FINDING COMMON GROUND

DEEP FOUNDATIONS INSTITUTE

DFI®

DFI Augered Cast-in-Place and Drilled Displacement Pile Technical Committee

Augercast Piles for Infrastructure Projects

Presentation to Southwest Geotechnical Engineering Conference

May 21, 2024

FINDING COMMON GROUND

About the Deep Foundations Institute:

Mission Statement:

"To bring together multidisciplined individuals and organizations to find common ground and create a shared vision and a consensus voice for continual advancement in the deep foundations industry"

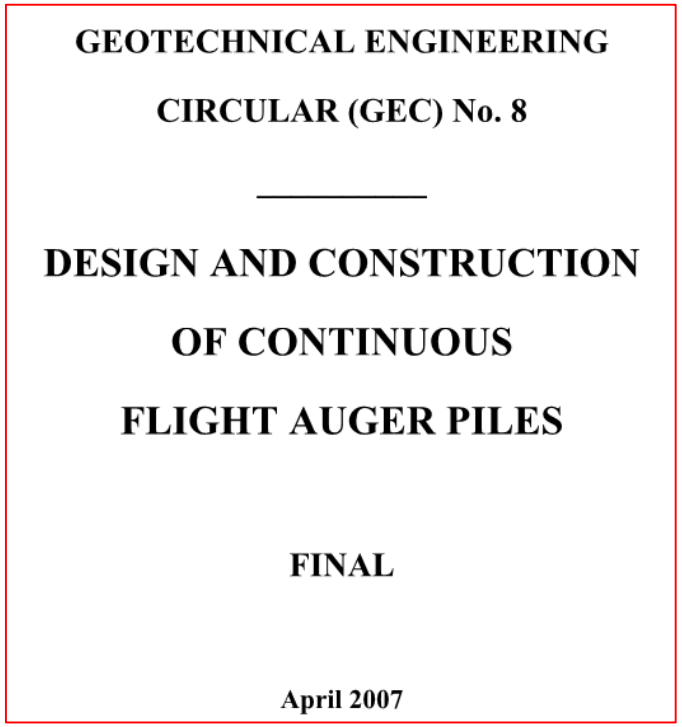
Presentation Outline

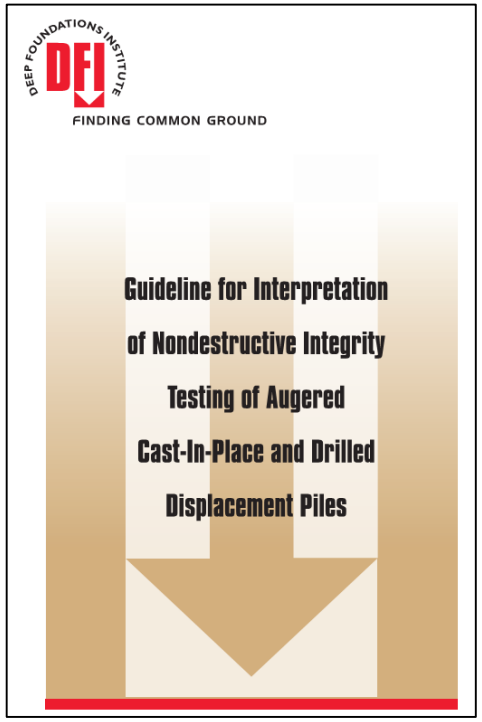
- DFI Augered Cast-in-Place & Drilled Displacement Pile Committee: Who are we and what have we done
- Common Terminology and Pile Components
- Sustainability in ACIP/DD Piles
- Miami Signature Bridge Case Study

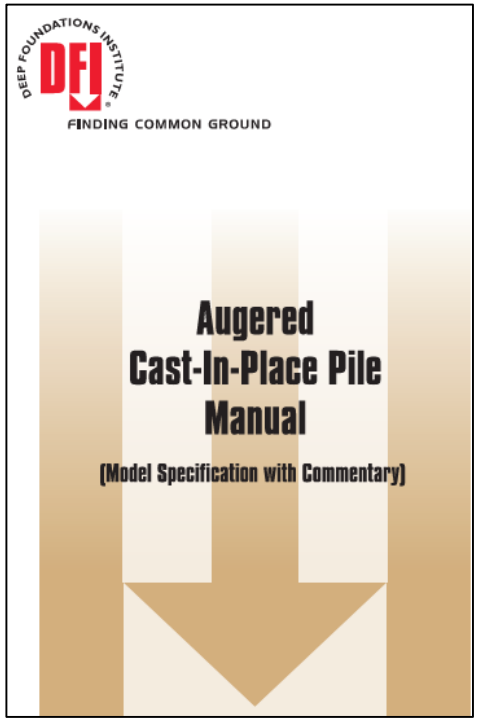
Recent ACIP/DD Pile Committee Activities

- 2016 FDOT ACIP Pile Installation, Monitoring and Testing program report published along with associated Thermal Measurement Recording Report issued by USF to FDOT
- 2017 Research into lateral/pw pressures generated when displacement piles are installed
- 2018 Research into thermal measurement and manually measured pile diameters
- Assisting ACIP Pile Specifications for FDOT, NAVFAC, and AASHTO

