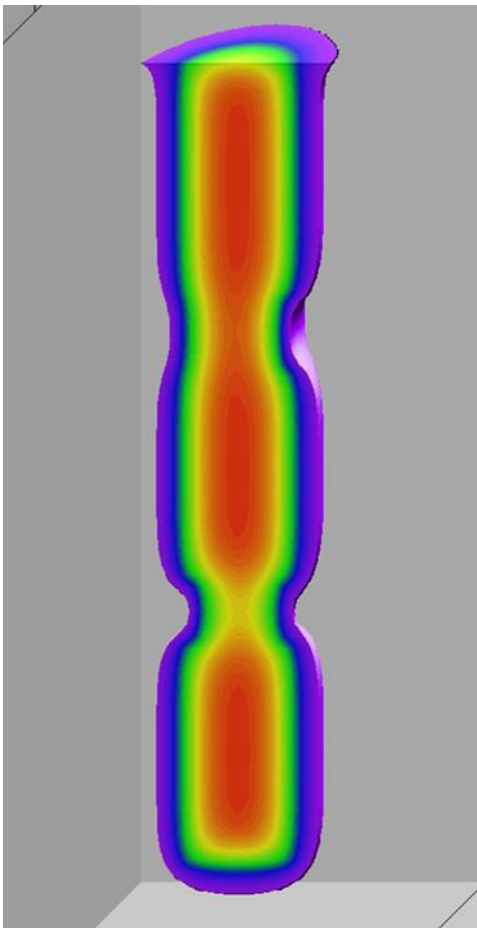


# Optimizing the Use of Thermal Integrity System for Evaluating Auger-Cast Piles



*Presented by:*  
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**USF** UNIVERSITY OF  
SOUTH FLORIDA

**Civil & Environmental Engineering**





# Problem Statement

- ◆ Thermal Integrity Profiling (TIP) has proven to be an effective method for evaluating the as-built integrity of drilled shafts.
- ◆ However, TIP is rarely used for evaluating auger-cast-in-place (ACIP) piles, as current practices do not require installation of standard integrity access tubes.
- ◆ Current integrity methods for ACIP piles is limited, thus their FDOT use has been limited to foundations for sound walls.
- ◆ **GOAL:** Translate the use of thermal integrity technology to an effective method for evaluating ACIP piles.



# Research Approach



- ◆ Task 1 Literature Review
- ◆ Task 2 Numerical Modeling
- ◆ Task 3 Feasibility Study of Probe-based Inclination Measurements
- ◆ Task 4 Field Testing
- ◆ Task 5 Reporting

