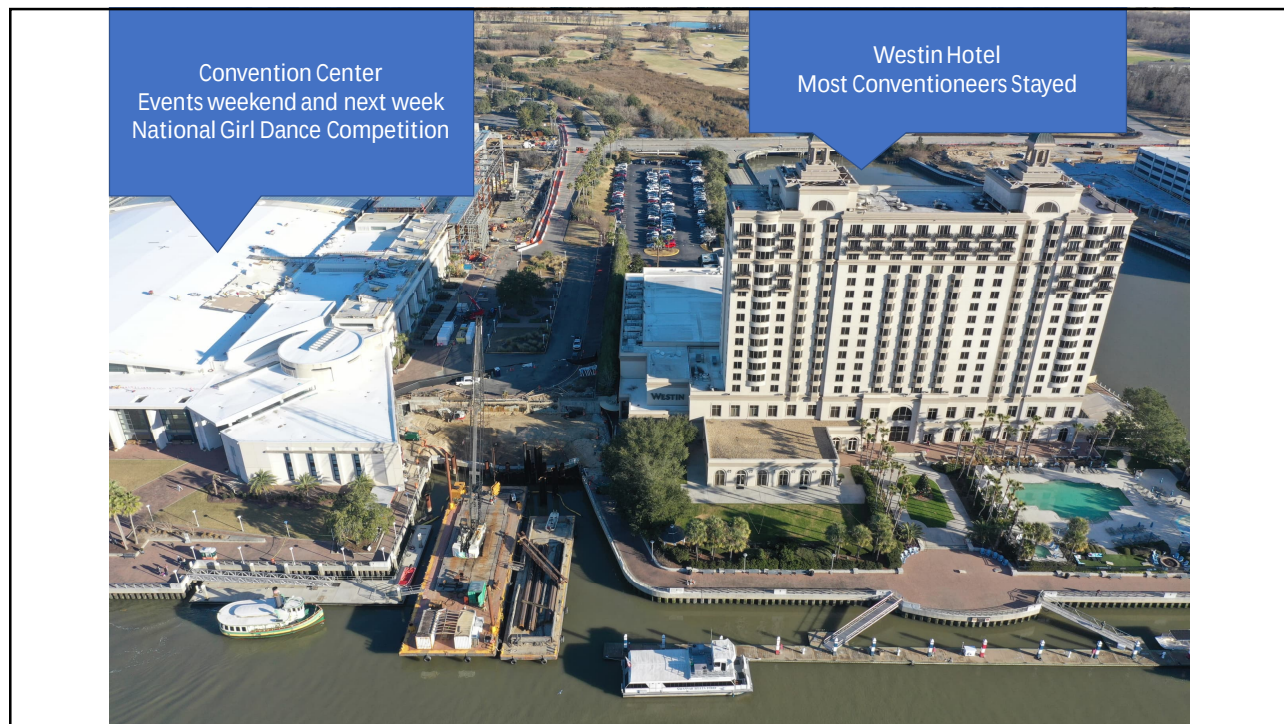


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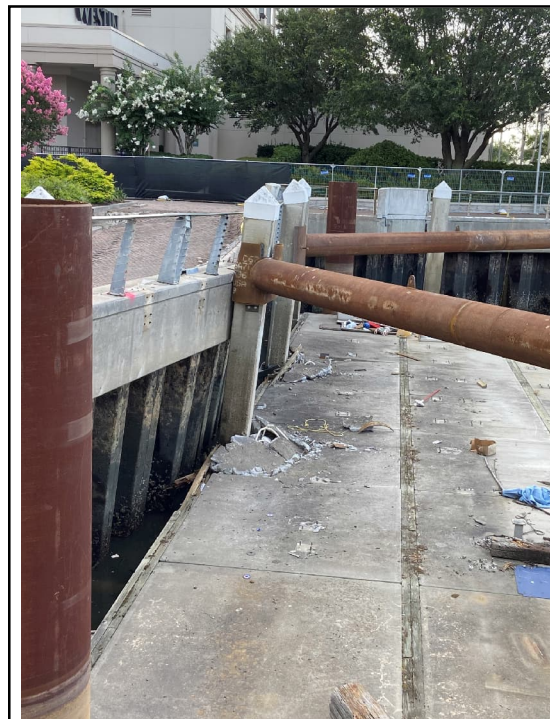