DFI Technical Resources







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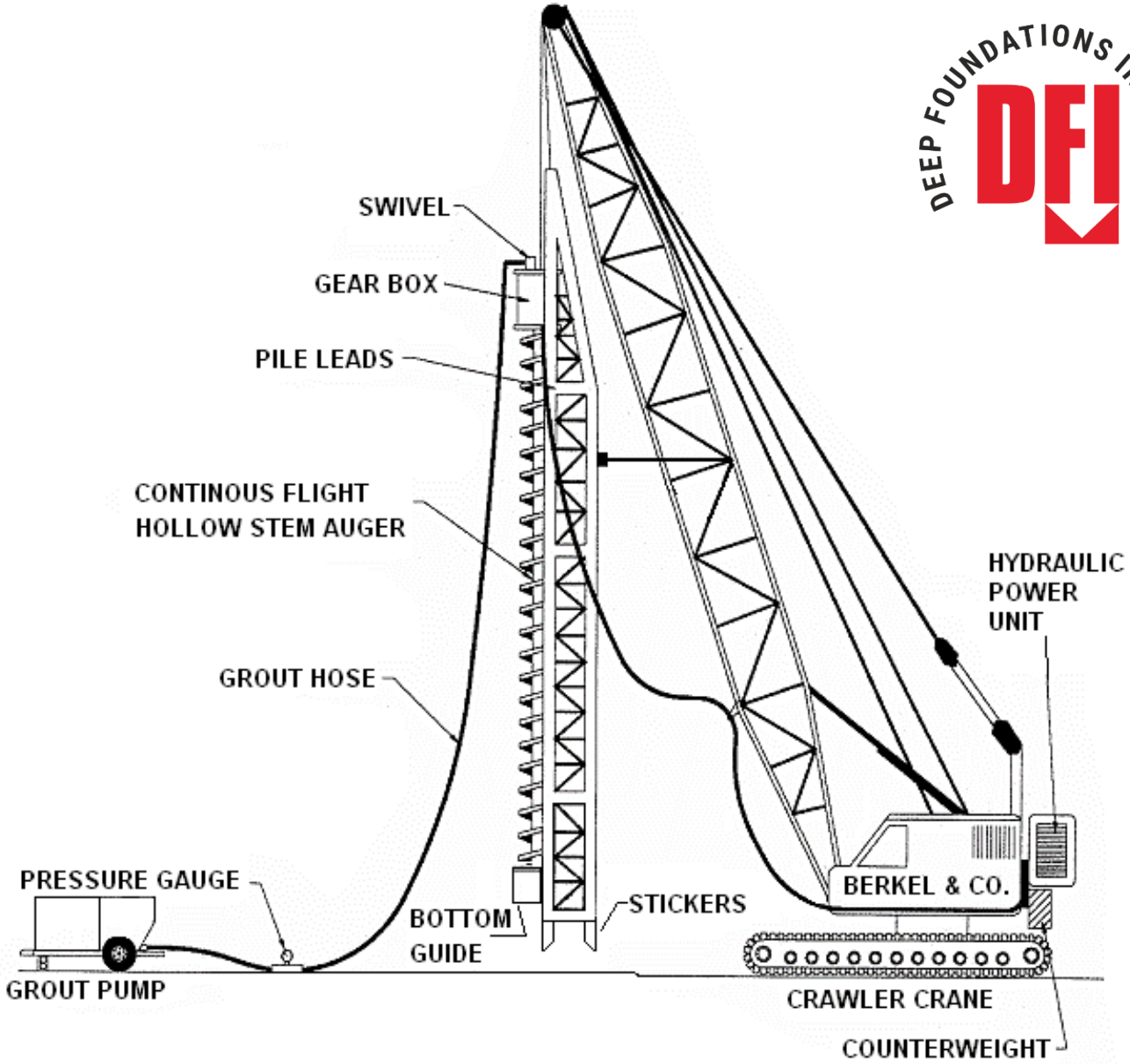
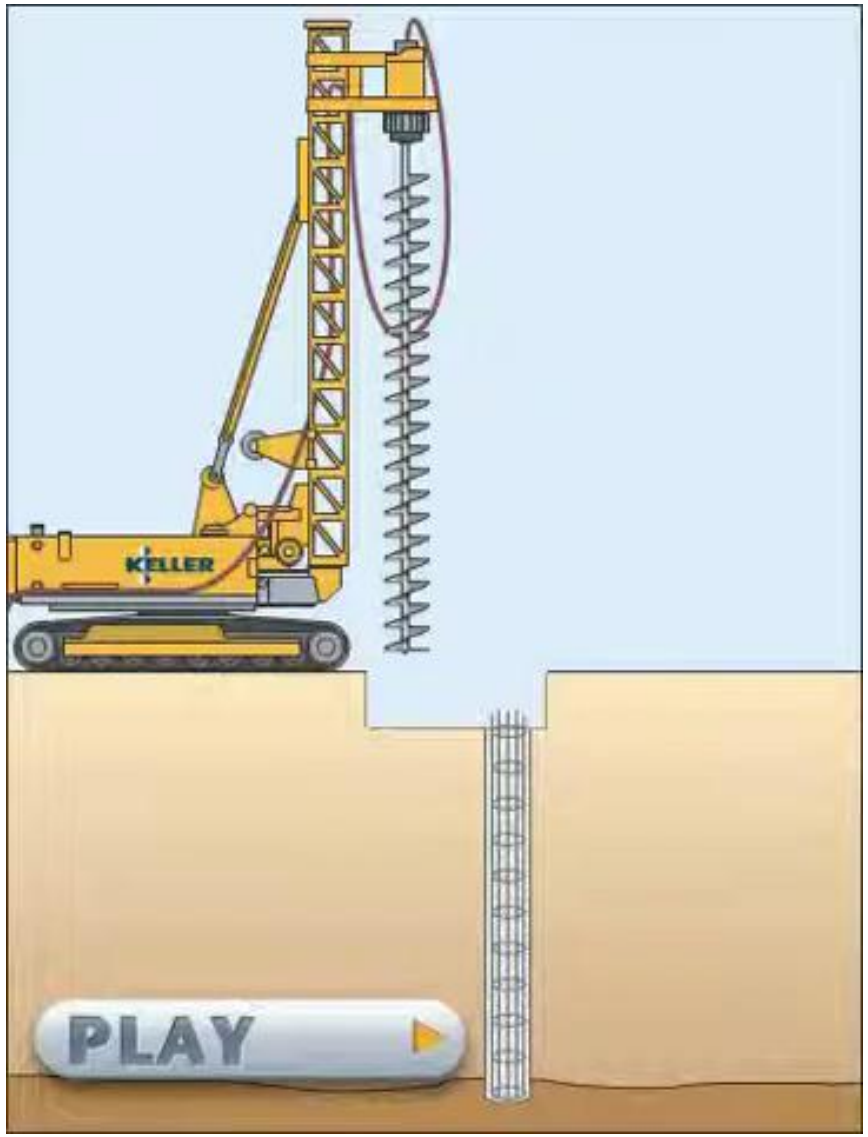
Pile Terminology