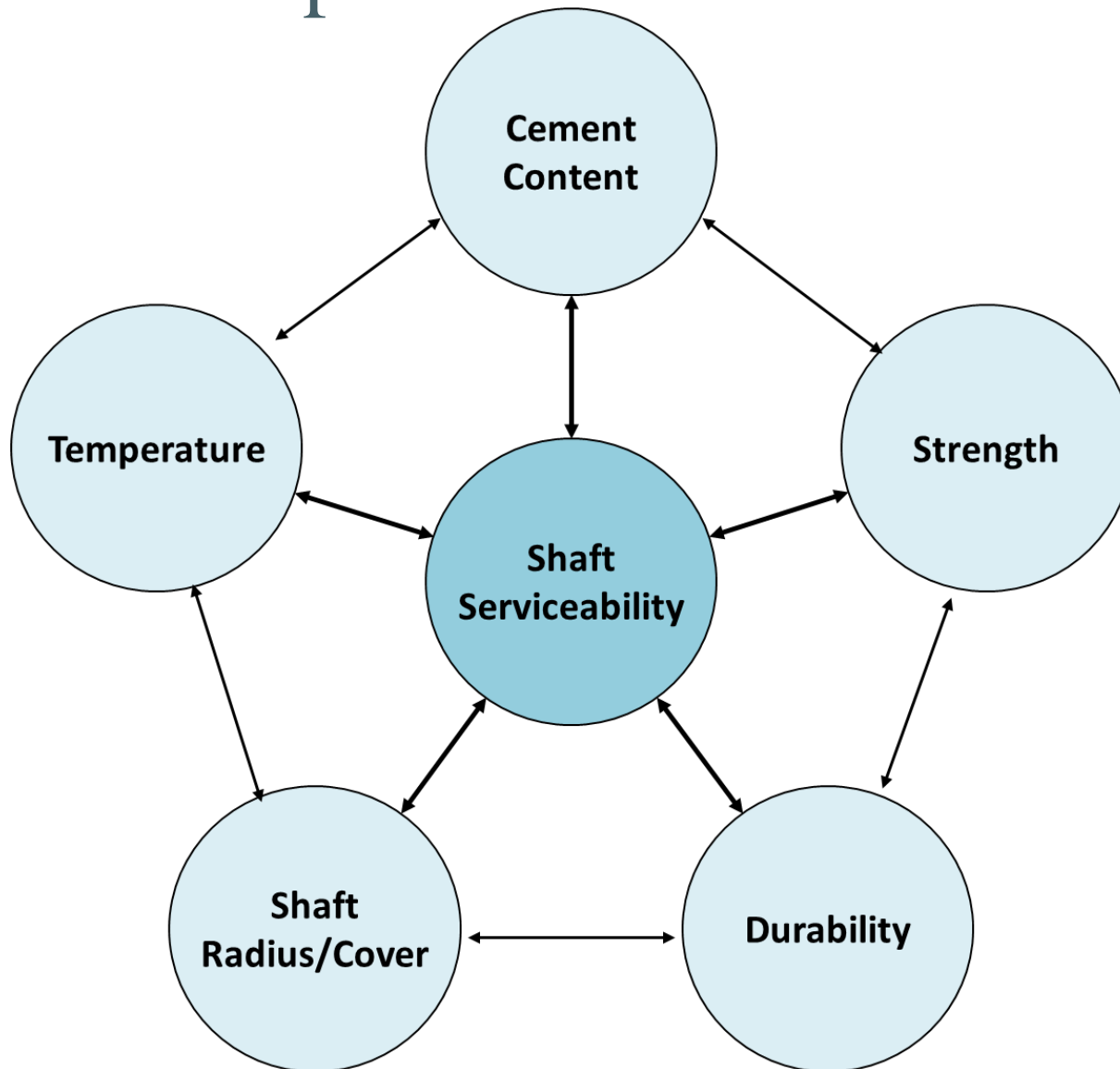


# Research Approach



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# TIP Principles



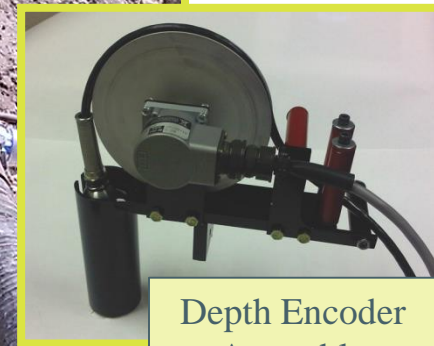


# TIP Methods

## Infrared Probe



Thermal Probe w/ Infrared Sensors



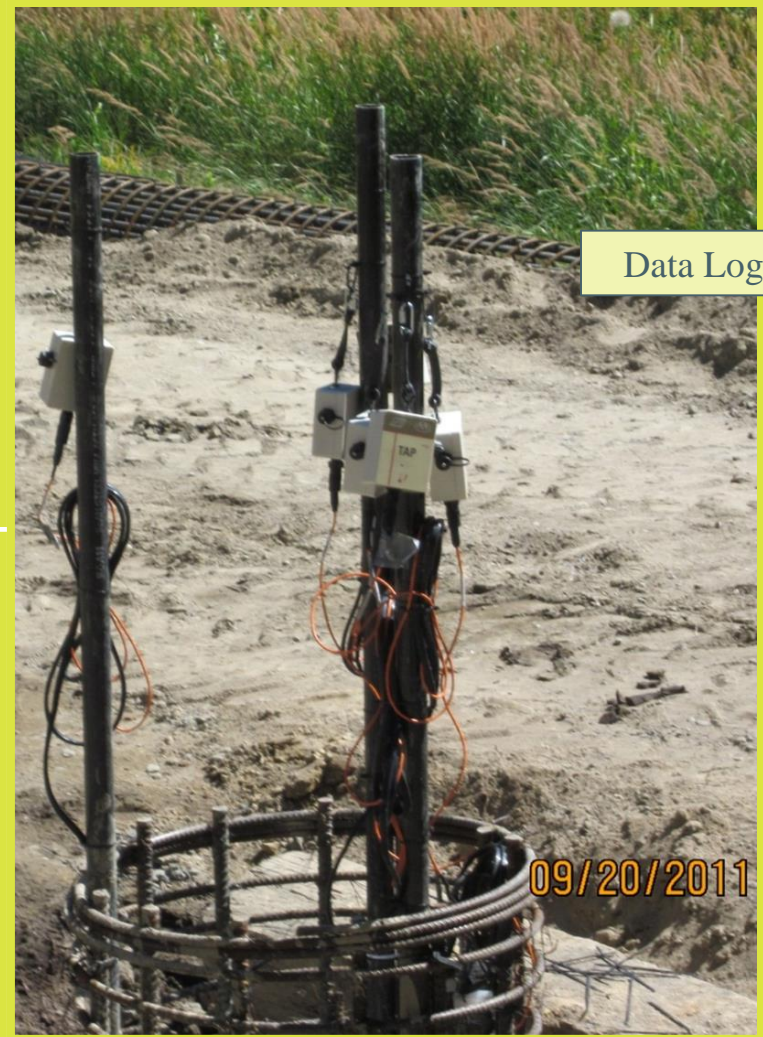
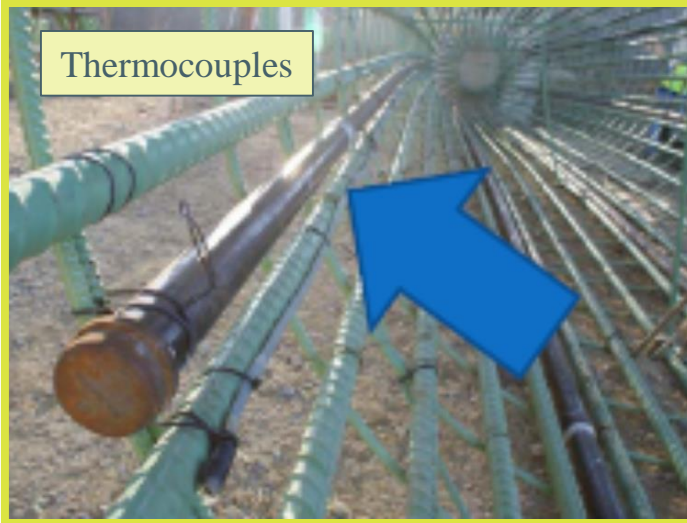
Depth Encoder Assembly



