U.S. Department of Transportation
Federal Highway Administration

AECOM

TEAM DelDOT
Transparent Efficient Accountable Measured

J.D. ECKMAN INC.
CONSTRUCTION
J.D.E.
BRIDGE HIGHWAY
EST. 1945

Delaware Department of Transportation

BR 1-813 \ I-495

Emergency Repairs

AGENDA

- Introduction
- Background
- Site Conditions – June 2, 2014
- Design
- Public Relations Efforts
- Lessons Learned
- Acknowledgements

Introduction

Barry Benton
Assistant Director, Bridge
DelDOT
Email: barry.benton@state.de.us
Phone: 302-760-2311

Introduction

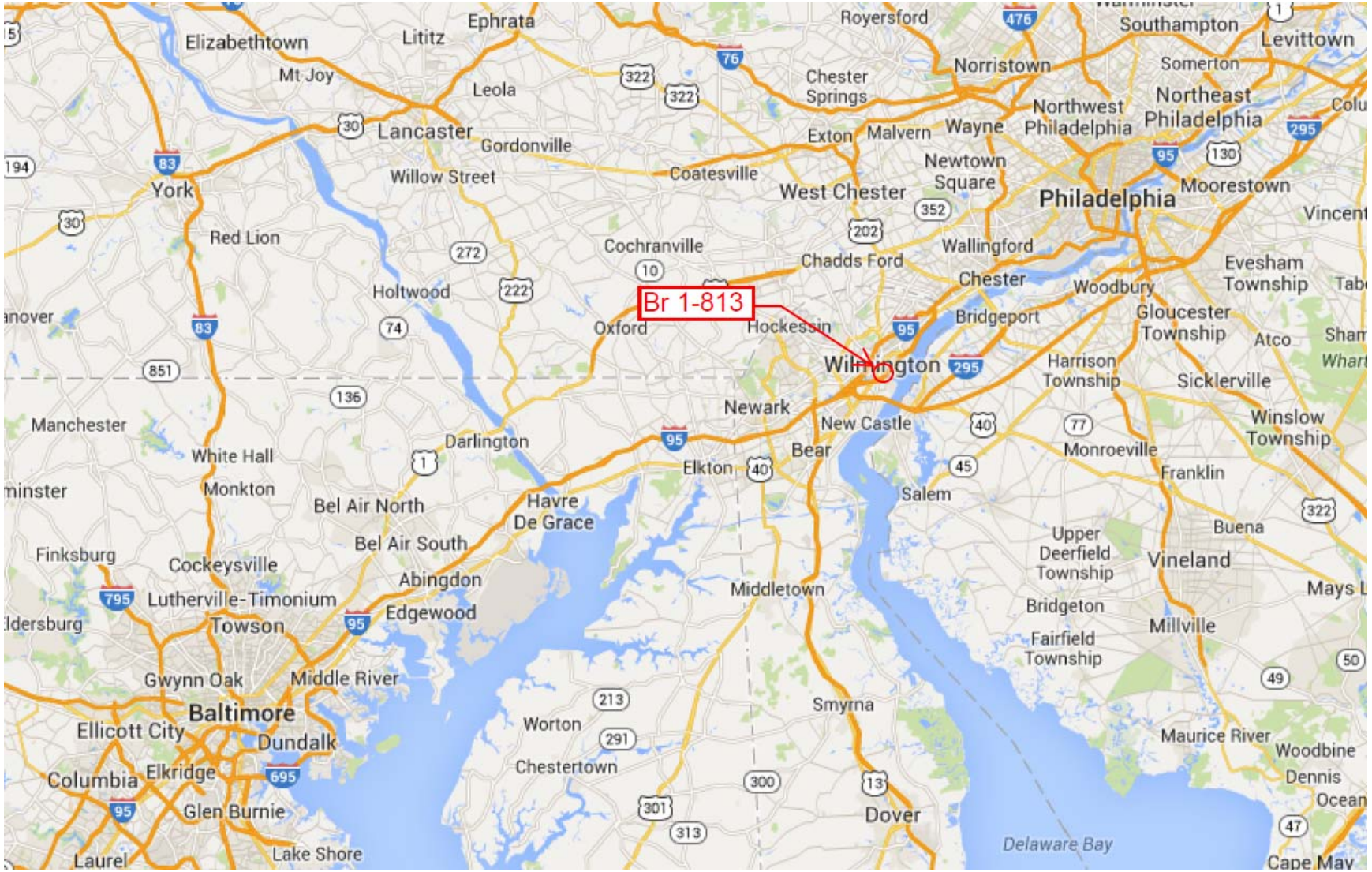
AECOM

- Neil Shemo, PE – Design Project Manager
- Harry Roecker, PE – Technical Leader
- John Milius, PE – Structures
- Paul Moffitt, PE - Geotech
- Bruce Kay – Construction Project Manager
- Nicholas Hetrick, PE – Resident Engineer

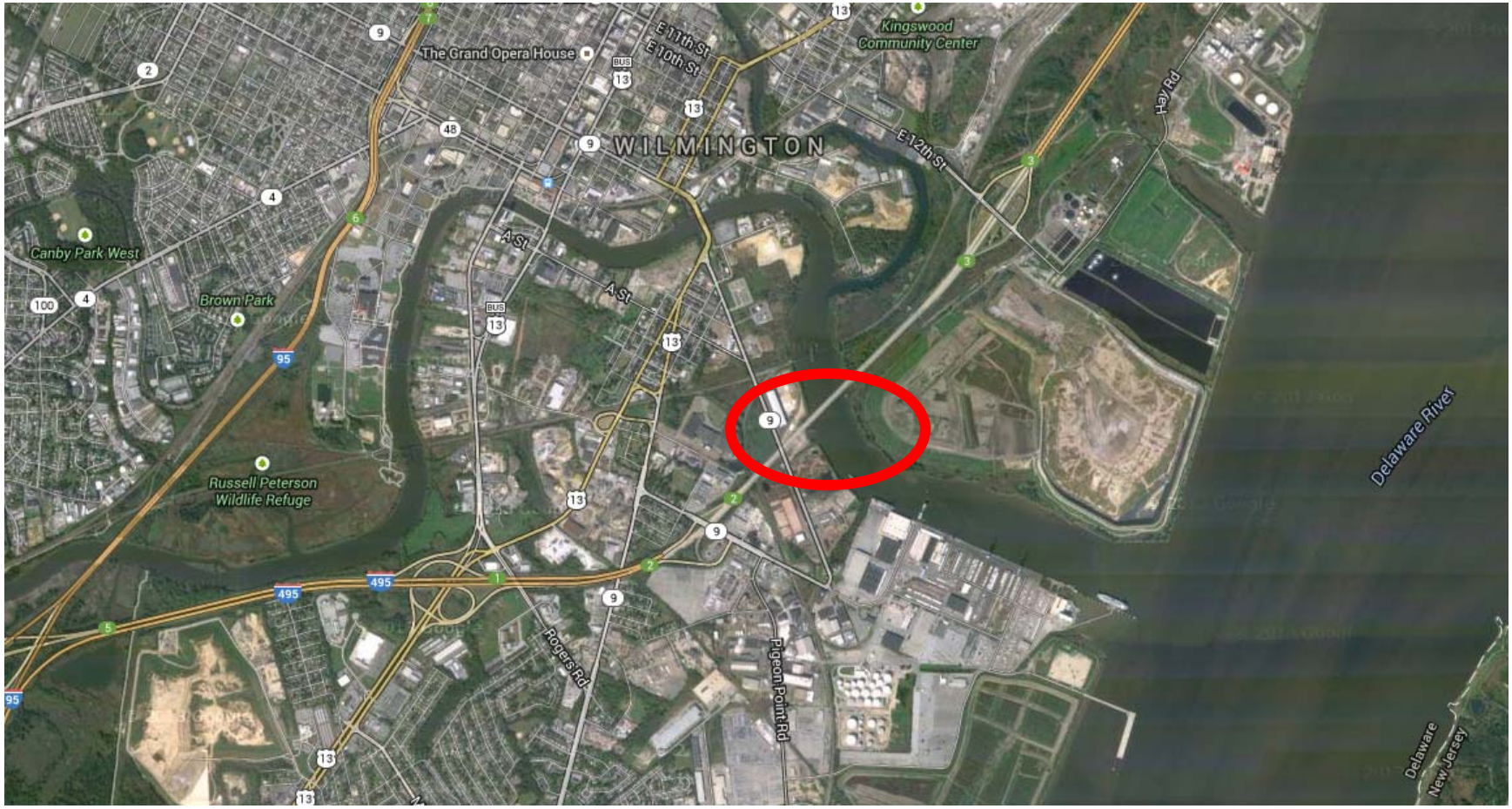
J.D. Eckman, Inc.

- Jim Roberts – Project Manager
- Josh Smolinsky, PE – Project Engineer
- Joe Rovnan, PE – Senior Structural Engineer
- Greg Burkhart, PE – VP Steel Division

Background


Br 1-813
Elizabethtown
Lititz
Ephrata
Mt Joy
Leola
Lancaster
Gordonville
Willow Street
York
Red Lion
Holtwood
Cochranville
Oxford
Coatesville
Chester Springs
Royersford
Norristown
Southampton
Levittown
Somerton
Northeast Philadelphia
Northwest Philadelphia
Exton
Malvern
Wayne
Newtown Square
West Chester
Philadelphia
Moorestown
Vincent
Wallingford
Chadds Ford
Chester
Woodbury
Evesham Township
Gloucester Township
Atco
Bridgeport
Hockessin
Wilmington
Harrison Township
Sicklerville
Winslow Township
Monroeville
Franklin
Salem
Upper Deerfield Township
Vineland
Buena
Millville
Bridgeton
Fairfield Township
Mays L
Middletown
Smyrna
Maurice River
Woodbine
Dennis
Ocean
Cape May
Delaware Bay
Dover
Chestertown
Worton
Newark
New Castle
Bear
Elkton
Darlington
Havre De Grace
Bel Air North
Bel Air South
Abingdon
Edgewood
Towson
Lutherville-Timonium
Cockeysville
Finksburg
Monkton
White Hall
Manchester
Middle River
Gwynn Oak
Baltimore
Dundalk
Ellicott City
Elkridge
Columbia
Glen Burnie
Laurel
Lake Shore

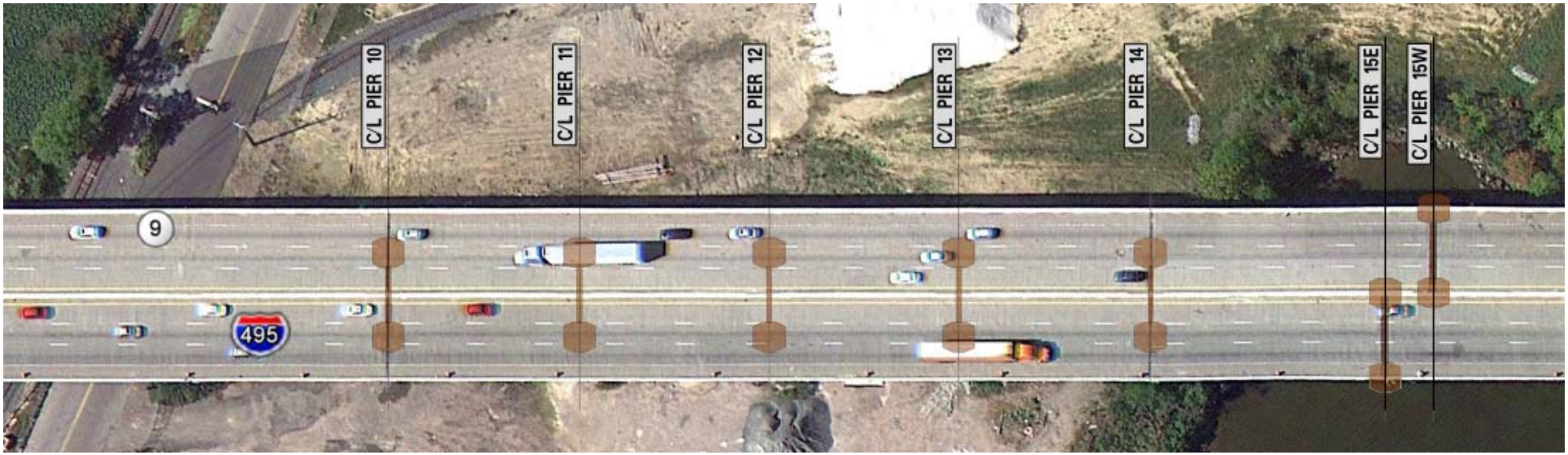
Background


WILMINGTON
The Grand Opera House
Kingswood Community Center
E 11th St
E 10th St
E 12th St
Hay Rd
A St
Canby Park West
Brown Park
Russell Peterson Wildlife Refuge
Rogers Rd
Pigeon Point Rd
Delaware River
Delaware
New Jersey
95
495

Background

- BR 1-813
- I-495 over the Christina River
- ADT=90,000
- Length – 4,390-ft
- 38 spans
- Welded Steel Plate Girder Superstructure
- Variable Foundations
- Inspected October 2012
  - No deficiencies