- Continuous Flight Auger (CFA)
- Auger Cast-in-Place (ACIP)
- Auger Pressure Grouted (APG)

All refer to single-pass, cast-in-place foundation systems with steel reinforcement.





What is an ACIP pile?

- Spoils removed by rotating flights
- Auger withdrawn with grout under fluid head pressure
- Reinforcing steel inserted into fluid grout

Application of ACIP Piles in Transportation Market

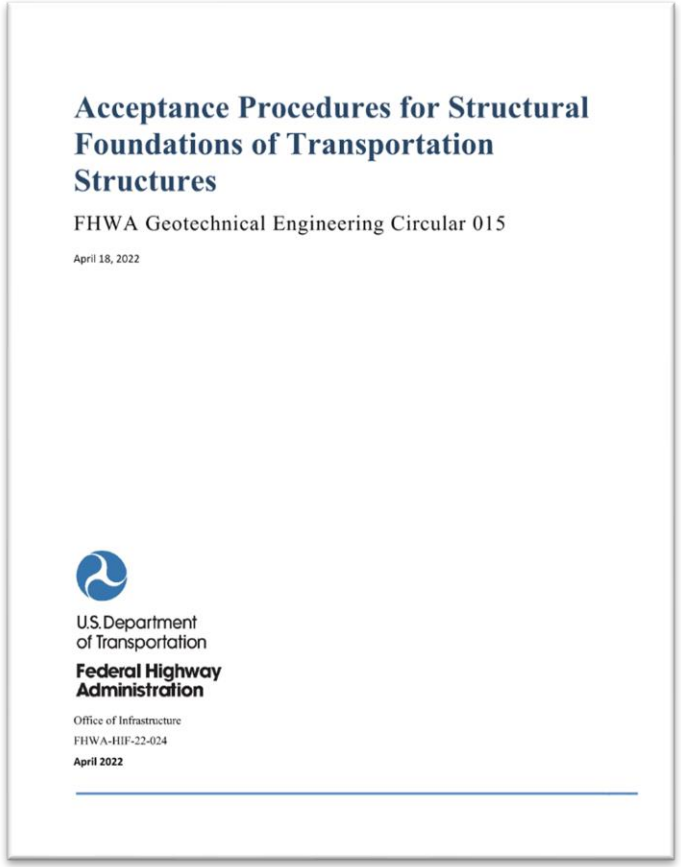
- Soundwalls in numerous states
- Excavation Support (as secant piles)
- ~20 state DOTs and FHWA have approved ACIP piles on project specified (VE) basis
- Selected Bridge Support to Date:
  - MetroRail in Miami, FL
  - Bridge / Retaining Wall Tiebacks in Canton, OH
  - I-135 in Salina, KS and Wichita, KS
  - 153rd St Bridge in Seattle, WA
  - SR-97 in Roy, UT