Data Collection System

# TIP Methods

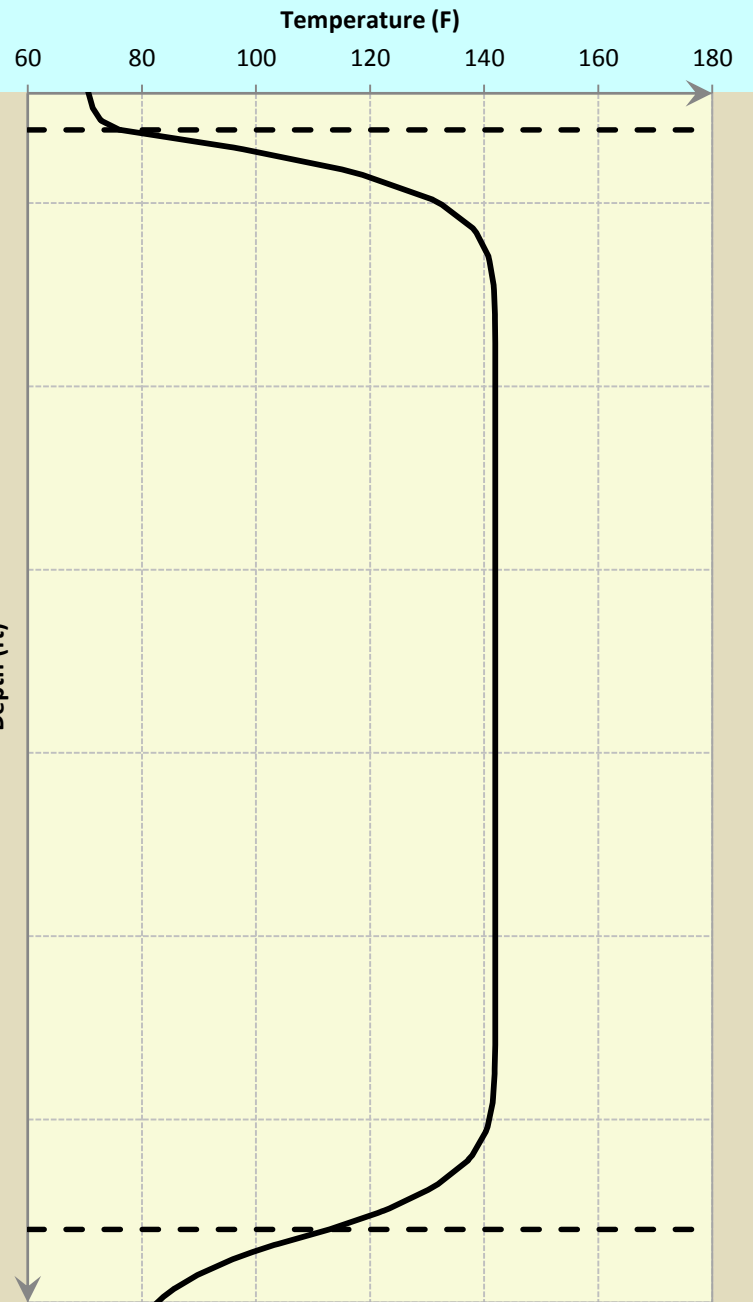
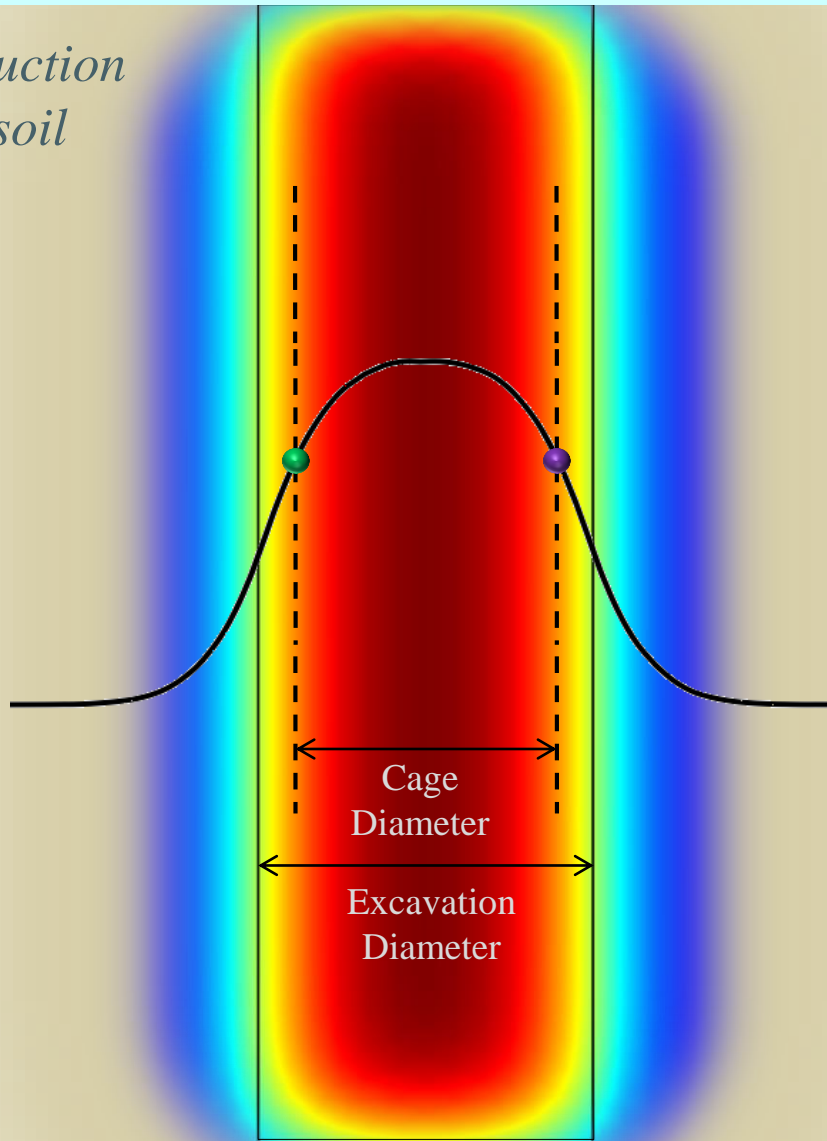
## Thermocouple Wire