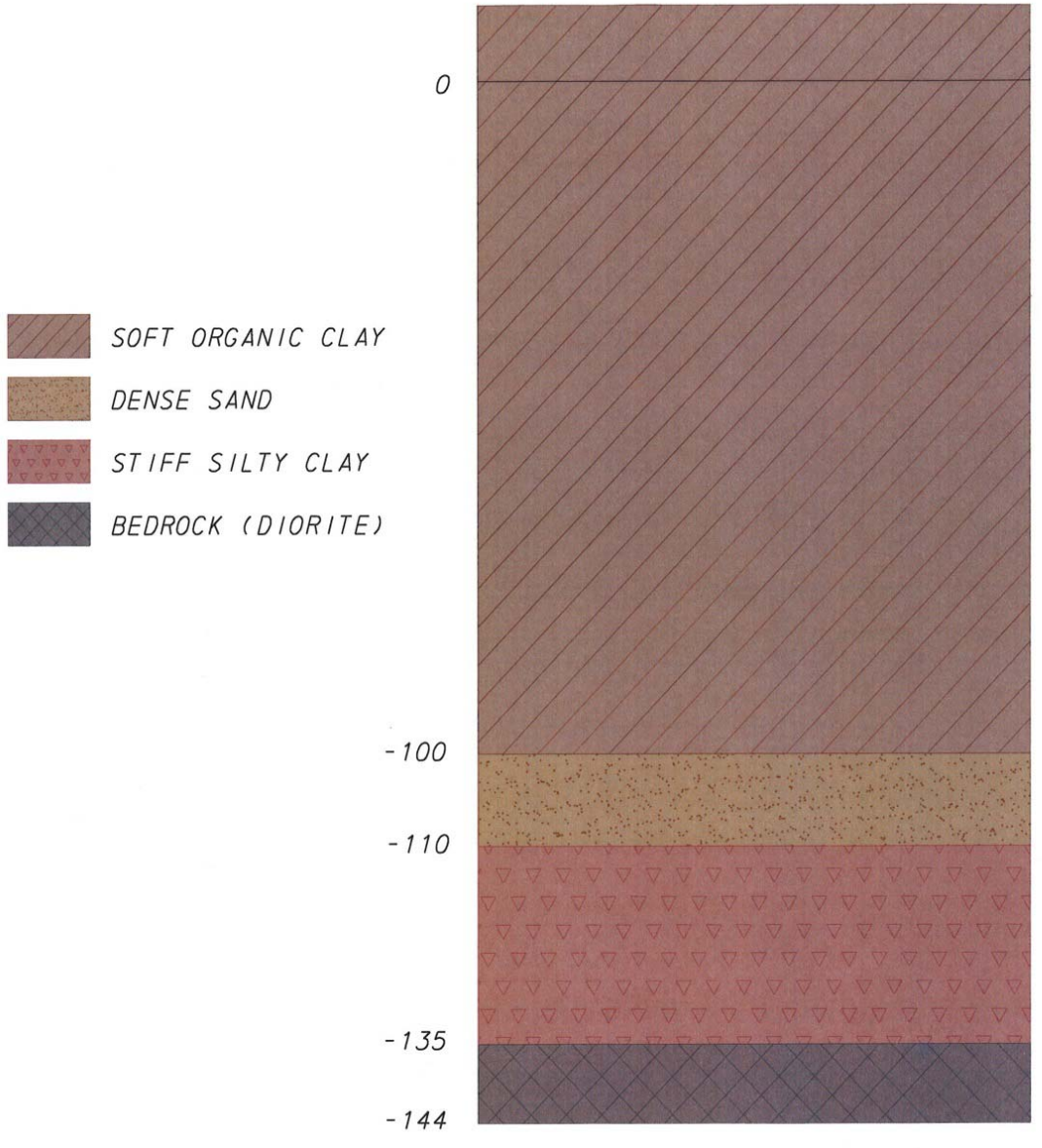
Background



- Spans11 thru 14
  - 4-span continuous
  - All spans 109-ft
  - Piers 10 thru 14
  - Pier 10 – Cast-in-Place Concrete Piles
  - Remainder – H-Piles to rock
- Span 15
  - Simple span
  - SB – 160.03-ft
  - NB – 132.87-ft
  - Pier 15 – H-Piles

Background

- Soil Profile
  - Soft Organic Clay
  - Dense Sand
  - Stiff Silty Clay
  - Bedrock (Diorite)

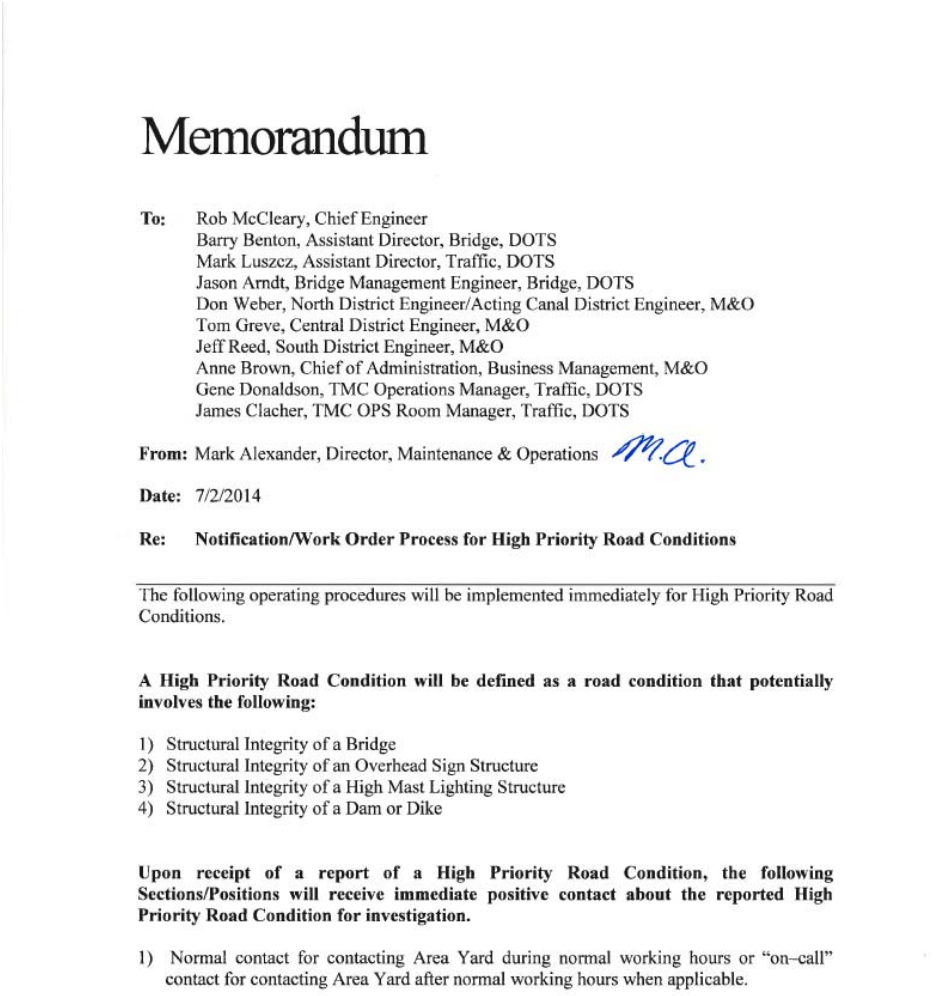


Missed Opportunities

- April 15, 2014: A 911 call from a motorist reported a difference in the barrier elevations between NB and SB on the bridge
- May 29, 2014: An engineer studying movements on an oil line adjacent to the bridge reported the condition as slightly out of plumb to the Department and advised us to check it out.
- May 30, 2014: Another 911 call from a motorist reported a dip in the bridge.
- June 2, 2014: Bridge was closed.

High Priority Road Conditions

- Reports that involve the structural integrity of a bridge, sign structure, high mast light or dam are High Priority Conditions
- Positive contact must be made with M&O and the Bridge Section
- Response must be immediate
- Both M&O and Bridge must approve before a HPWO can be closed
- TMC to notify the “requestor” of the resolution of the WO



Memorandum

To: Rob McCleary, Chief Engineer
Barry Benton, Assistant Director, Bridge, DOTS
Mark Luszcz, Assistant Director, Traffic, DOTS
Jason Arndt, Bridge Management Engineer, Bridge, DOTS
Don Weber, North District Engineer/Acting Canal District Engineer, M&O
Tom Greve, Central District Engineer, M&O
Jeff Reed, South District Engineer, M&O
Anne Brown, Chief of Administration, Business Management, M&O
Gene Donaldson, TMC Operations Manager, Traffic, DOTS
James Clacher, TMC OPS Room Manager, Traffic, DOTS

From: Mark Alexander, Director, Maintenance & Operations M.A.

Date: 7/2/2014

Re: **Notification/Work Order Process for High Priority Road Conditions**

The following operating procedures will be implemented immediately for High Priority Road Conditions.

A High Priority Road Condition will be defined as a road condition that potentially involves the following:

1) Structural Integrity of a Bridge
2) Structural Integrity of an Overhead Sign Structure
3) Structural Integrity of a High Mast Lighting Structure
4) Structural Integrity of a Dam or Dike

Upon receipt of a report of a High Priority Road Condition, the following Sections/Positions will receive immediate positive contact about the reported High Priority Road Condition for investigation.

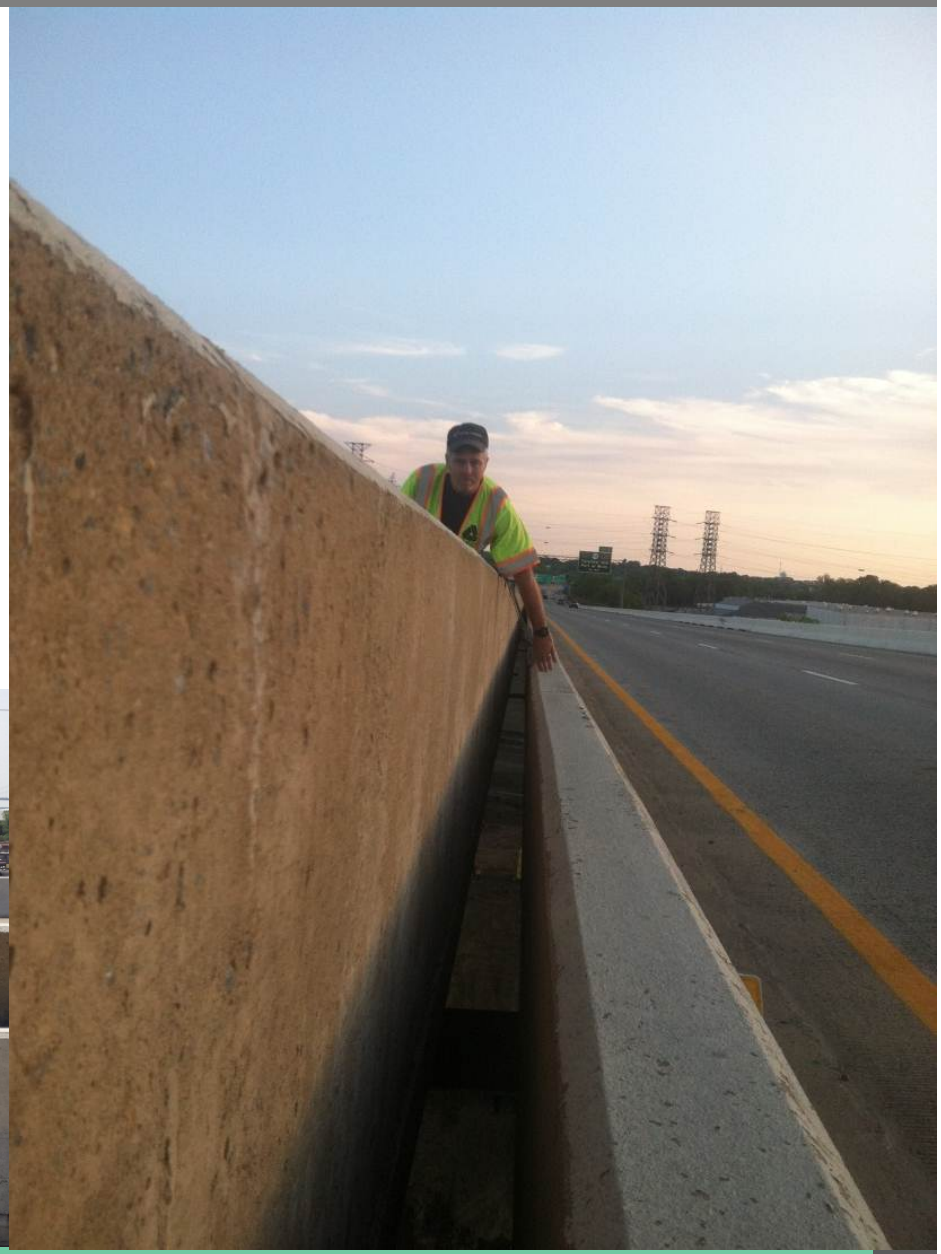
1) Normal contact for contacting Area Yard during normal working hours or “on–call” contact for contacting Area Yard after normal working hours when applicable.