Application of ACIP Piles in Transportation Market

Geotechnical Engineering Circular No. 15

Acceptance Procedures for Structural Foundations of Transportation Structures

Chapter 7: Assessment and Acceptance of Continuous Flight Auger Pile Foundations



SUSTAINABILITY AND ACIP TECHNOLOGY

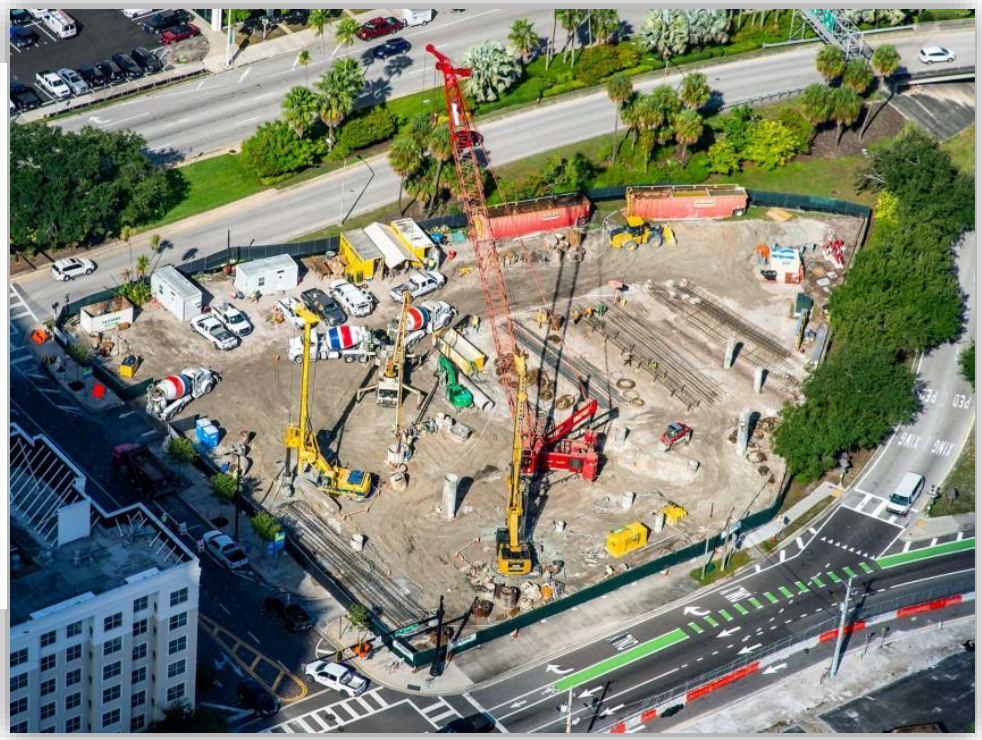
- IIJA/Bipartisan Infrastructure Law requires development of a carbon reduction strategy
    - “Facilitate approaches to the construction of transportation assets that result in lower transportation emissions as compared to existing approaches.” [§ 11403; 23 U.S.C. 175(d)(2)(B)]
- Carbon reduction strategies: higher strength concrete with longer and more slender shafts can result in carbon savings

SUSTAINABILITY AND ACIP TECHNOLOGY

- Case Study in Carbon Emissions Reduction (Keller project in Florida):
  - High rise residential building founded on sand underlain by limestone

Mix Data

Lab. No	7262	7263	7264
Cement lbs/cy	475	571	721
Fly Ash lbs/cy	119	143	180
Sand (ssd) lbs/cy	1397	1279	1096
#57 Rock (ssd) lbs/cy	1459	1470	1487
Water Red./Retarder oz/cwt	5	5	5
W/C Ratio	0.50	0.43	0.37
28 Day Avg (psi)	5333	6923	8307

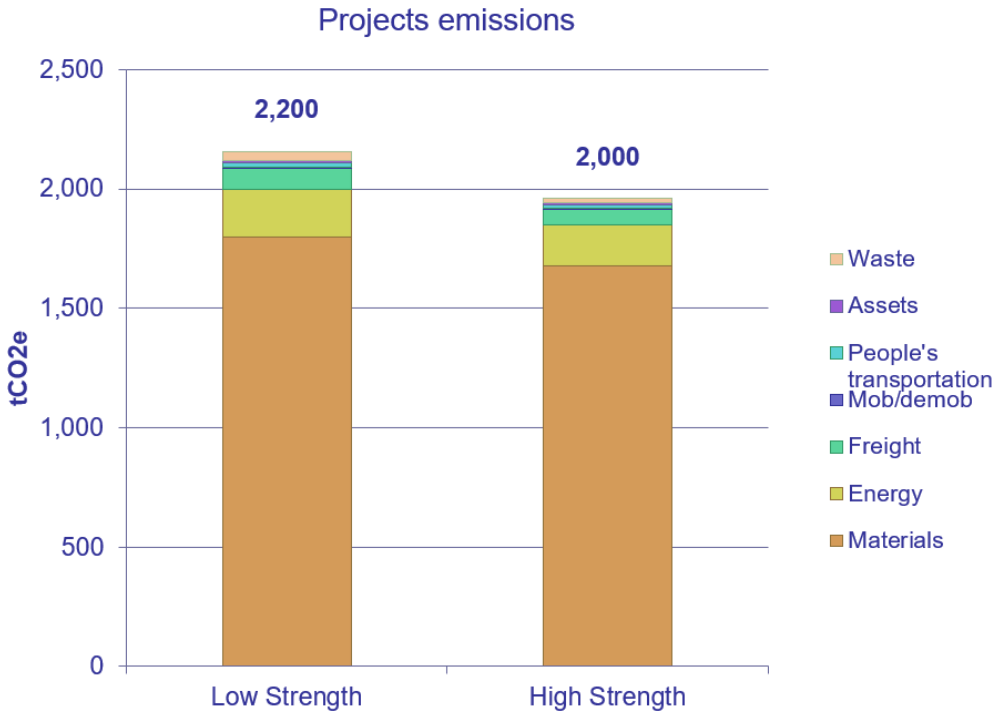


SUSTAINABILITY AND ACIP TECHNOLOGY

- Case Study in Carbon Emissions Reduction (Keller project in Florida):
  - High rise residential building founded on sand underlain by limestone

    - **10% reduction in carbon emissions**
    - 11 days schedule savings
    - 20% cost savings