*Convection  
to air*



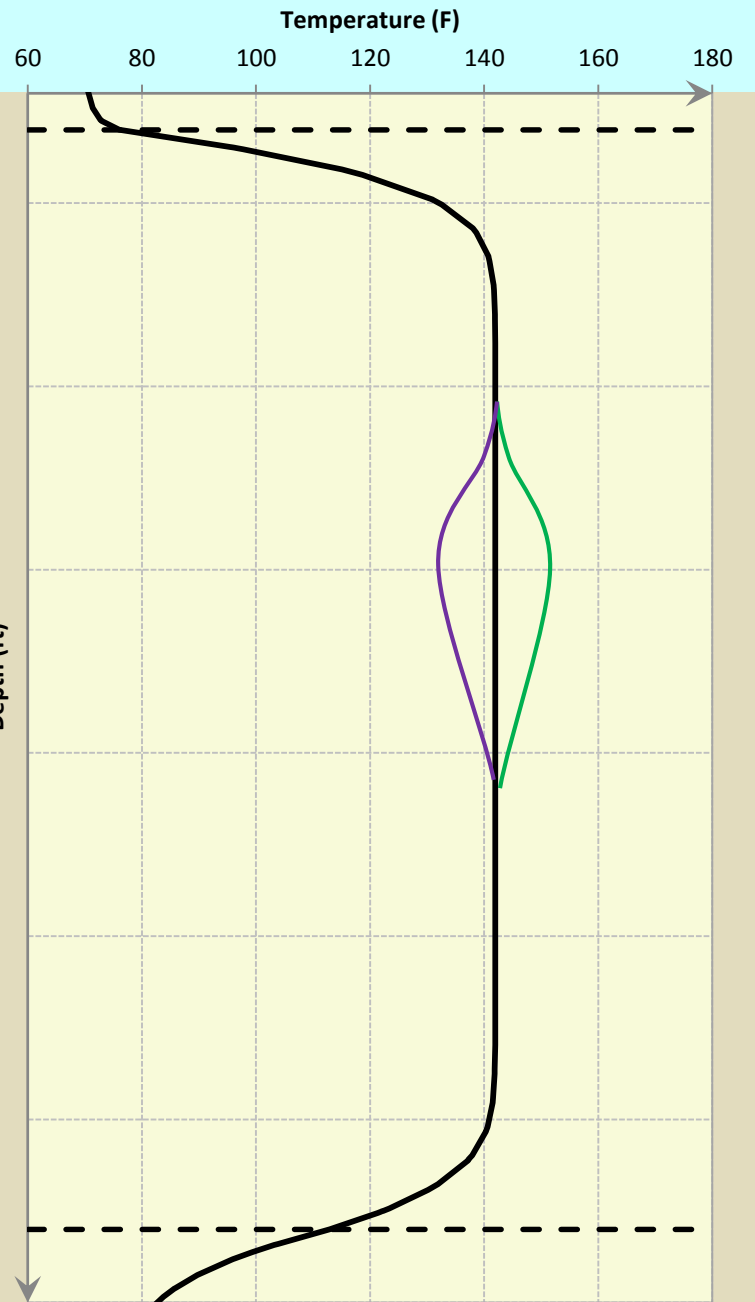
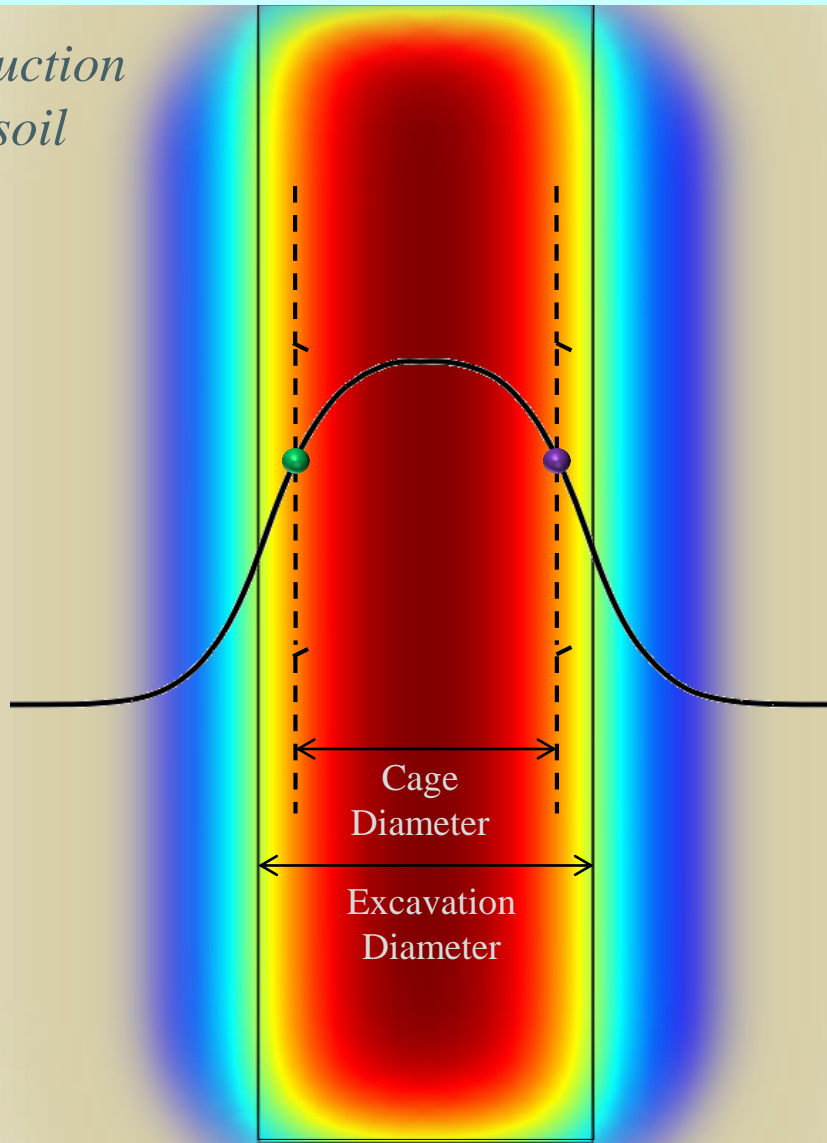
*Conduction  
to soil*