Site Conditions

- June 2ND at 2:30 PM
  - Arrived on-site 3:15 PM
- Piers Tilted to the Right (Facing North)
- Tension Cracks in Soil
- Displacement of Bridge Superstructure

Site Conditions

- NB and SB Superstructure Rotated to the East
  - 18-inch difference in elevation of median barriers
  - + 3-inch gap in median barriers



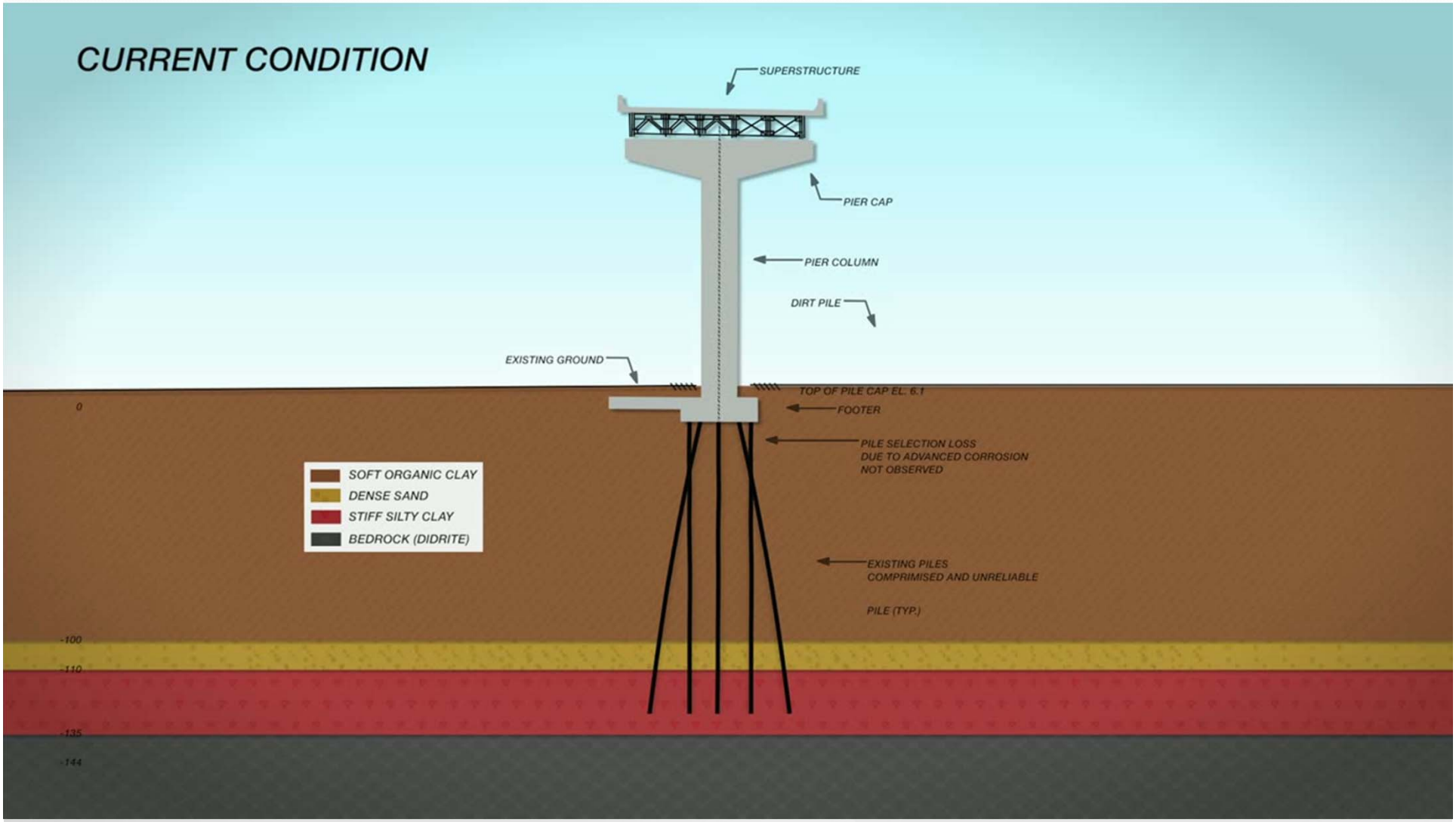
Site Conditions

Can a dirt pile move a bridge?

- 400’ long x 150’ wide x 25’ high from ground
- Over 50,000 tons
- Settled over 4’

AECOM

CURRENT CONDITION



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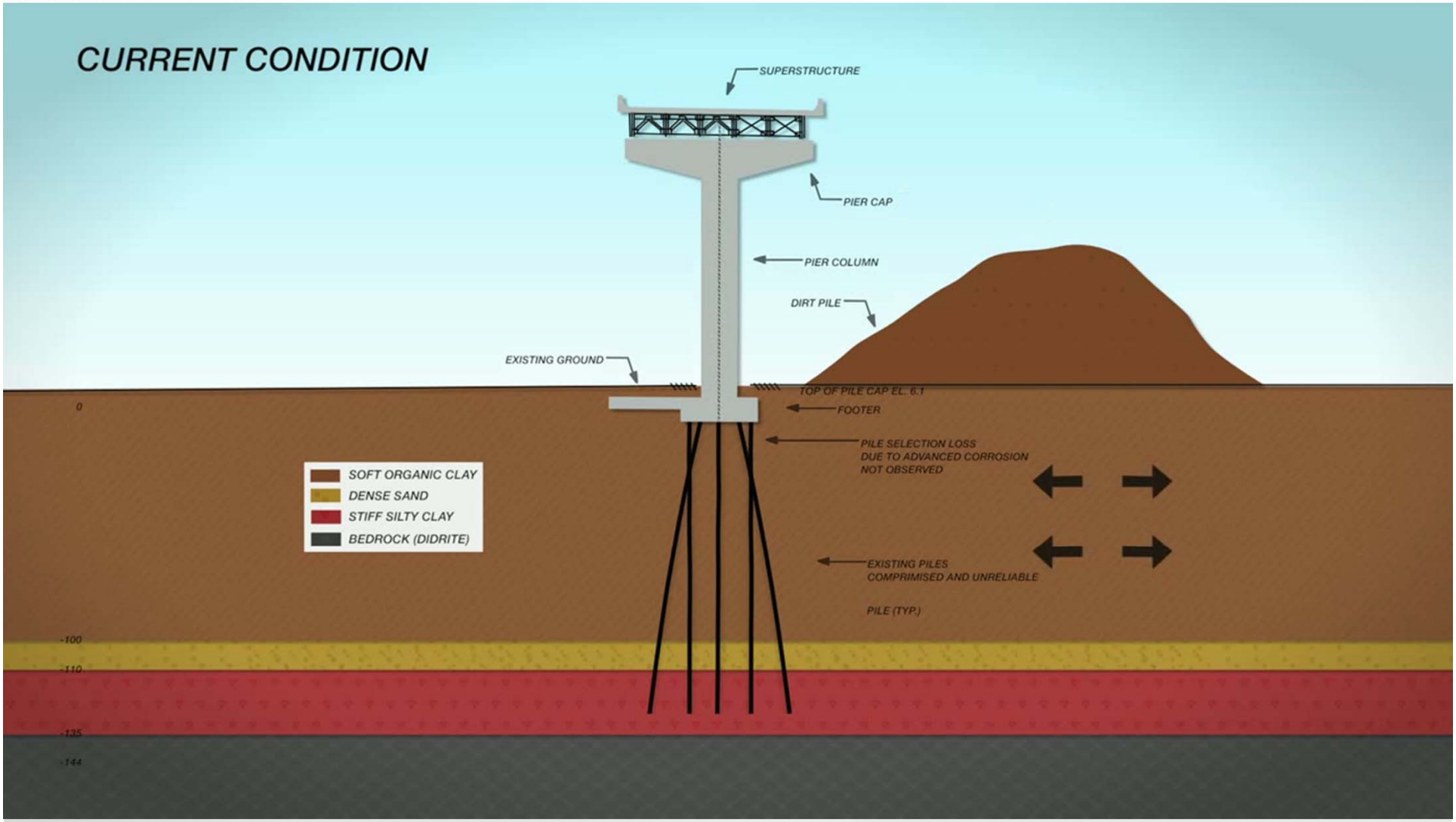
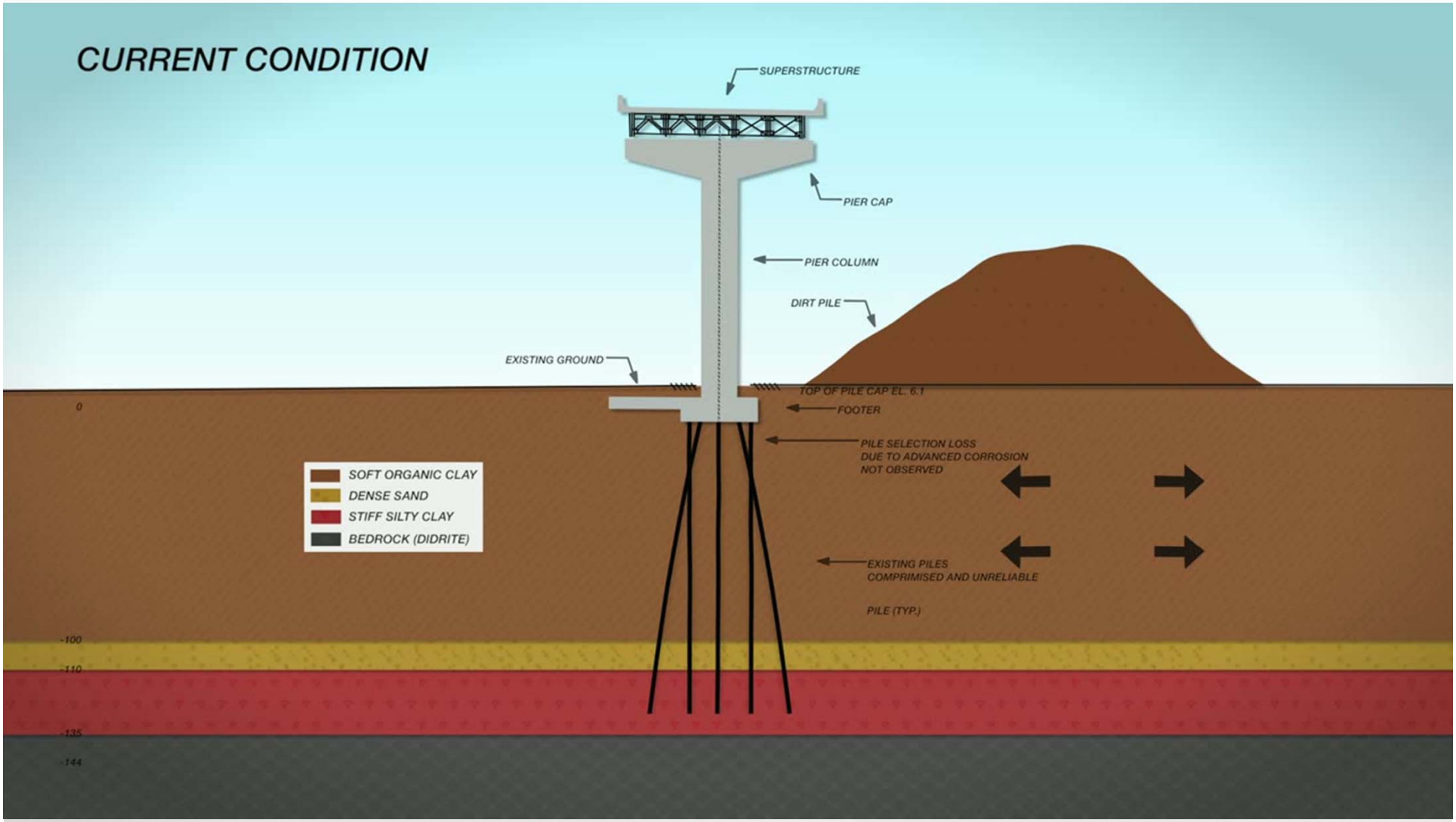

CURRENT CONDITION
SUPERSTRUCTURE
PIER CAP
PIER COLUMN
DIRT PILE
EXISTING GROUND
TOP OF PILE CAP EL. 6.1
FOOTER
PILE SELECTION LOSS
DUE TO ADVANCED CORROSION
NOT OBSERVED
EXISTING PILES
COMPRIMISED AND UNRELIABLE
PILE (TYP.)
SOFT ORGANIC CLAY
DENSE SAND
STIFF SILTY CLAY
BEDROCK (DIDRITE)
0
-100
-110
-135
-144