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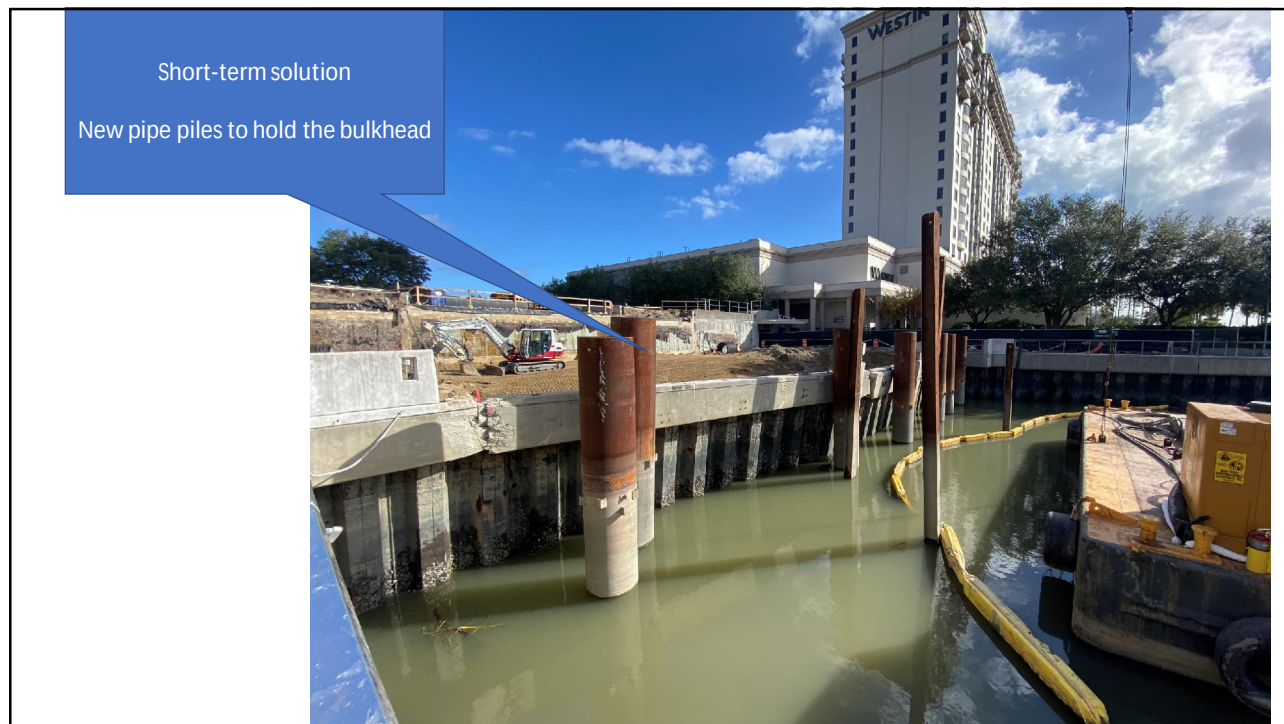


- Prevent Complete Collapse of Bulkhead into the River
- Struts to connect the concrete guide piles



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Tension cracks below brick pavers  
To the bottom of the steps

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## On-Site Quick Decisions

- Convention Center & Westin Hotels were safe;
- Ferry Dock was not safe and needed to be relocated;
- Not allowed excavation behind bulkhead;
- Use lateral struts to connect guide piles to prevent collapsing into the river temporarily;
- Ethic and liability questions.