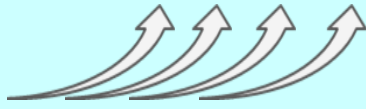
*Convection  
to air*



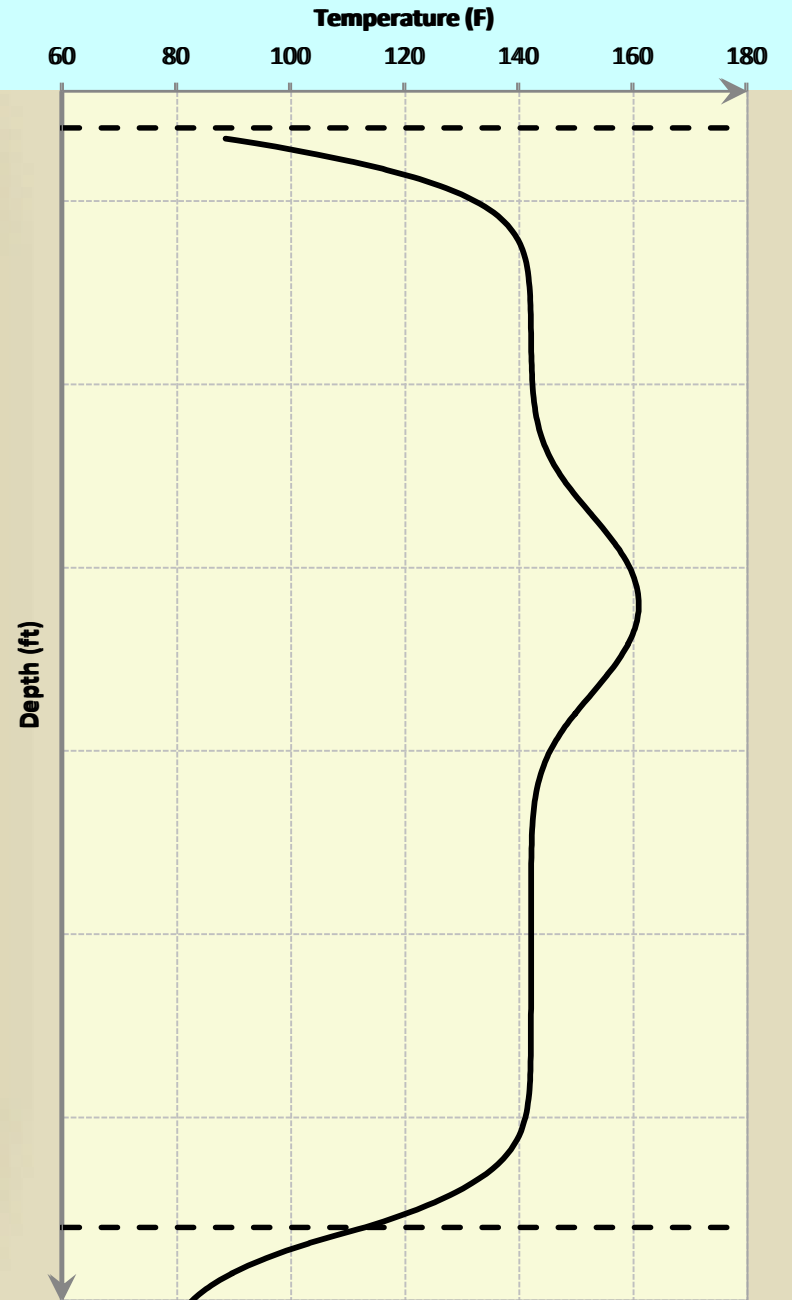
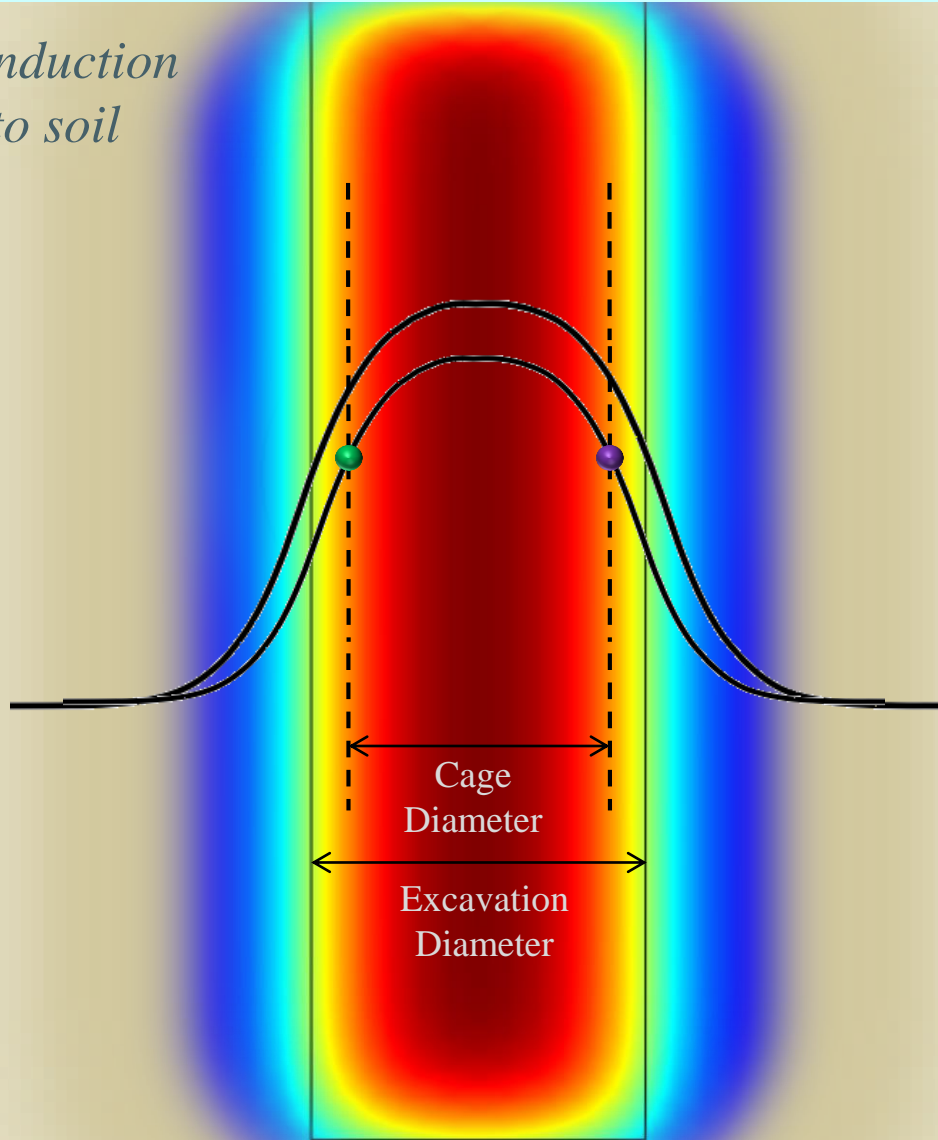
*Conduction  
to soil*