AECOM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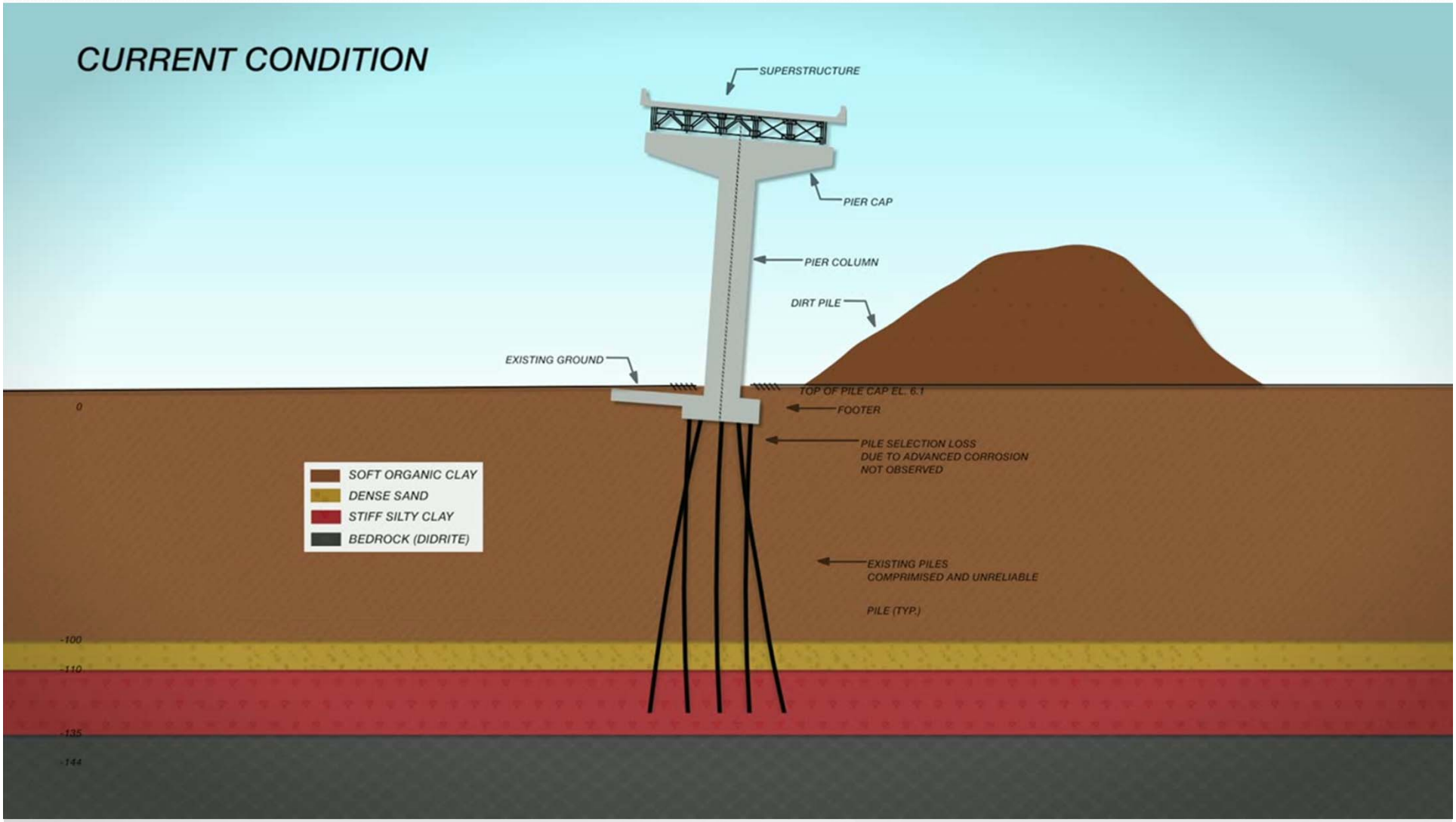
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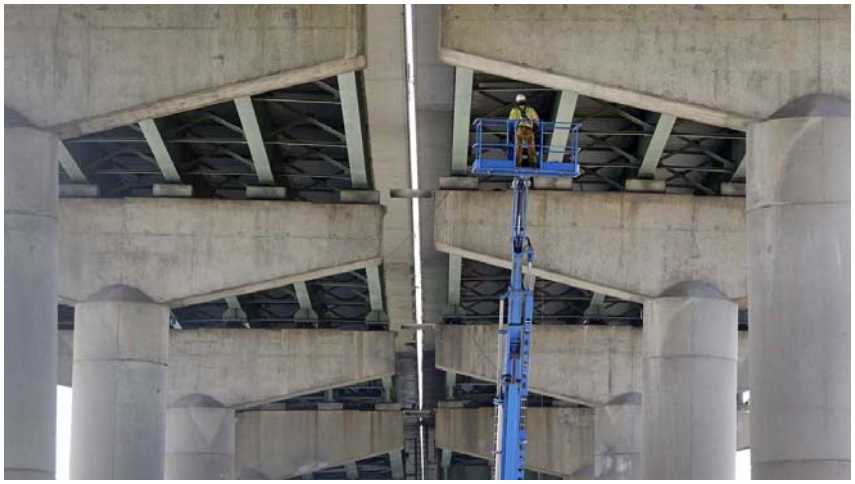
Response

- Close Bridge To Traffic
- Get Disaster Declaration
- Inspect Structure (Super & Sub)
- Quantify Pier and Deck Movements
  - Install Tiltmeters
  - Field Survey
- Remove Soil Embankment
  - Began night of 6/2/2014
  - 24-hour a day operation
  - Completed 6/10/2014
- Subsurface Investigation
  - Piezometers & Inclinometers
  - Borings & Rock Cores



Response

Pier and Deck Movements

PIER MOVEMENTS					
Pier	Translation	Rotation			
	At Base	Transverse		Longitudinal	
	(ft)	Degrees	ft	Degrees	ft
11W	0.11	0.114	0.13	0.058	0.07
11E	0.27	0.443	0.50	0.070	0.08
12W	1.91	1.620	1.84	0.520	0.59
12E	1.92	1.820	2.07	0.390	0.44
13W	1.00	0.930	1.06	0.620	0.70
13E	1.17	1.440	1.63	1.030	1.17
14W	-0.07	0.212	0.24	0.074	0.08
14E	0.31	0.104	0.12	0.591	0.67

Response

Pier and Deck Movements

APPROX. DECK MOVEMENTS				
PIER	SB Fascia Gutter		NB Fascia Gutter	
	Horiz. (ft)	Vert. (ft)	Horiz. (ft)	Vert. (ft)
14	0.21L	+0.03	0.39R	-0.26
13	0.18L	+0.45	0.41R	-0.77
12	0.15L	+0.68	0.26R	-0.89
11	0.13L	+0.13	0.21R	-0.19
10	0.11R	+0.04	0.14R	-0.02

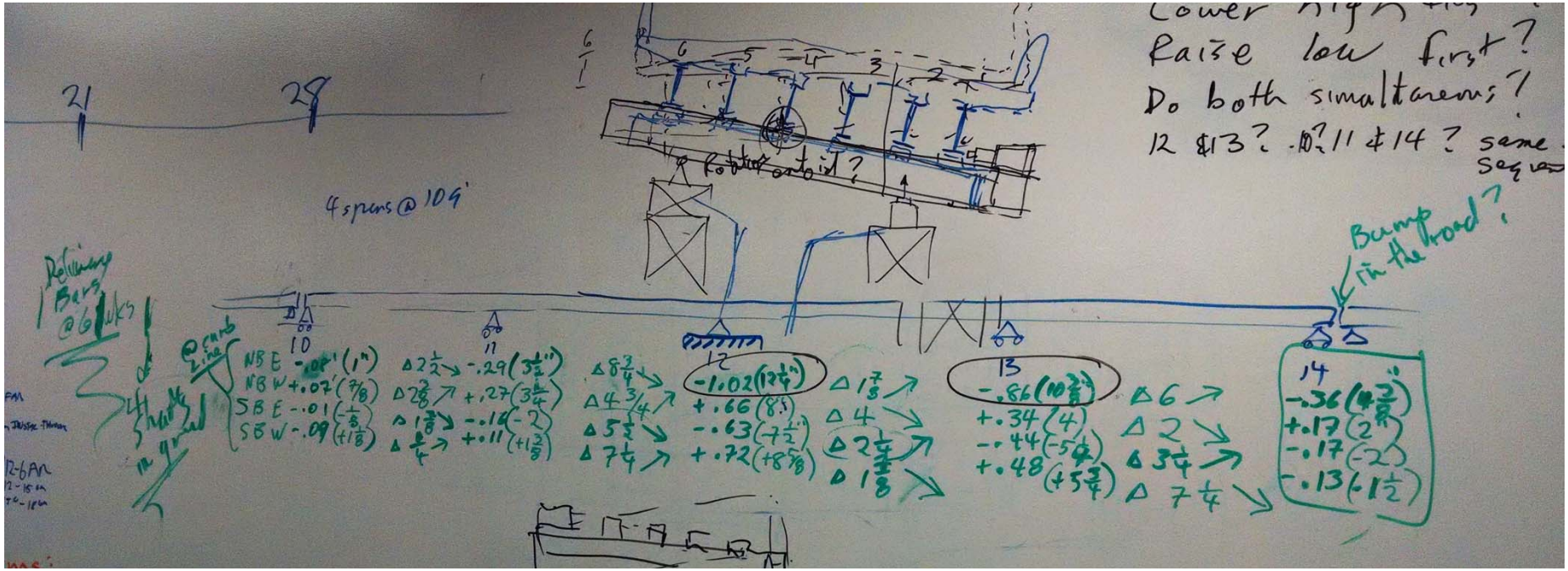
Response

- Pile Cap Inspection
  - Large Horizontal Cracks
  - No Pile Corrosion
  - Local Buckling on One Pile

Response

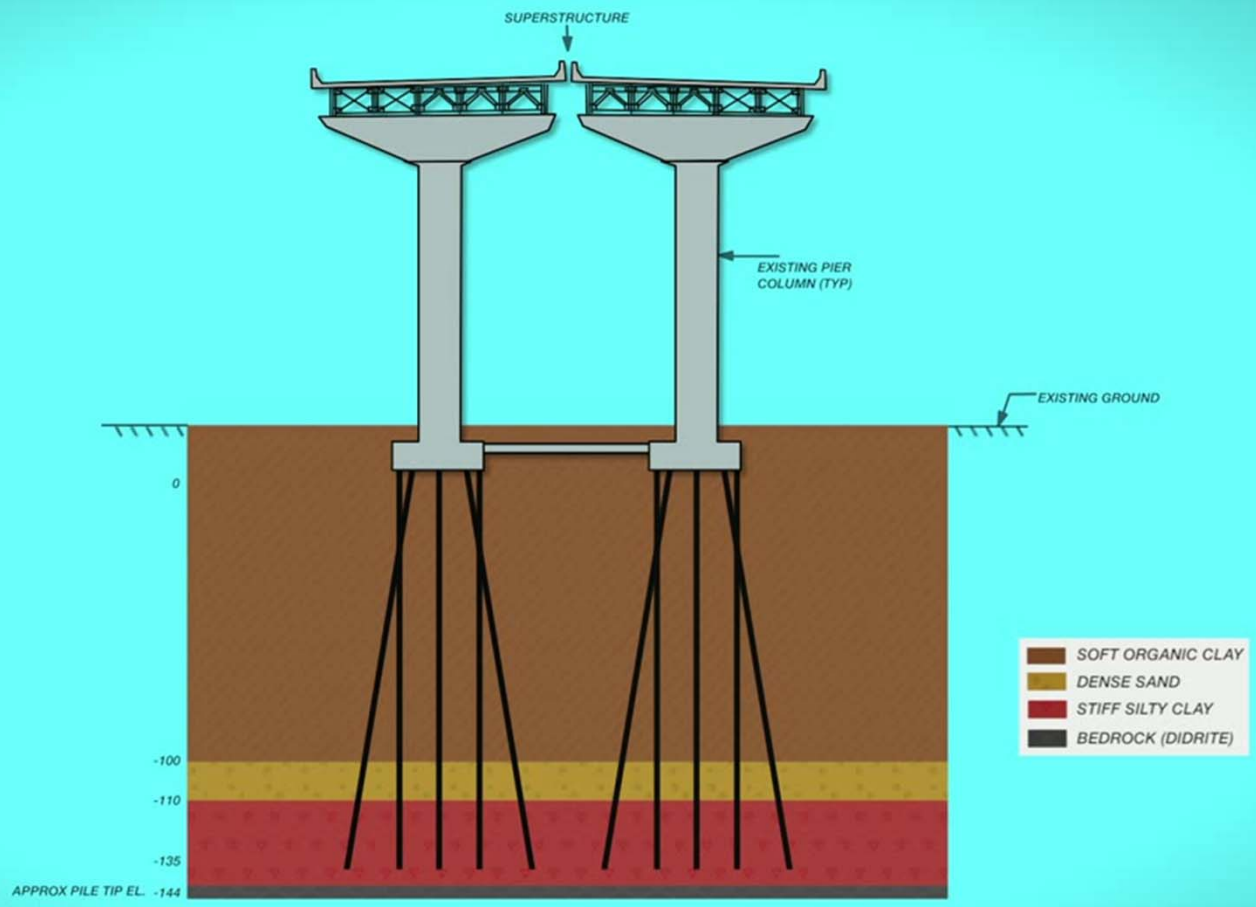
Response

- June 3: Meeting with AECOM to discuss alternatives
- June 4: Meeting of minds in the “war room”. (DelDOT Bridge, DelDOT Construction, AECOM, FHWA, U of D, JD Eckman, Ted Zoli from HNTB)
- June 5: Scope for repairs is set.