    - Decreased diameter
    - Increased length
    - Increased concrete strength



SUSTAINABILITY AND ACIP TECHNOLOGY

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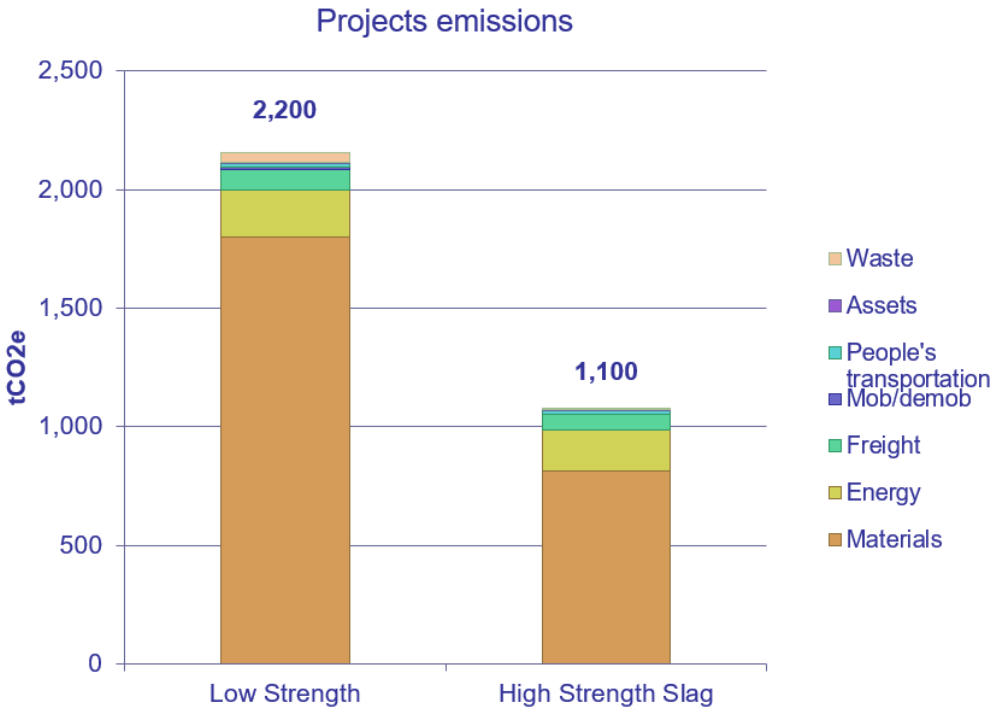
Explore Slag Cement Substitution

Limestone cement
Slag cement 25%
Slag cement 75%

Slag substitution decreased carbon emissions from materials by 1,000 tons



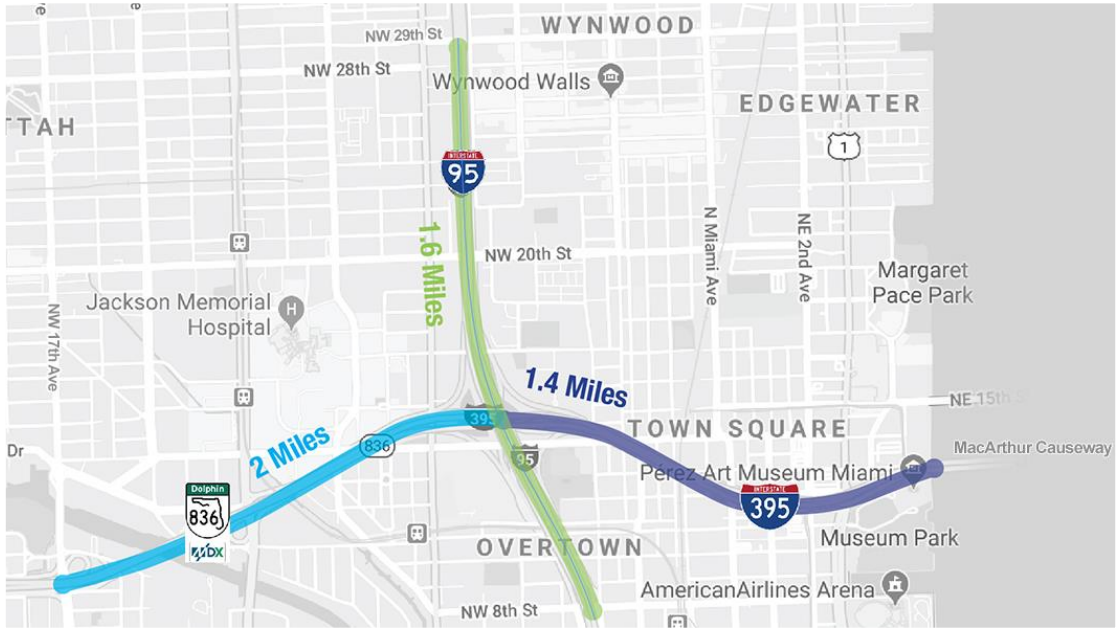
Case History: FDOT I-395/SR-836 Signature Bridge

- Client: Florida Department of Transportation (FDOT)

- Multiple phases: ~5-year schedule
- ~1000 x 30” dia. piles up to 90’ deep for connecting and ancillary structures
    - Some battered and low headroom piles
- ~800 x 36” dia. piles 115-140’ deep for main Signature Bridge structure

- General Contractor: Archer Western de Moya JV
- Deep Foundation Contractor: Keller North America
- Geotech: Universal Engineering Services (UES)
- Testing Agencies:
    - Load Test Consulting (LTC) / GRL Engineers Inc.
    - Applied Foundation Testing (AFT) / Radise International.