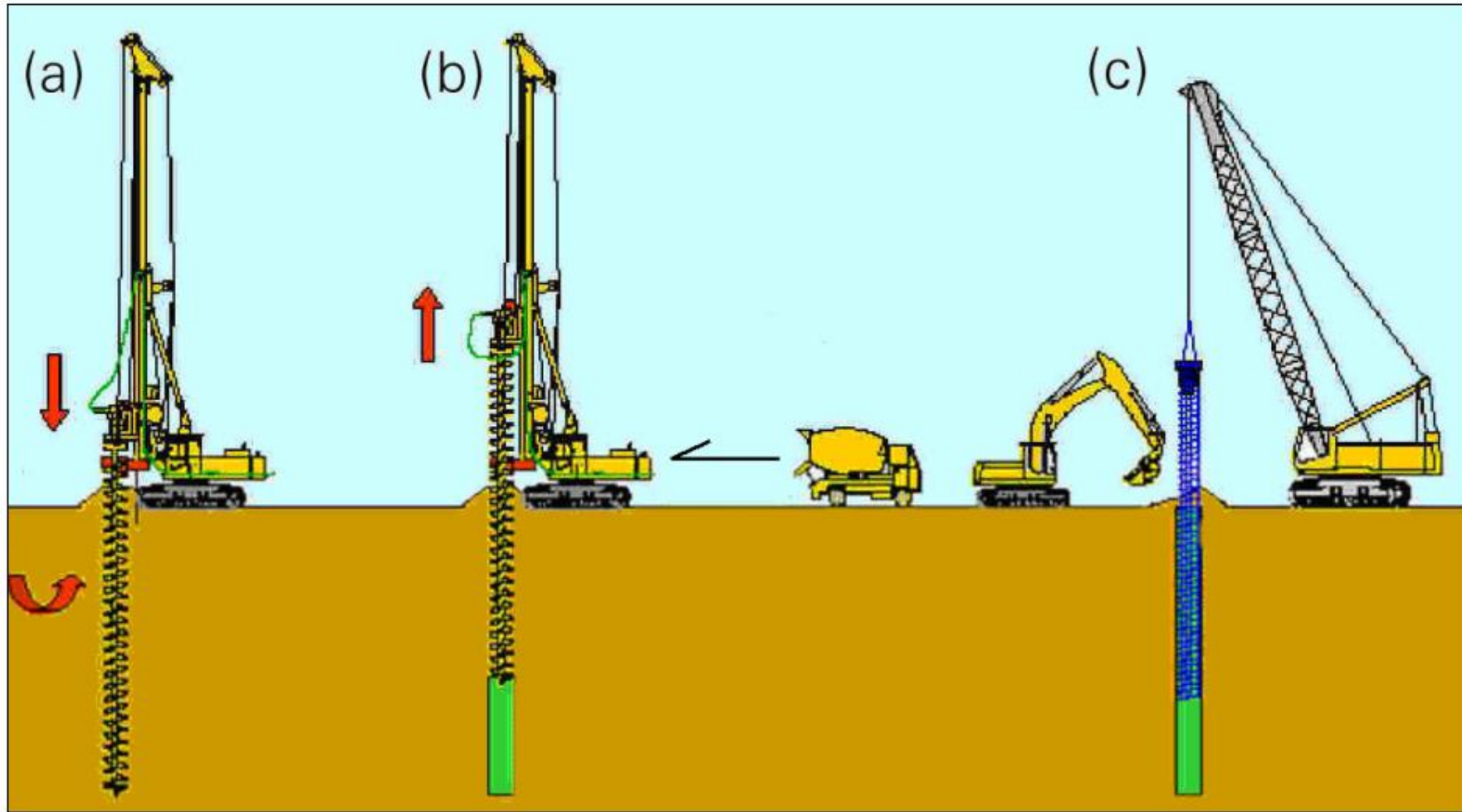
*Convection  
to air*



*Conduction  
to soil*



# ACIP Piles Construction



# ACIP Piles Construction



# ACIP Piles

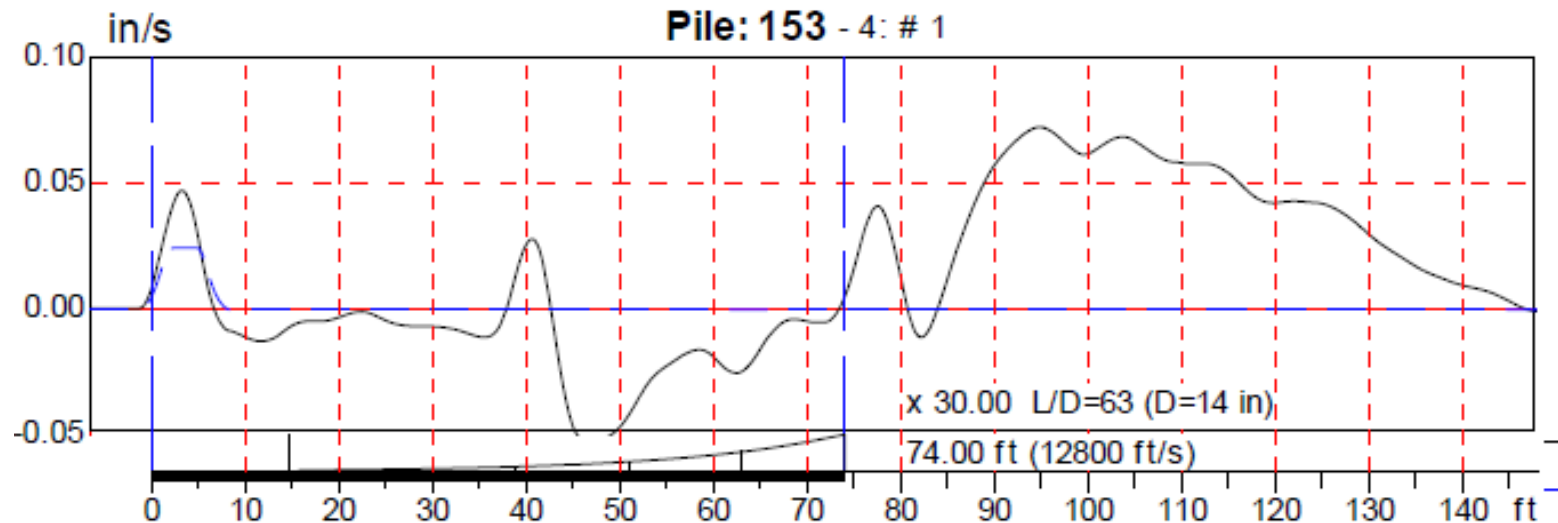