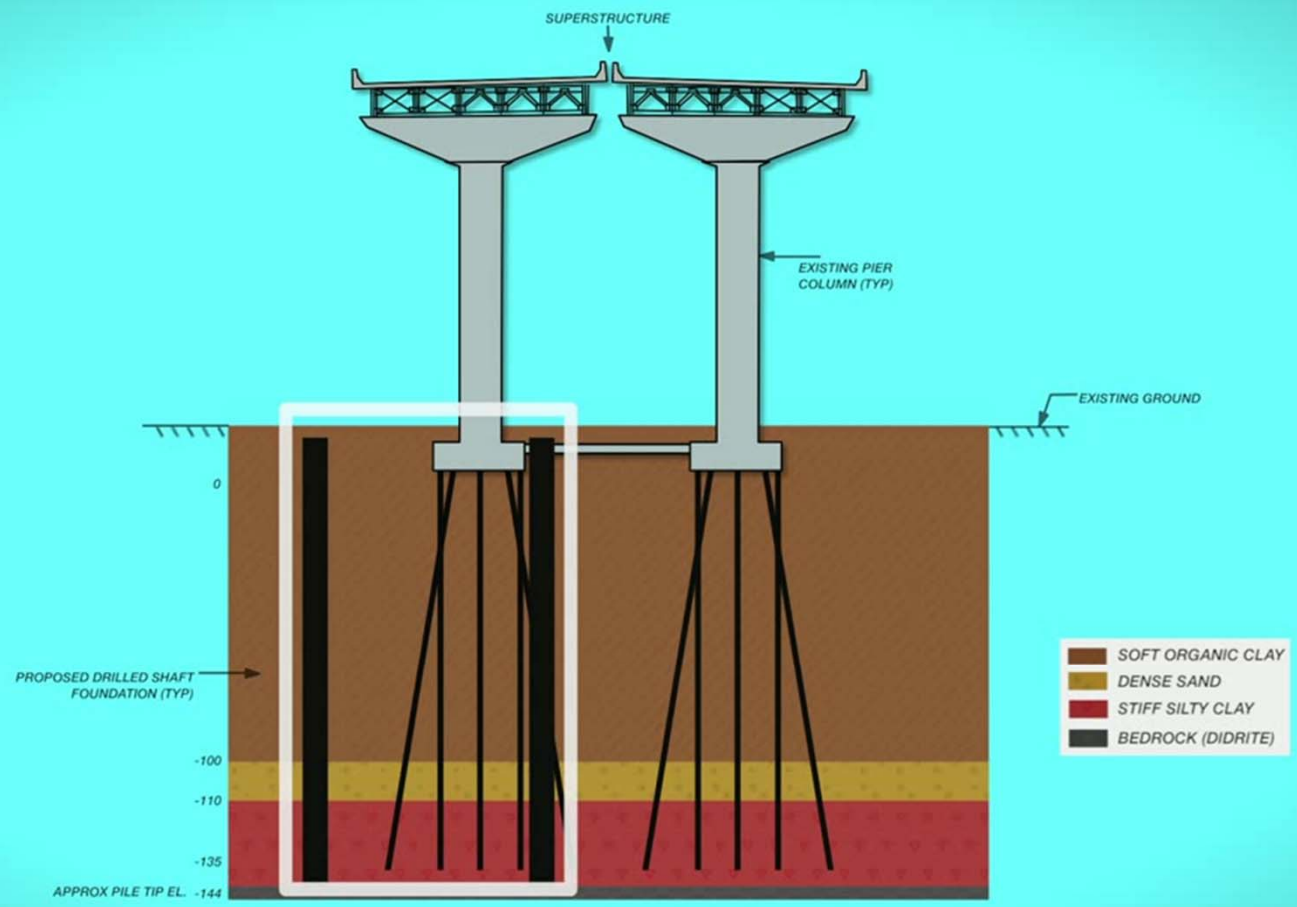
Response

- Initial Considerations
  - Which piers are damaged
  - Which piers are ok
  - Minimize disturbance to structure
  - Schedule
    - How long will I-495 be closed
  - Repair approach
    - Bridge replacement
    - Pier replacement
    - Underpinning
    - Shafts or micro piles
  - Temporary support used in final product
- Decisions
  - Piers 10 and 15, OK as is
  - Underpin Piers 11 and 14
  - Replace Piers 12 and 13
  - Drilled Shafts and Grade Beams
    - 4-ft diameter
    - Casing to bedrock
    - Rebar from Tappan Zee
  - Superstructure OK
  - Tie piers together at top
  - Work southbound bridge (west piers) first
  - Bridge Jacking to return superstructure to as-built condition
  - Jack at piers 12 and 13 first



PROPOSED FOUNDATION REPAIR

AECOM



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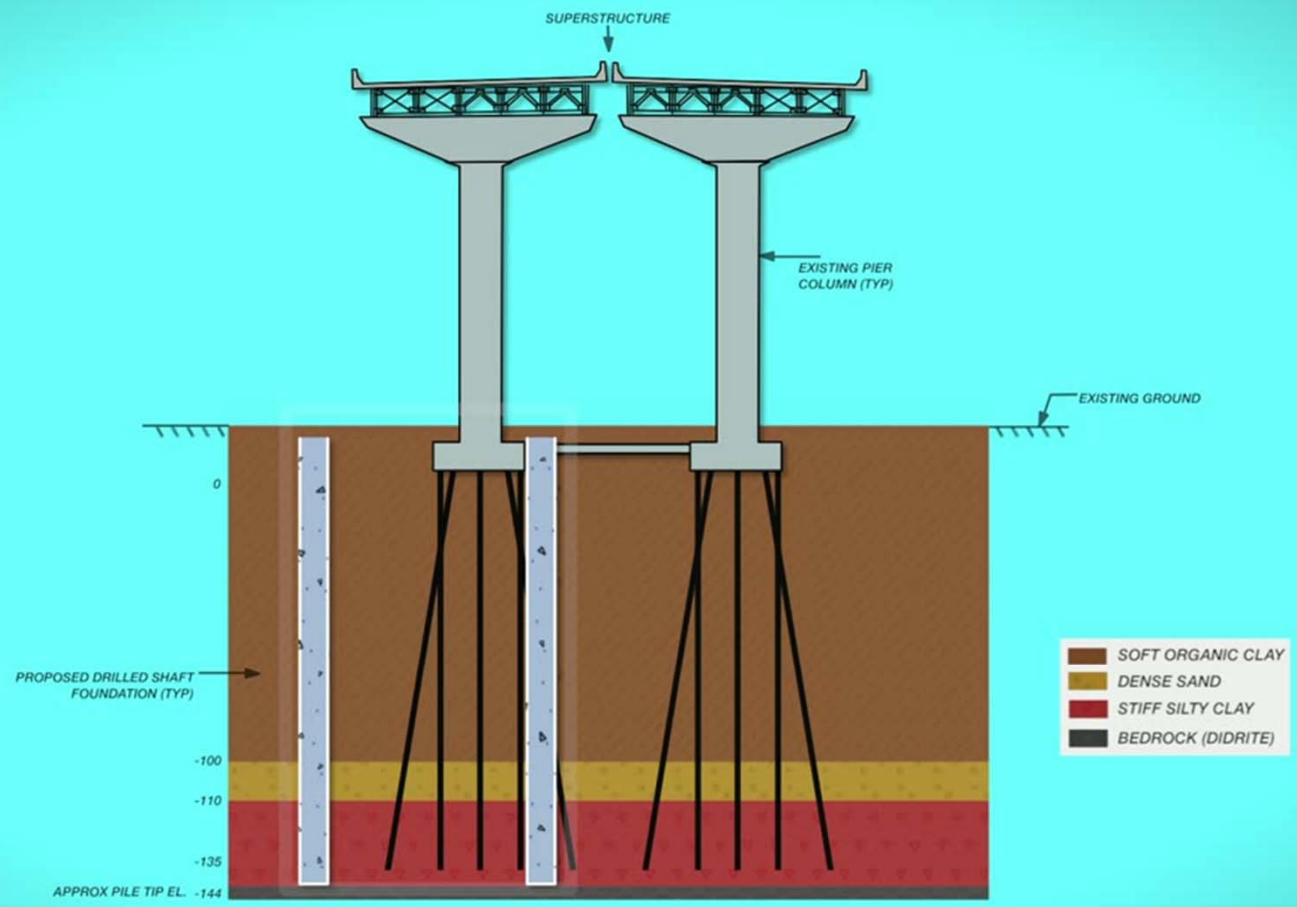

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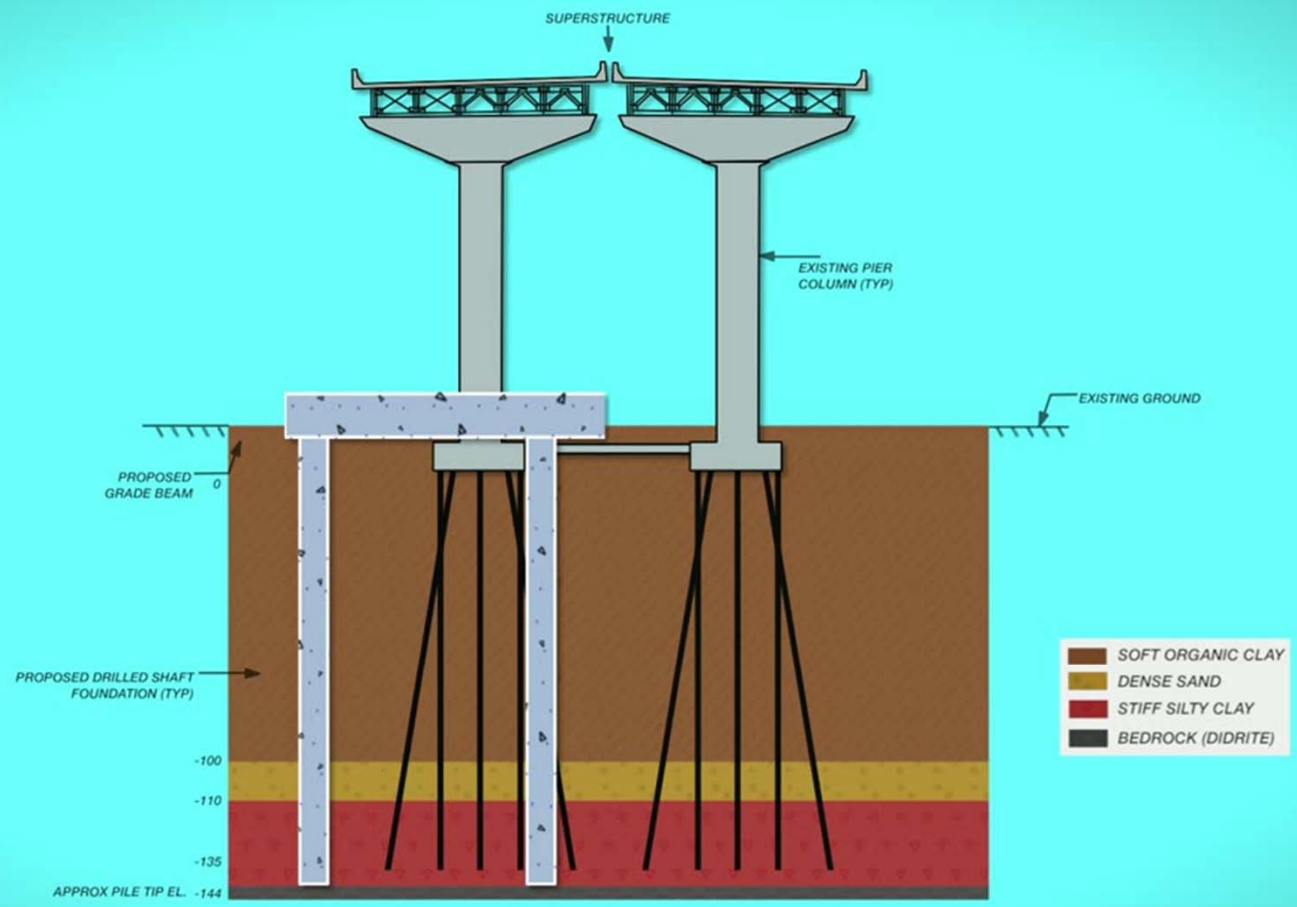

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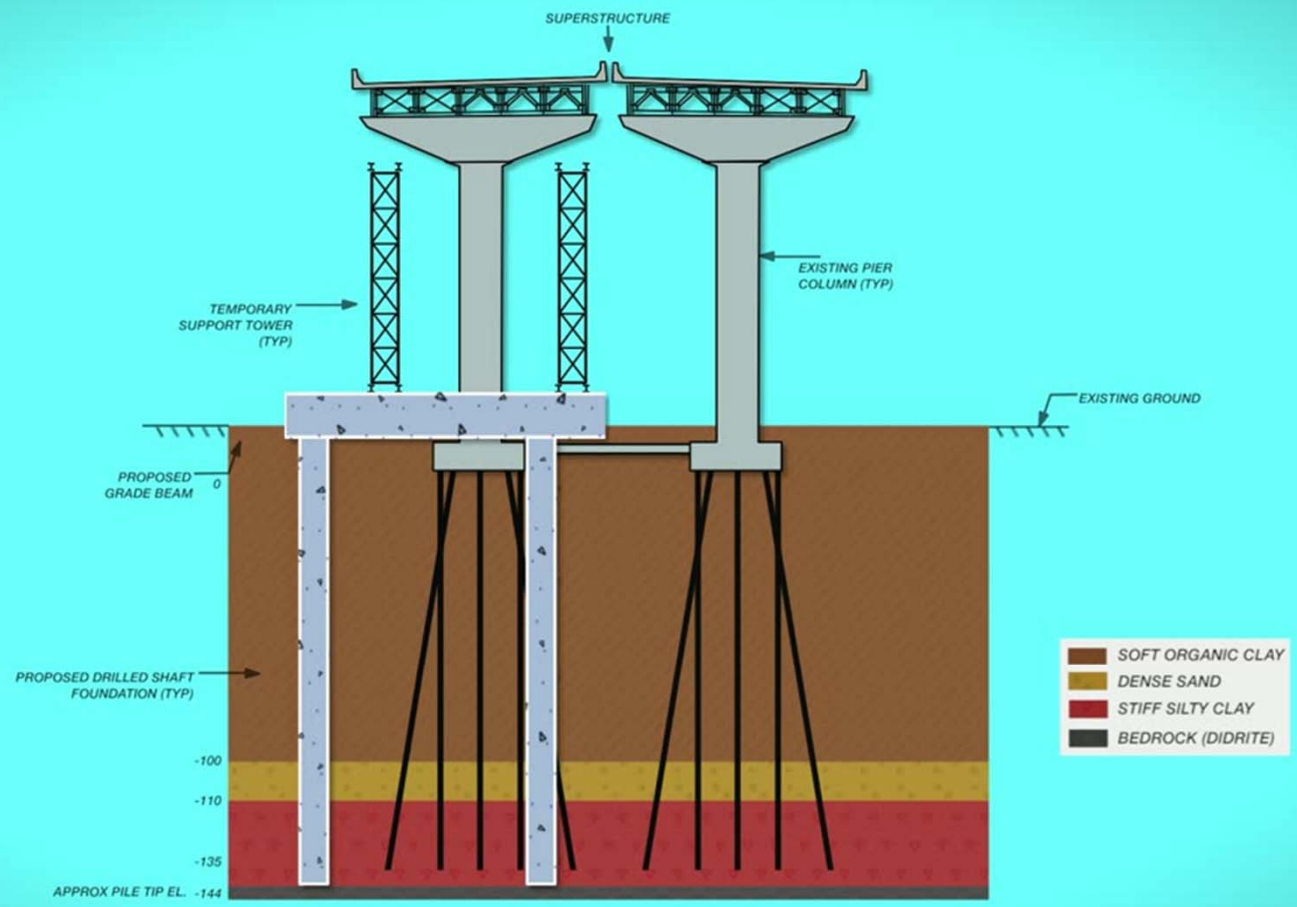