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## Weekend earthquake destabilizes Hutchinson Island dock, Westin parking garage, ferry service

Zoe Nicholson

Savannah Morning News

Published 11:11 a.m. ET June 21, 2022 | Updated 1:43 p.m. ET June 22, 2022



we're going to extend that for three months beyond the opening date of the

**What are the next steps for Savannah City Council with the Civic Center site?**  
Savannah Morning News reporter Will Feebles on the next steps for the Civic Center site as it goes in front of City Council.  
Savannah Morning News

*This is a developing story. Check back for updates*

A weekend earthquake has rendered parts of Hutchinson Island unstable, including the ferry dock and Westin parking garage, by causing land to settle near the banks of the Savannah River.

Communication Difficulties

**The 65th Daytona 500 kicks off NASCAR Cup**

SPORTS | FEBRUARY 19, 2022 | 1:00PM EST  
NASCAR CUP SERIES

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Rincon man helps pooches, inmates through dog training program

**Jo Smith's resignation renders ethics case moot**

Records reveal why council member faced hearing

**Hutchinson Island riverwalk collapse repairs underway**

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### M 3.9 – 7 km E of Stillmore, Georgia

2022-06-18 08:05:23 (UTC) | 32.453°N 82.141°W | 0.8 km depth

ShakeMap

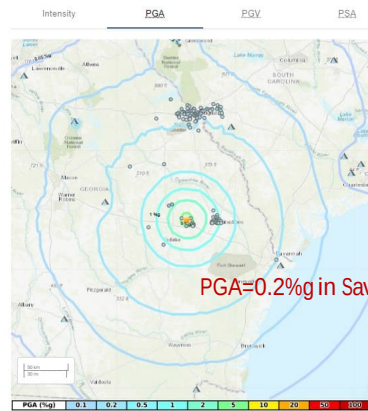
[View all shakemap products \(1 total\)](#)

Contributed by US<sup>4</sup> last updated 2022-07-28 04:40:48 (UTC)

✓ The data below are the most preferred data available

⚠ The data below have NOT been reviewed by a scientist

Version 6



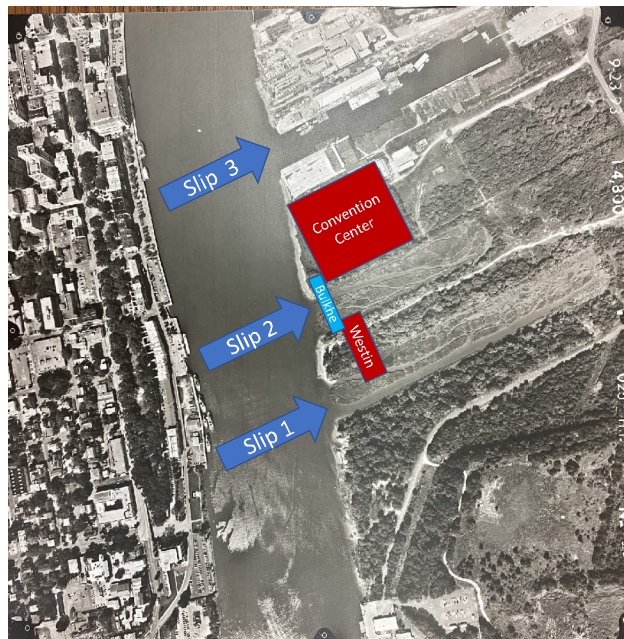
### Earthquake Effects

- M 3.9 Earthquake. 7 km E of Stillmore, about 70 miles west of Hutchinson in Savannah;
- Peak Ground Acceleration (PGA) 0.2%g=0.002g.
- Typical design earthquake (M7.3 centered near Charleston SC) would have a PGA of 0.2g in Savannah.
- This earthquake is about 1% of a design earthquake. Too small to cause significant loads or soil effects like soil liquefaction.
- Seismic monitors on Elba Island LNG did not detect this earthquake.

### Counter-arguments:

- o What about the system being so marginal, it has a factor of safety of 1.01. A small earthquake can push it over;
- o An underground parking garage on River Street had leakage repaired, but the cracks re-opened after the earthquake.