## Quality Control



# ACIP Piles

## Quality Assurance

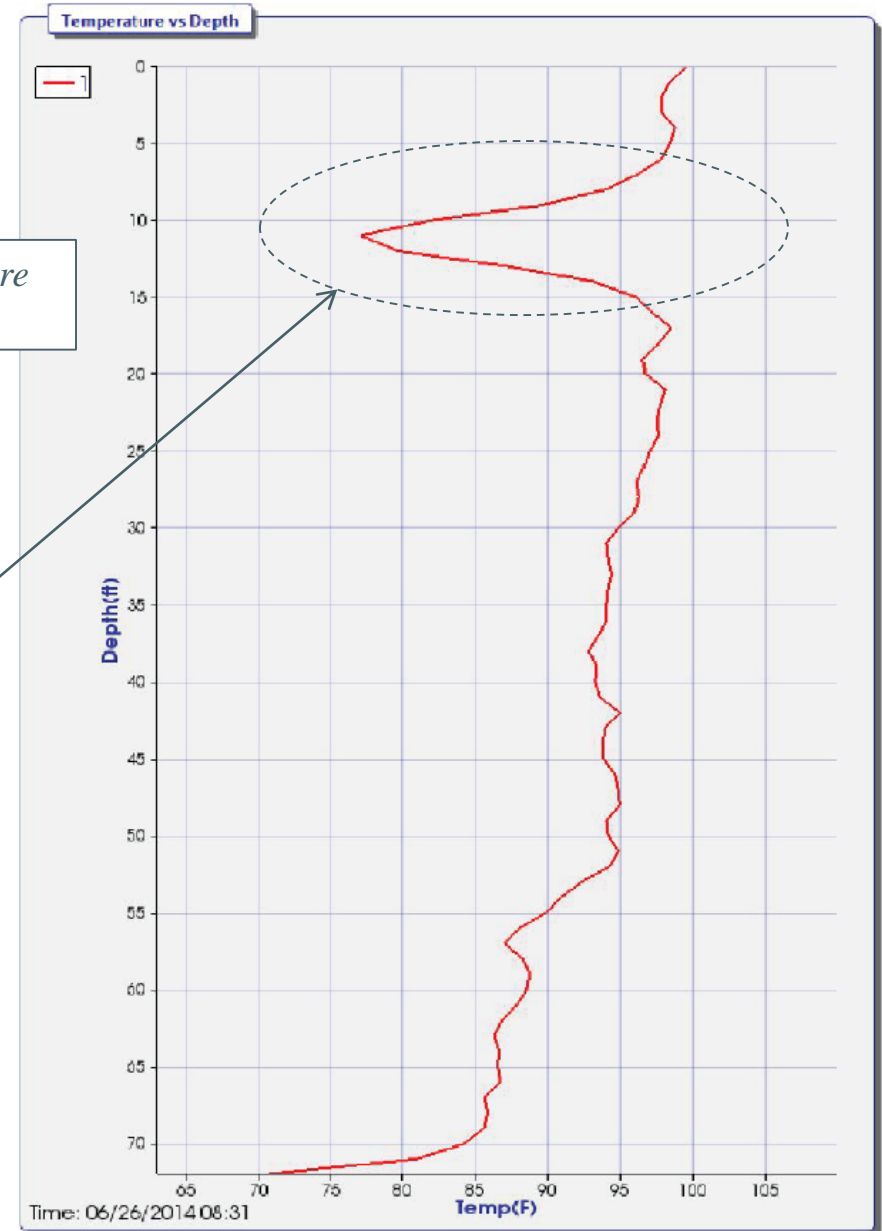
Surface methods involving stress wave propagation analysis are the most common form of integrity testing for ACIP piles.