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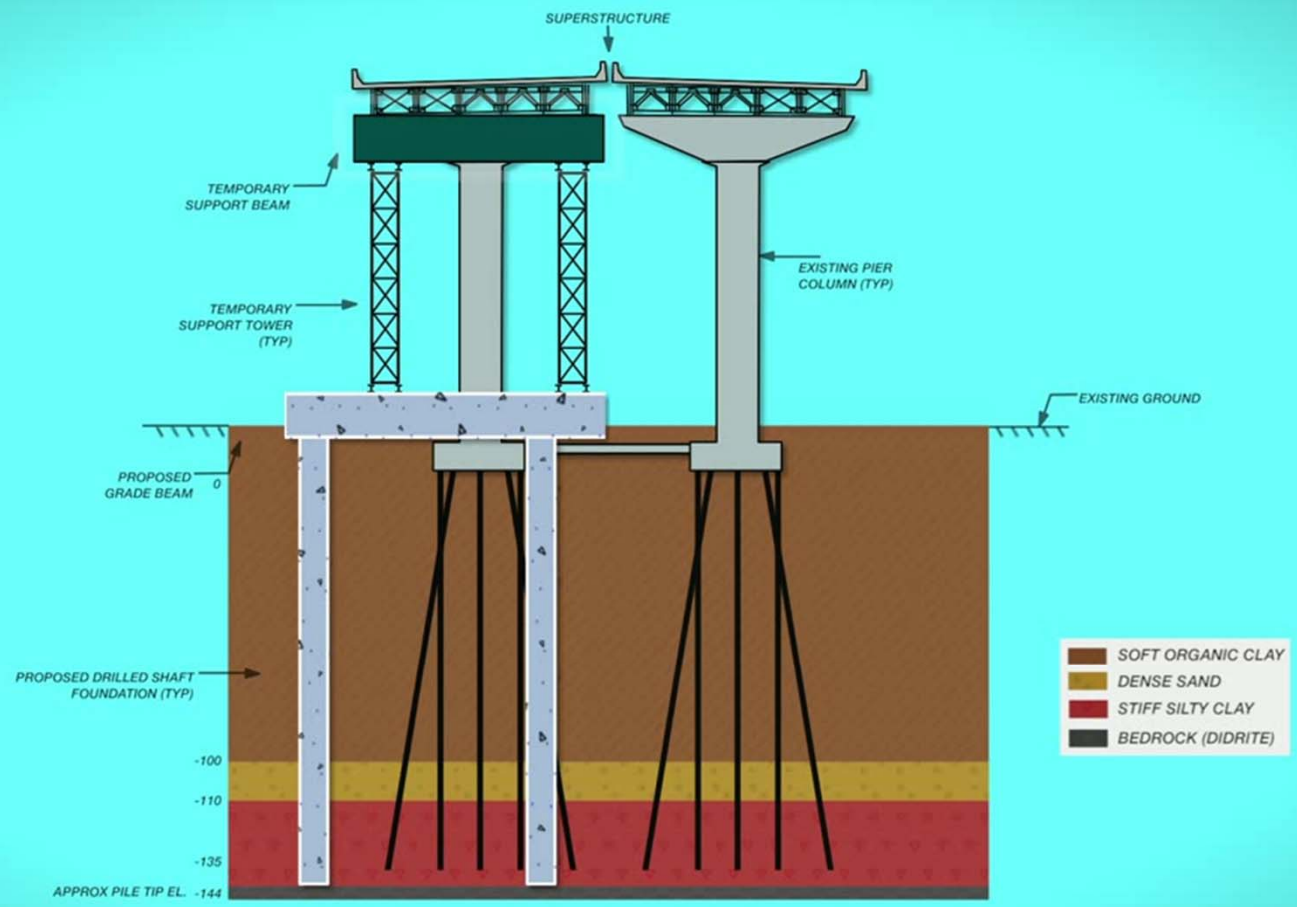

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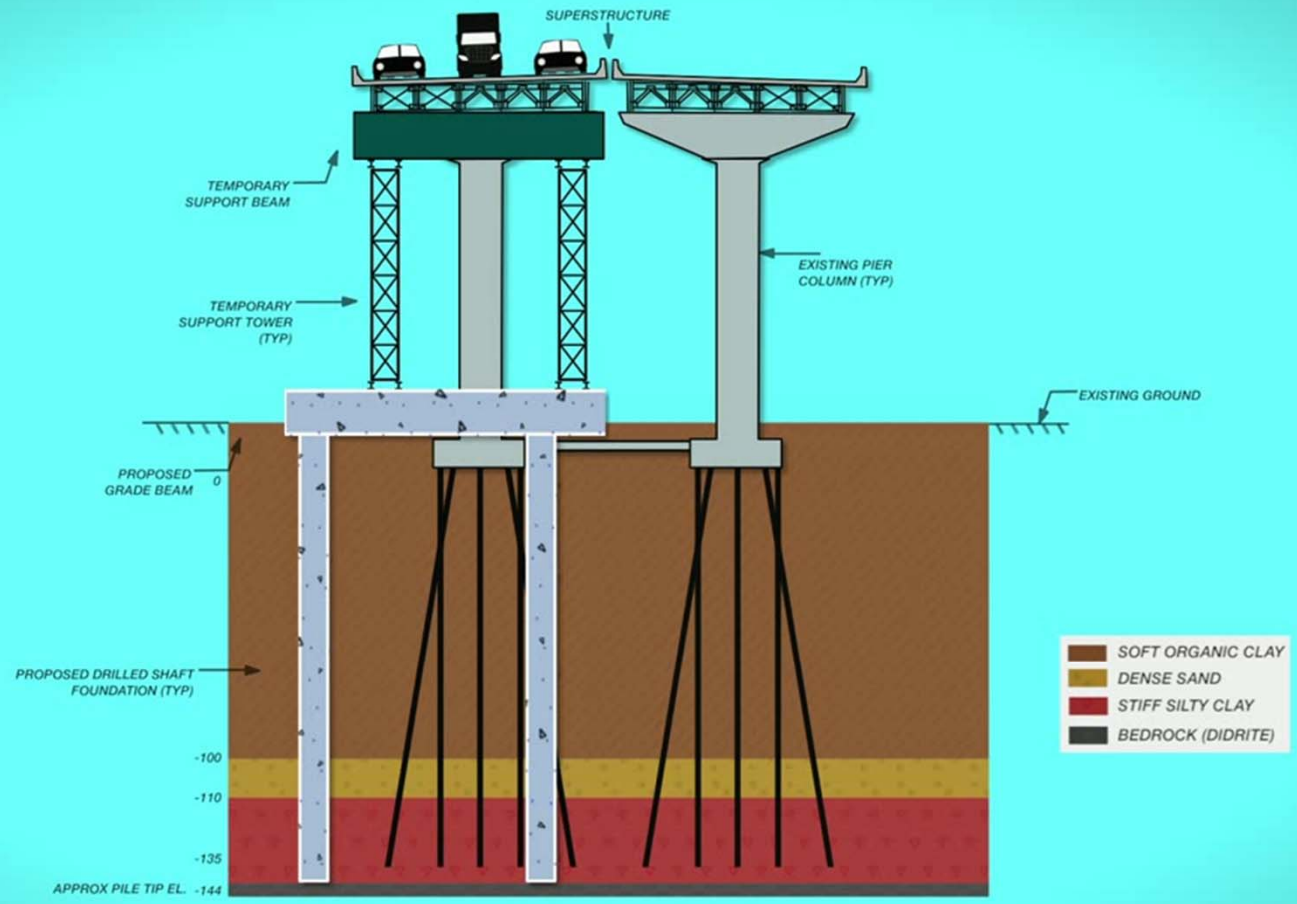

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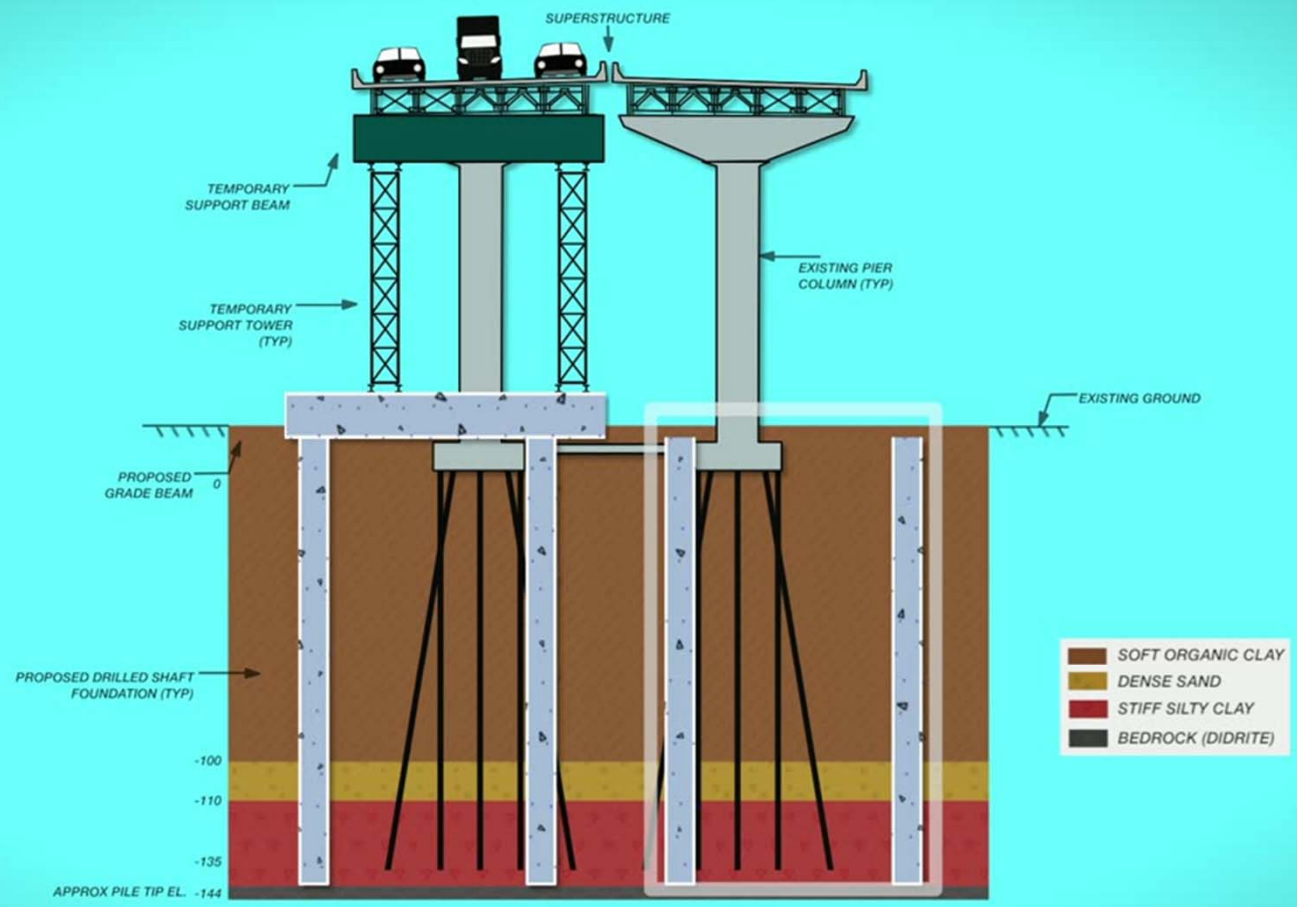