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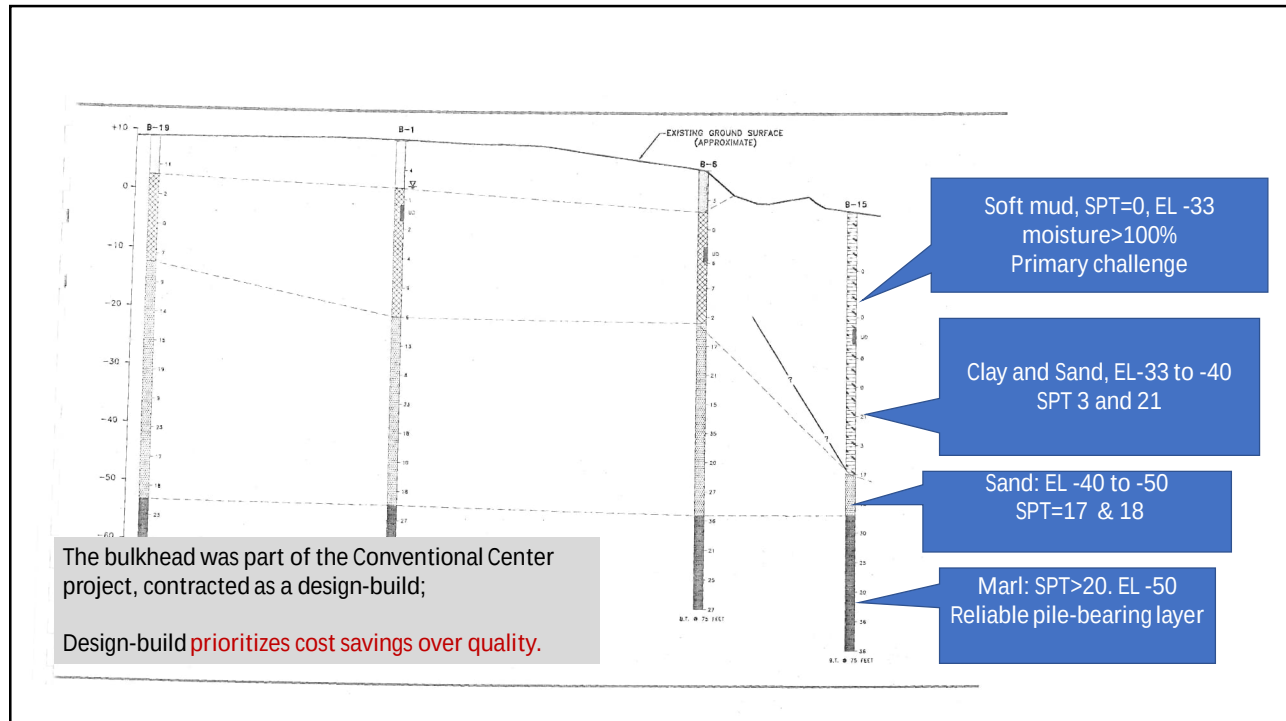


Boring Location Plan for Convention Center  
(Law Engineering)