I-395/SR-836



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I-395/SR-836

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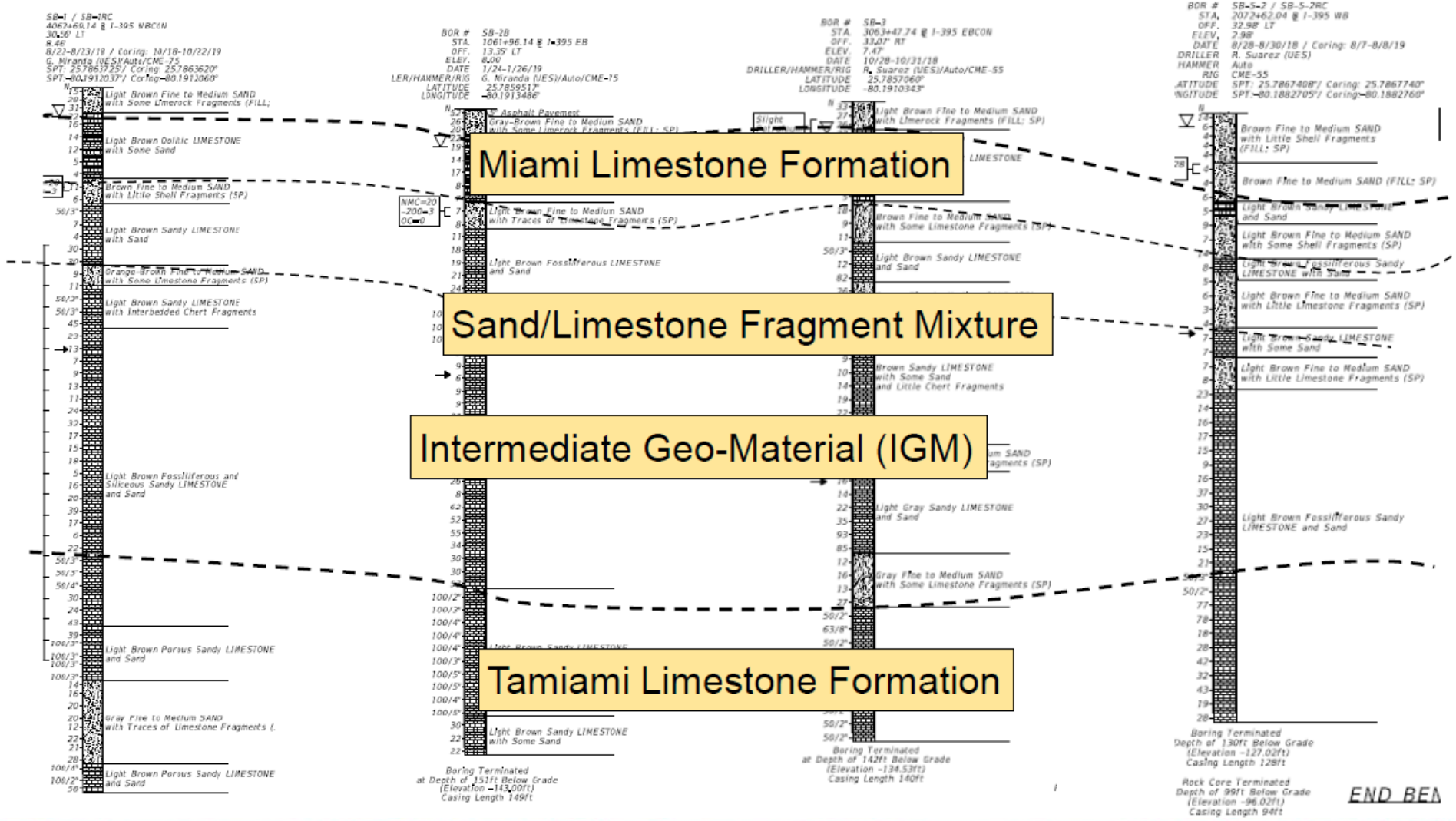
SIGNATURE BRIDGE DEEP FOUNDATION SELECTION

- Driven Piles did not achieve needed capacity in pre-design testing program
- Drilled Shafts are problematic in South Florida geology – only used for in-water piers
- Auger Cast-in-Place piles were selected by FDOT as the preferred deep foundation solution

SIGNATURE BRIDGE STRATIGRAPHY



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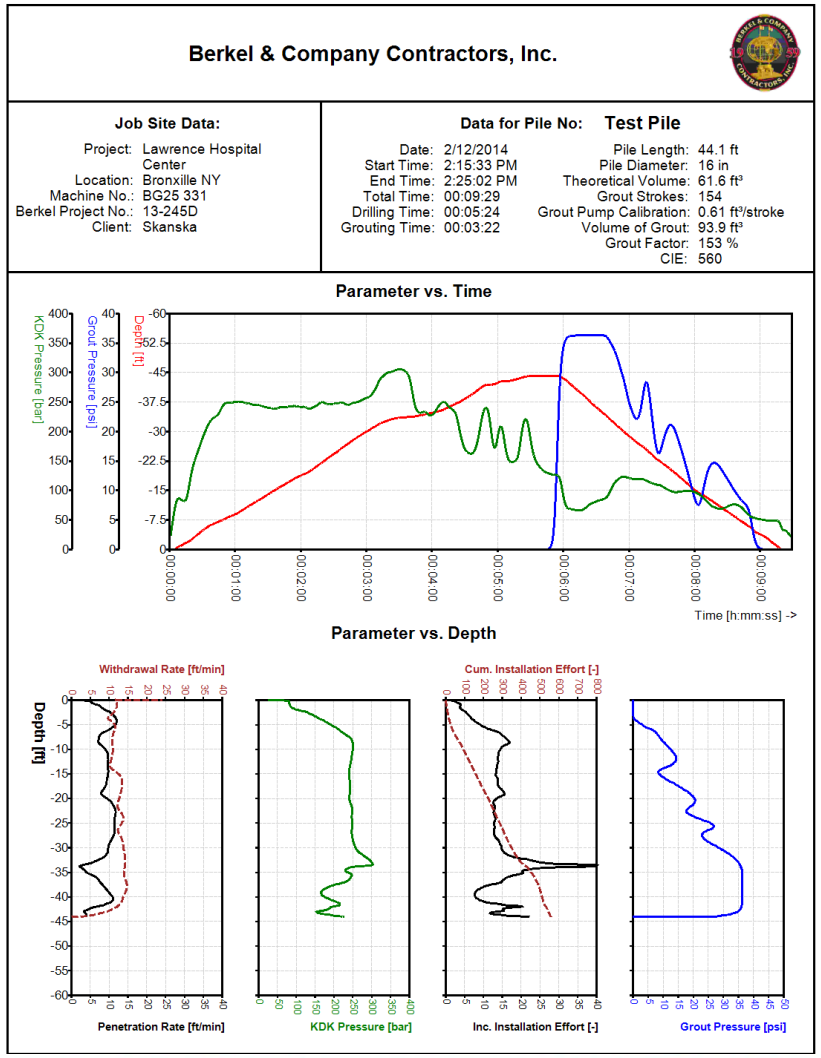
ACIP Pile Quality Assurance - During Construction