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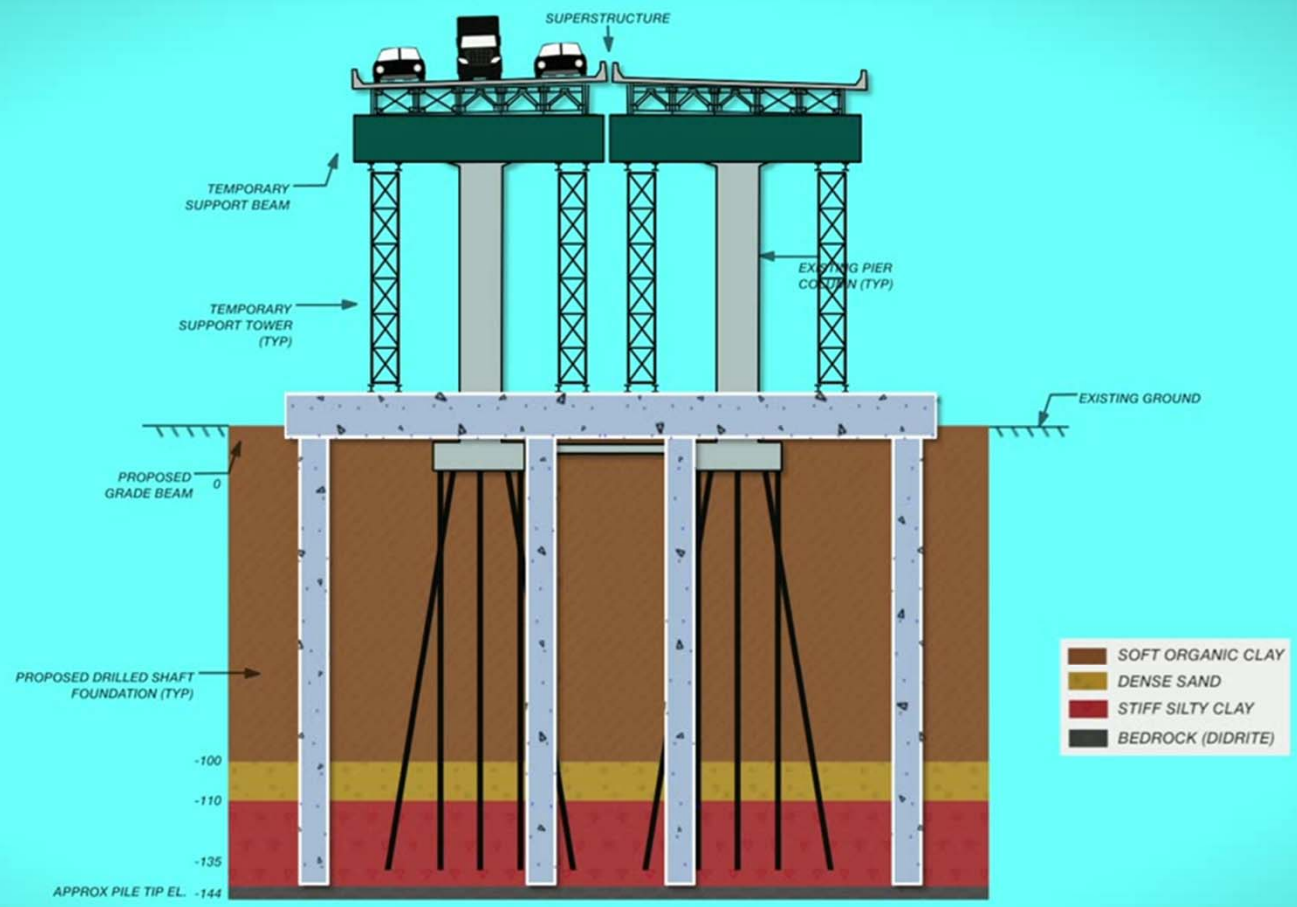

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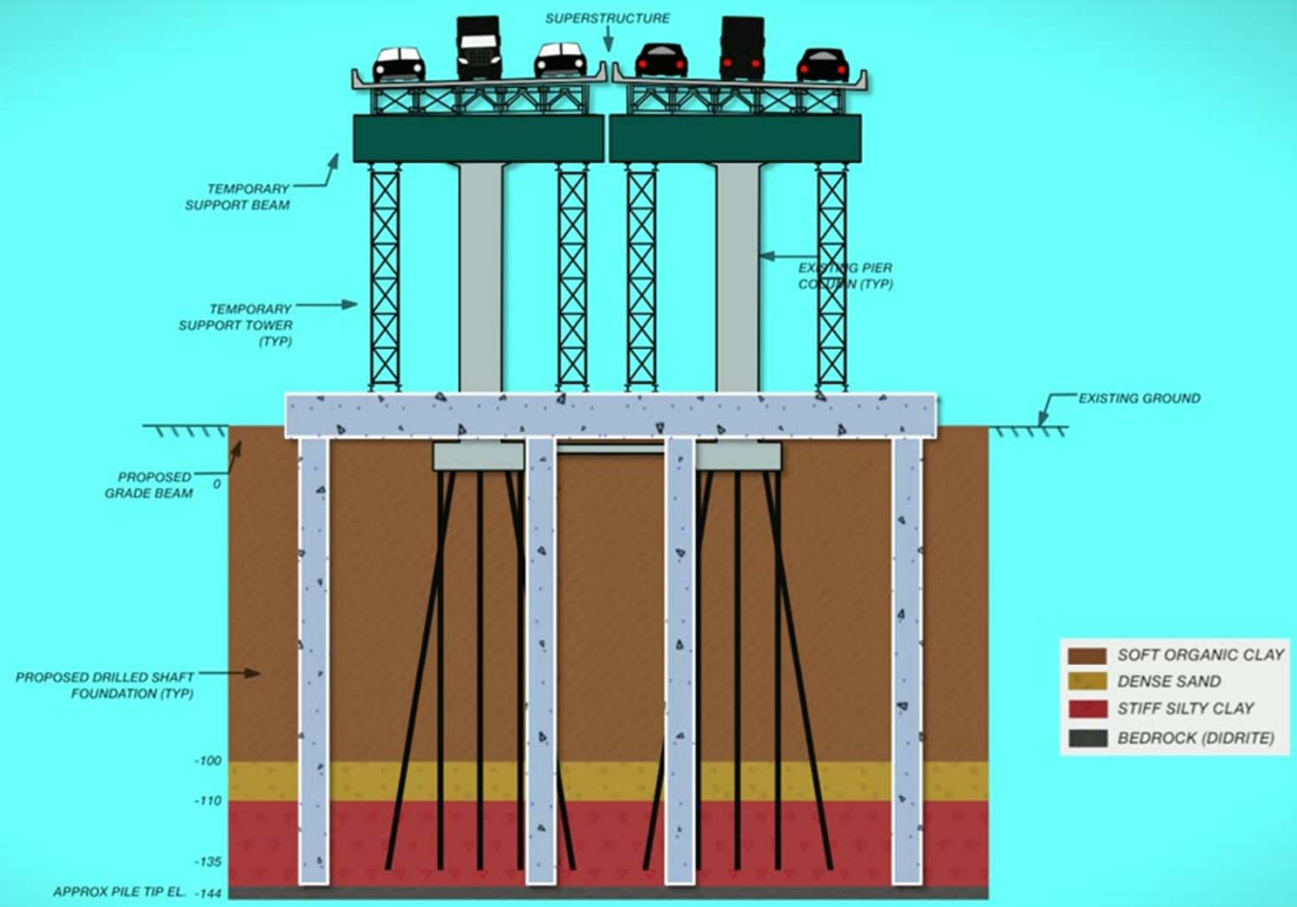

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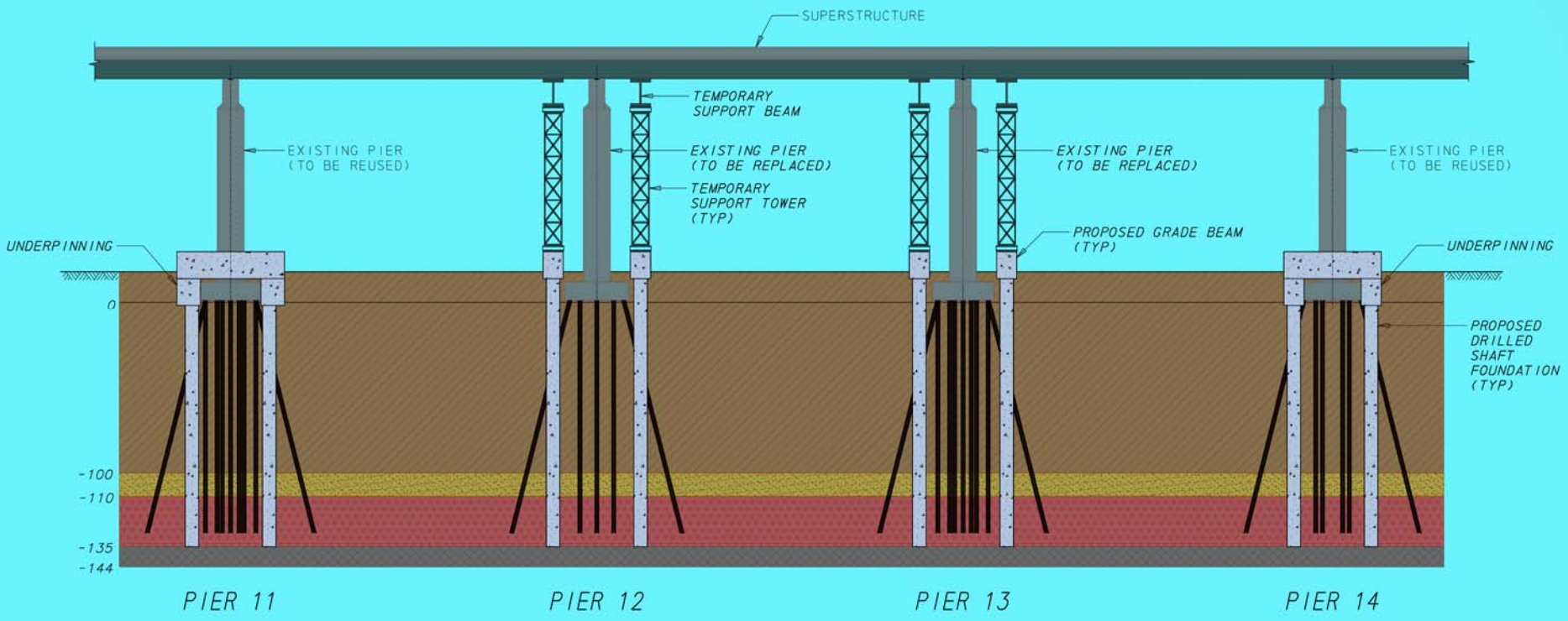
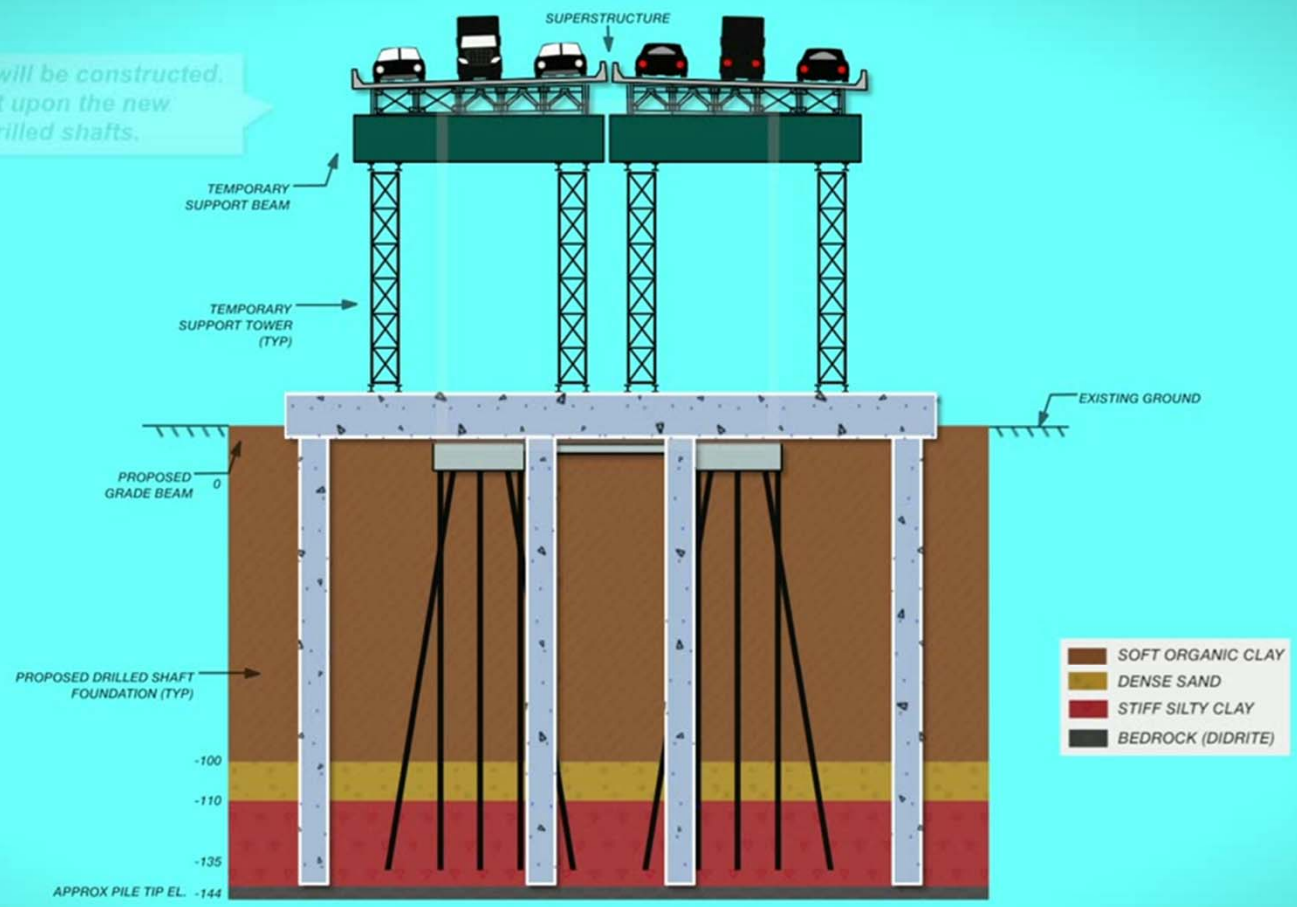


PROPOSED FOUNDATION REPAIR / TEMPORARY SUPPORT ELEVATION

AECOM

A new three column pier will be constructed. The new pier will rest upon the new grade beam and drilled shafts.