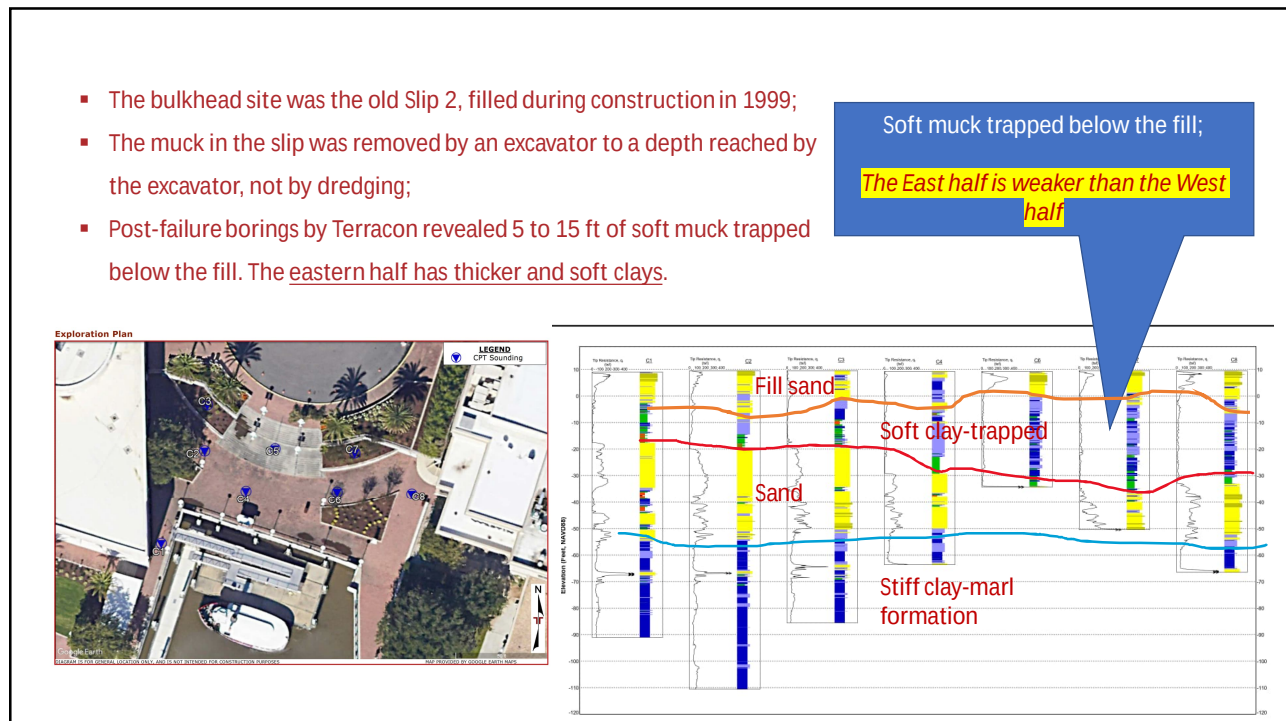


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## Causes of failure

1. Most likely a combination of multiple causes;
2. The **earthquake**, which happened four hours before the bulkhead failure, was unlikely the direct or primary cause;
3. The **tiebacks** using helical piles were the least expensive, not a reliable system. The helical anchors installed in the clay soils can move (creep).
4. Each **helical anchor** acts individually. "The zipper effect" of the helical anchor system: the failed anchor would transfer additional loads to the adjacent anchors to cause the next one to fail.
5. The **settling fill** and pavers, caused by the trapped muck, would add loads to the tiebacks. No PVC casing was included in the tierods to accommodate settling.

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## Repair Options

1. Deep mass mixing, or soil mixing columns and panel walls
  - The ground was unsafe for deep mixing rigs or drill rigs;
  - No. The old slip has helical anchors, riprap and debris that would damage mixing tools;
2. Auger cast piles
  - No. for the same reason above, as expected at the east side of the Convention Center expansion
3. Relieving platform supported on piles;
4. Steel H piles for ease of construction and penetration through potential debris