- Observe auger insertion.
- Monitor the cuttings
- Count pump strokes.
- Observe rate of auger withdrawal.
- Log depth of grout return.
- Use Automated Measurement Equipment (AME).

AUTOMATIC MONITORING EQUIPMENT (AME)



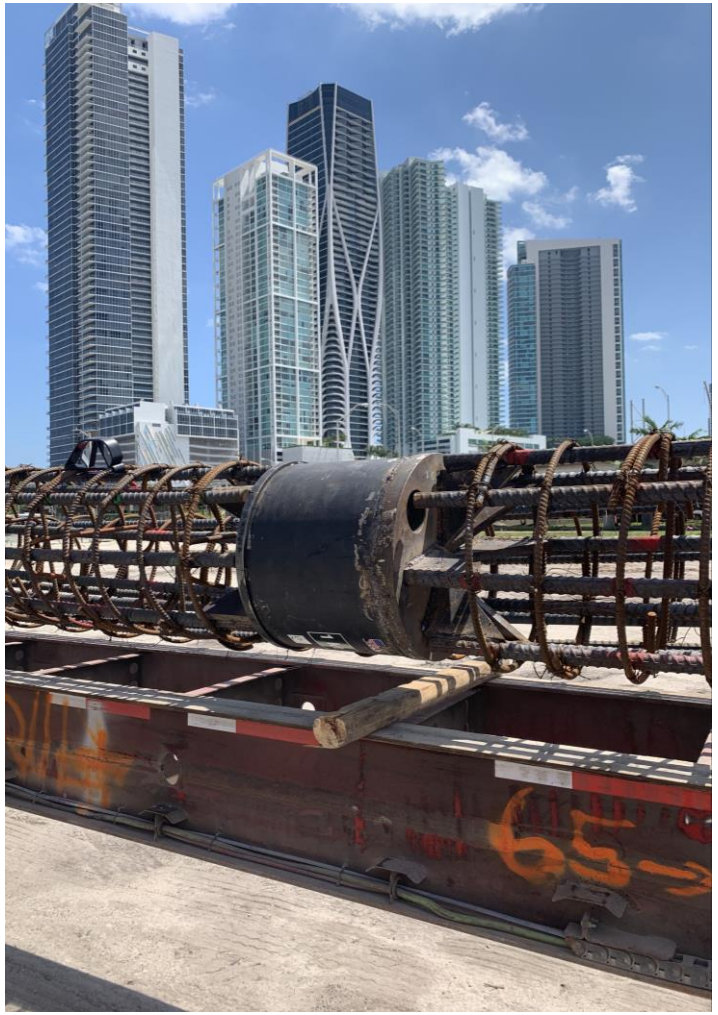
Primary Drilling Parameters:

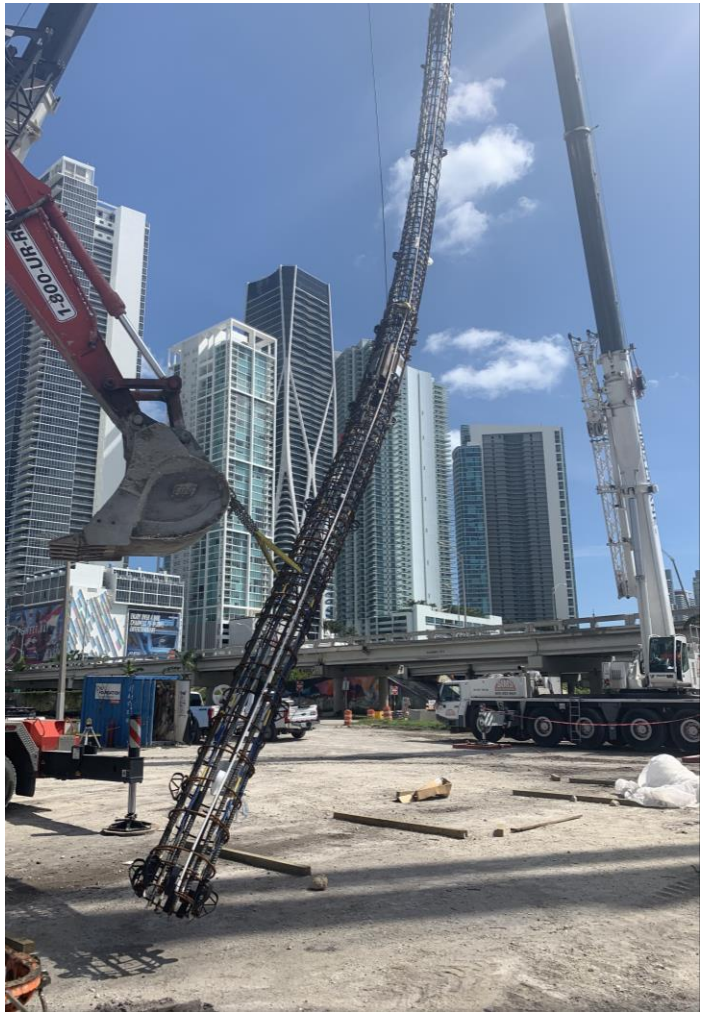
- Time: Recorded by an internal counter and referenced to the initial date and time input by the operator at the beginning of the project.
- Depth: From proximity switch that measures rotation of the main winch supporting the drilling turntable and drilling tools.
- Hydraulic Fluid Pressure driving turntable (i.e. KDK Pressure): From in-line pressure transducer.
- Rotation of auger: From proximity switch on turntable.