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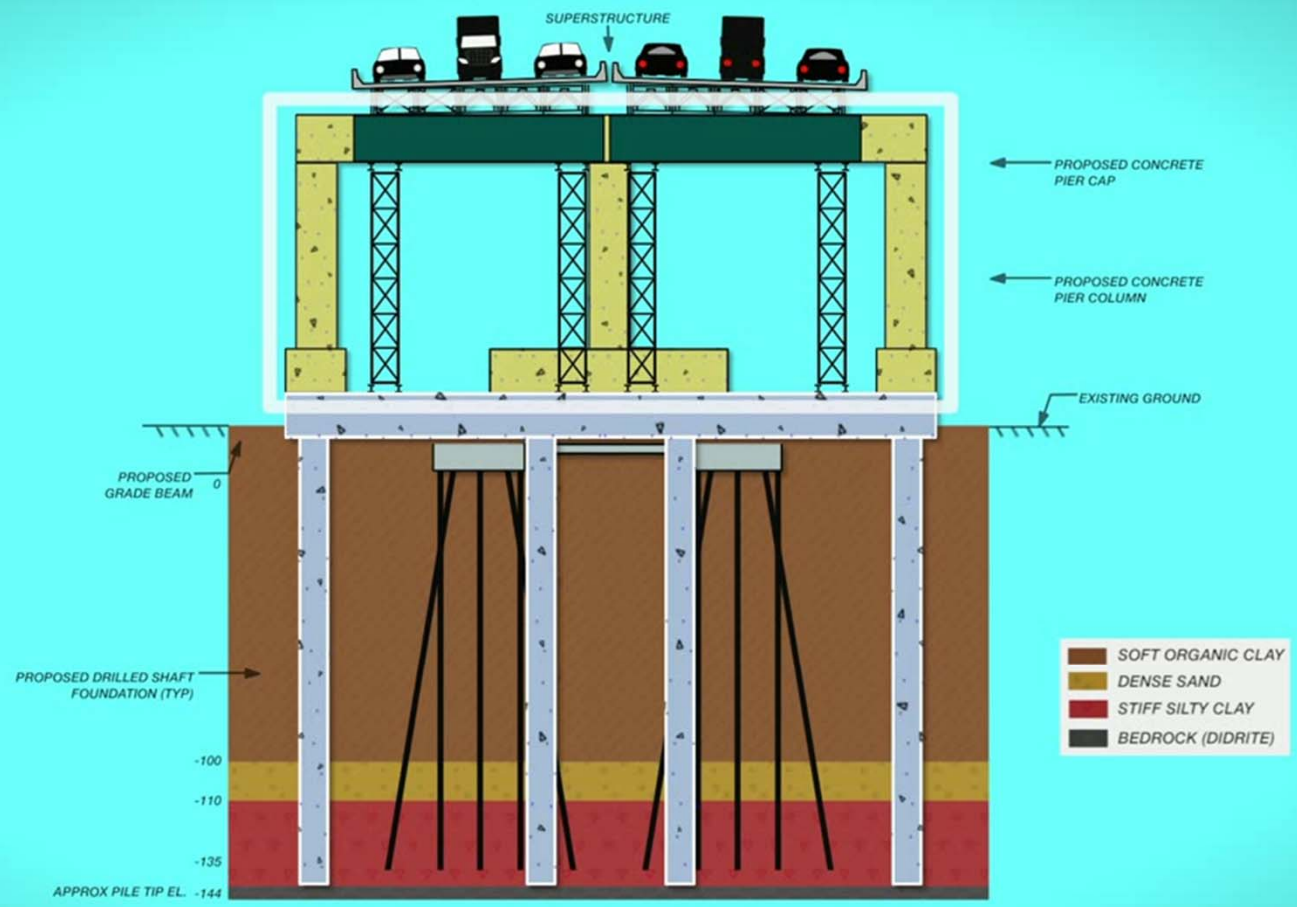

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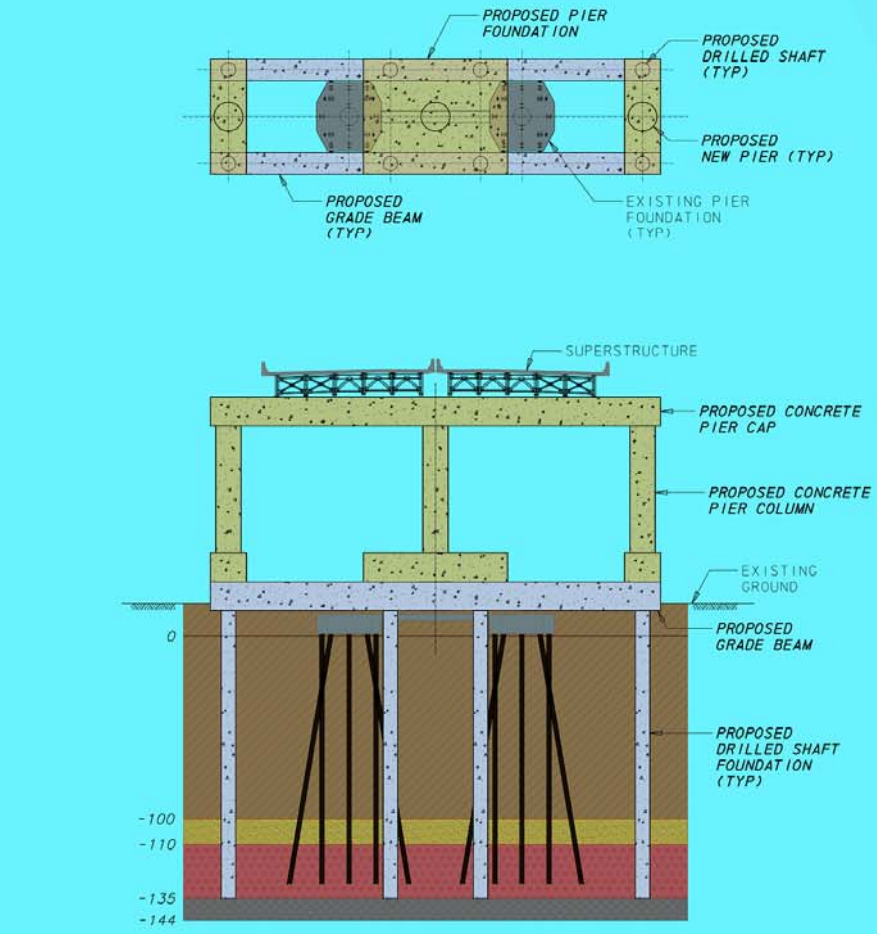


PROPOSED FOUNDATION REPAIR (FINAL CONDITION)

Public Relations Efforts

- All interview requests went through PR Section.
- A project website was set up the day after the bridge was closed.
- Weekly project updates were posted on the website.
- Conducted interviews with many engineering magazines, newspapers and television news programs.
- There were 16 FOIA requests related to this incident.
- The DelDOT PR Section and the Secretary's Office did an excellent job of managing the message that the Department sent to the public.

FOIA Documents from 5/29/2014 thru 6/11/2014

Public Relations Efforts

Shailen Bhatt

Secretary of Transportation

Public Relations Efforts

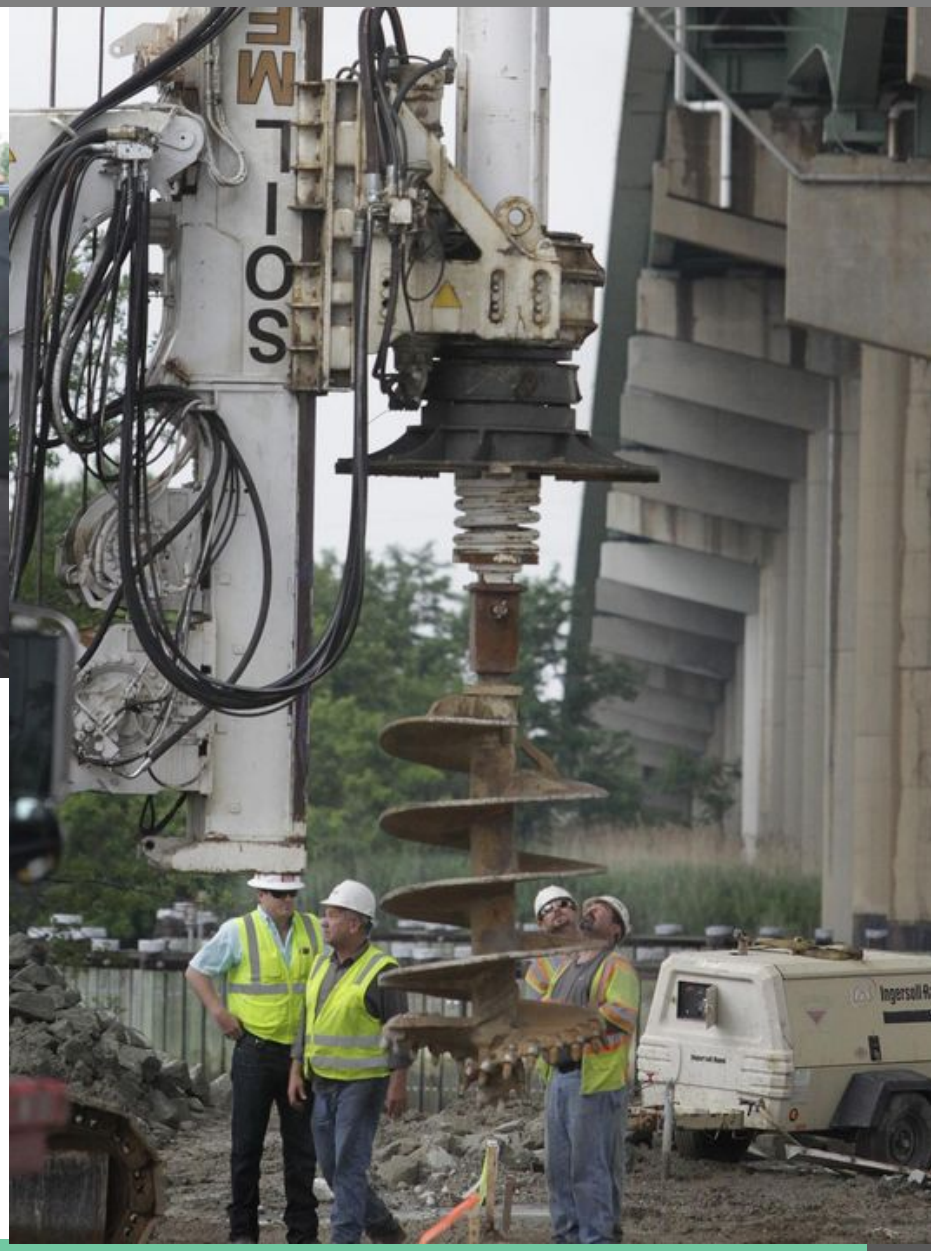
First Press Conference 6/3/2014

Public Relations Efforts

The Governor Visits the Bridge

6/5/2014

Public Relations Efforts



Secretary Foxx Visits the Bridge

6/13/2014

Public Relations Efforts

President Obama
Visits the Bridge
7/17/2014

Lessons Learned

- Don’t become complacent. The responsibility of being a bridge owner is huge. DelDOT now has a new High Priority Road Condition process.
- Grab a journal and document EVERYTHING.
- When responding to an emergency, know that PR will be a vital component and have them on the project team. They need to be at meetings and understand the project to accurately convey the message to the media.
- Write every e-mail and memo as though it will be in the paper…because it probably will.
- Assemble the proper team. If construction is complex, bring the Contractor in early.
- Limit the number of chefs in the kitchen.

Lessons Learned

- You must rely on all members of your team to do their part. We are typically at our best in emergency situations.
- Daily progress reports ensure that any delays are dealt with immediately (especially when they are given to the Secretary and the Governor).
- Don’t forget to take care of yourself. (Eat. Stay hydrated. Sleep.) Adrenaline carries you at first. Fatigue and stress can affect your decision making.
- Keep a positive outlook and focus on getting the job done.

Inspirational Quotes at the Field Office

“I am convinced that life is 10% what happens to me and 90% of how I react to it.”

“Everything will be fine in the end. If it’s not fine now, it’s not the end.”

Acknowledgements

- AECOM
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  - Daniel Montag, PE
  - Khalid Mohamed, PE
- HNTB
  - Ted Zoli, PE
- JD Eckman, Inc.
  - Jim Roberts
  - Greg Burkhart
  - Matt Hurley
  - Josh Smolinsky
  - Joe Rovnan
- AH Beck
  - Ian Kolda
- Tappan Zee Constructors
- All States that pitched in to offer assistance with permits, materials and knowledge.

QUESTIONS?