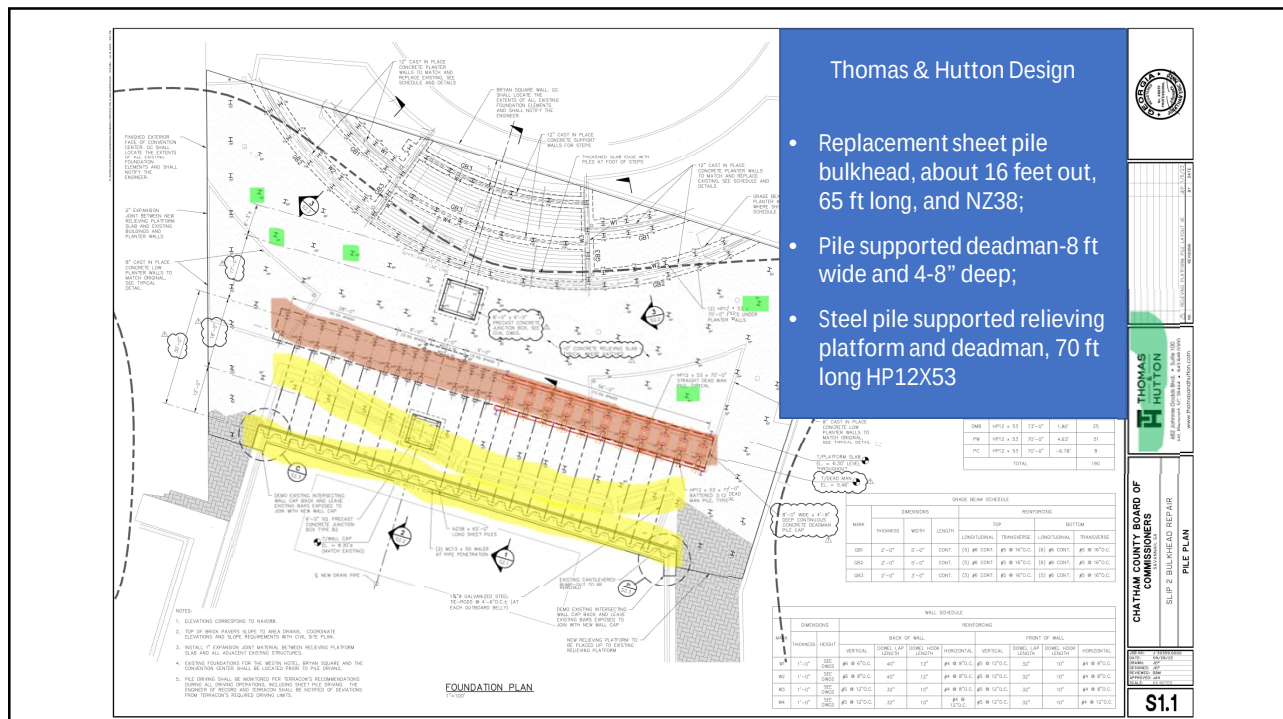
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- After the removal of steps and planters



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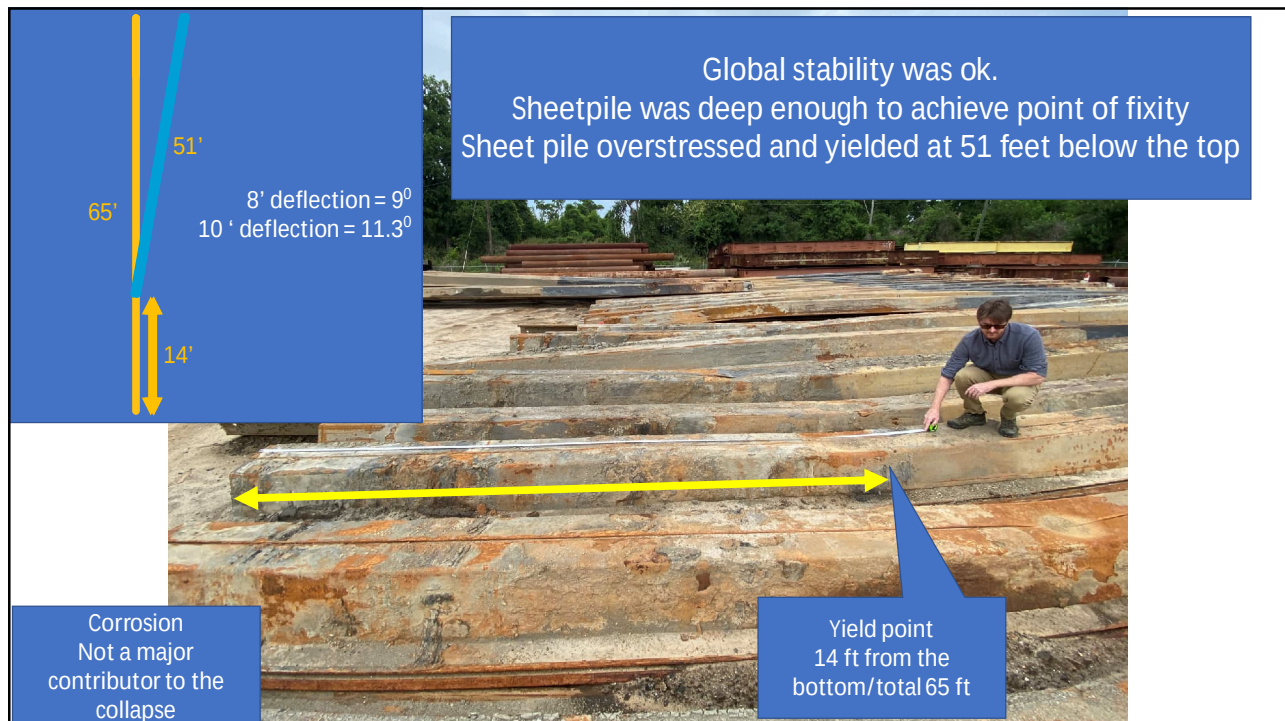