ACIP Pile Testing & Quality Control - Post Construction

- Nondestructive Integrity Test (NDT) Options
  - Low-strain Pile Integrity Test (ASTM D5882)
  - Crosshole Sonic Logging (ASTM D6760)
  - Gamma/Gamma Logging (ASTM D6274)
  - Thermal Integrity Profiling (ASTM D7949)
- Axial Load Testing Options
  - Static Load Test (ASTM D1143 Compressive, D3689 Tensile, D8169 Bi-directional)
  - Rapid Load Test (ASTM D7383 “Statnamic”)
  - High-strain Dynamic Test (ASTM D4945 PDA)

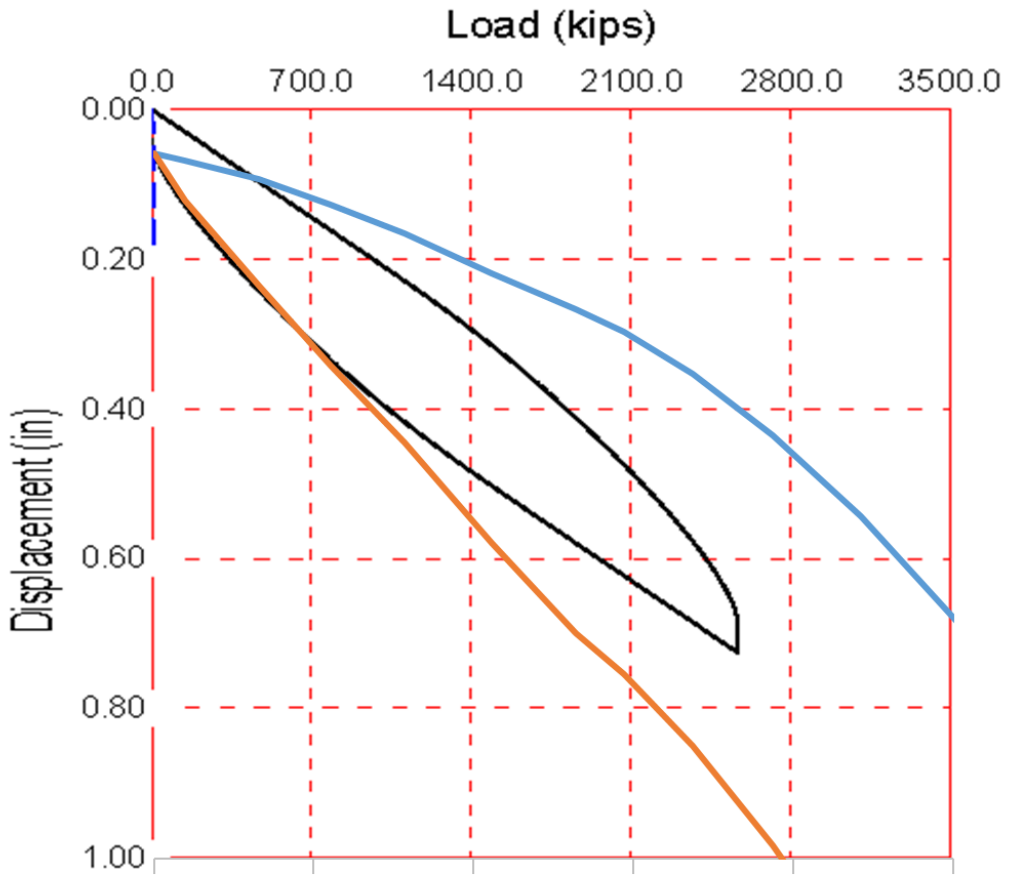
SIGNATURE BRIDGE - BDSLT





SIGNATURE BRIDGE – LOAD TESTING

ASTM D4945 (PDA)



ASTM D8169

OTHER PROJECTS

Miami MetroRail – ca. 1979

Las Vegas WWTP - 2021

Other Projects

SR-97 in Roy, UT (UDOT) – Test Program

ASTM D4945-17 Testing

HAVE US PRESENT TO YOU!

One-hour virtual presentation plus Q&A to delve into the details of ACIP/DD installation including:

- Terminology
- Equipment
- Materials
- Working Platforms
- Quality Control/Assurance
- Sustainability
- Case Studies

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