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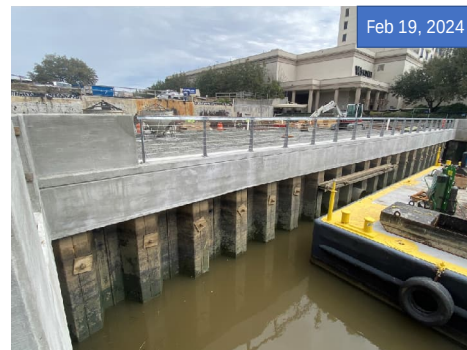
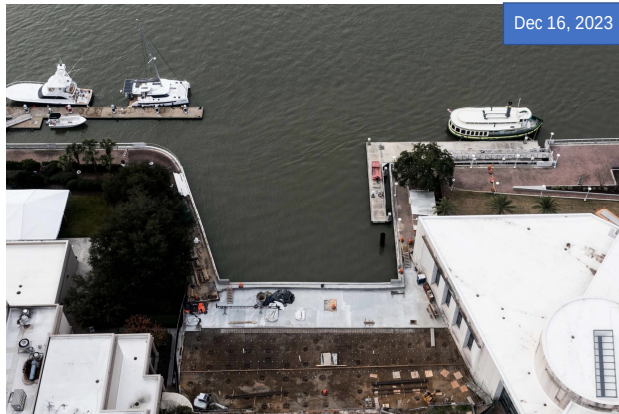


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## Latest Conditions of Bulkhead and Plaza Repair Work

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## Summary

- Engineers play a vital role in supporting public agencies in an emergency response to infrastructure failure. The responsibility and liability of a private firm need to be better defined and understood;
- The earthquake, which happened four hours before the bulkhead collapse, was not a primary cause of the bulkhead collapse;
- The bulkhead was built over an abandoned slip, but only the near surface mud was removed by an excavator, not by dredging. A layer of soft soils was trapped below the upper fill; The eastern half has thicker clay layer than the western half.
- The bulkhead and the river walk, constructed through a design-build contract, used helical piles as tiebacks and were not a reliable system;
- The tieback design did not consider the effects of the settling fill;
- The failure was not a global stability failure, but a local structural failure. The sheetpiles were deep enough;
- The most economical but less reliable helical tie back system was the first breaking point and primary contributor to the collapse;
- The repair used pile-supported deadman tiebacks and relieving platform.



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## Acknowledgments

City of Savannah  
Chatham County  
Thomas & Hutton  
TIC-Kiewit



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# Thank you!

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