# ACIP Piles Quality Assurance

*Single thermal wire  
tied to center bar*

Even with only a minimal set of temperature measurements, anomalies can be easily detected by direct observation of thermal profiles.

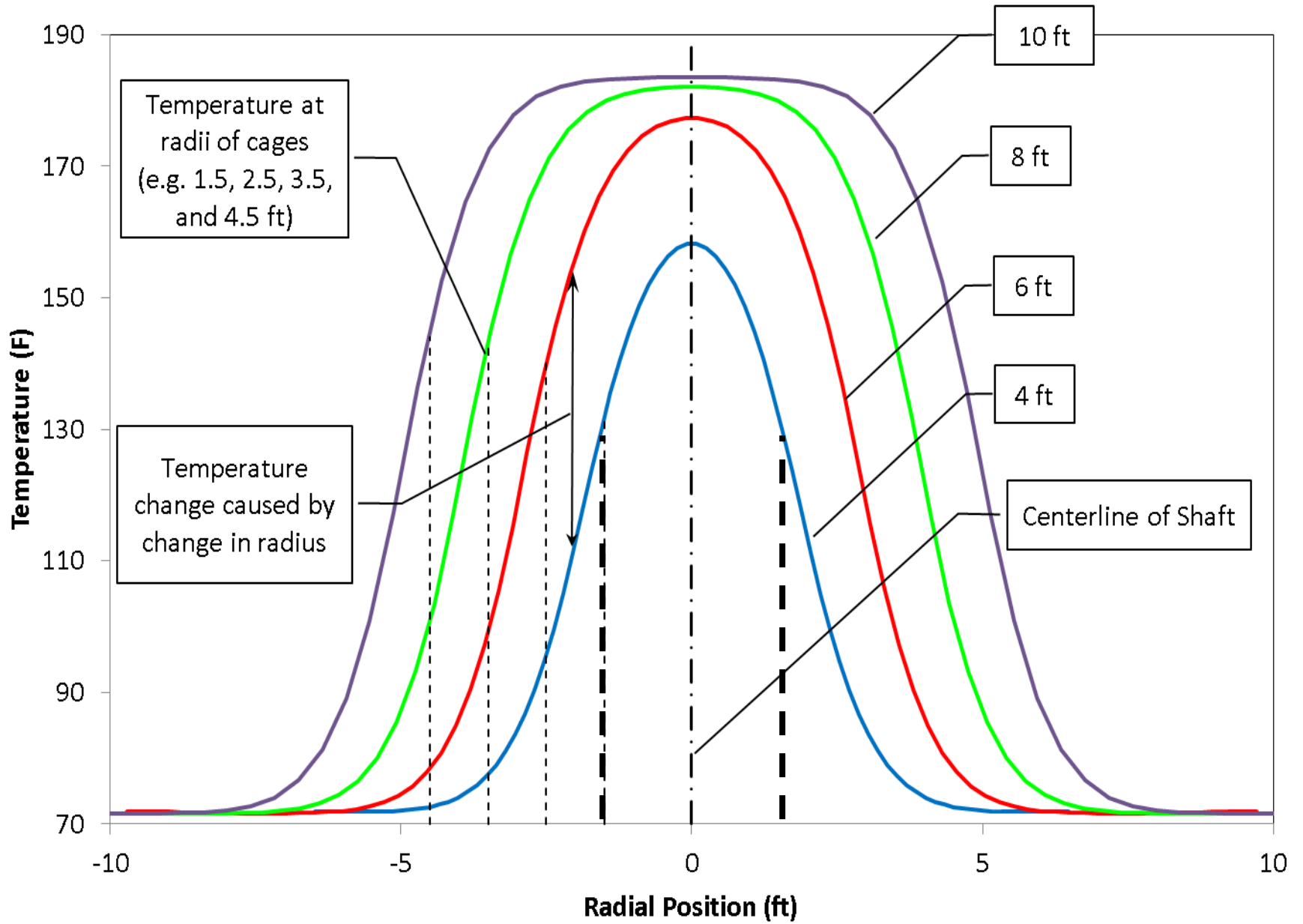




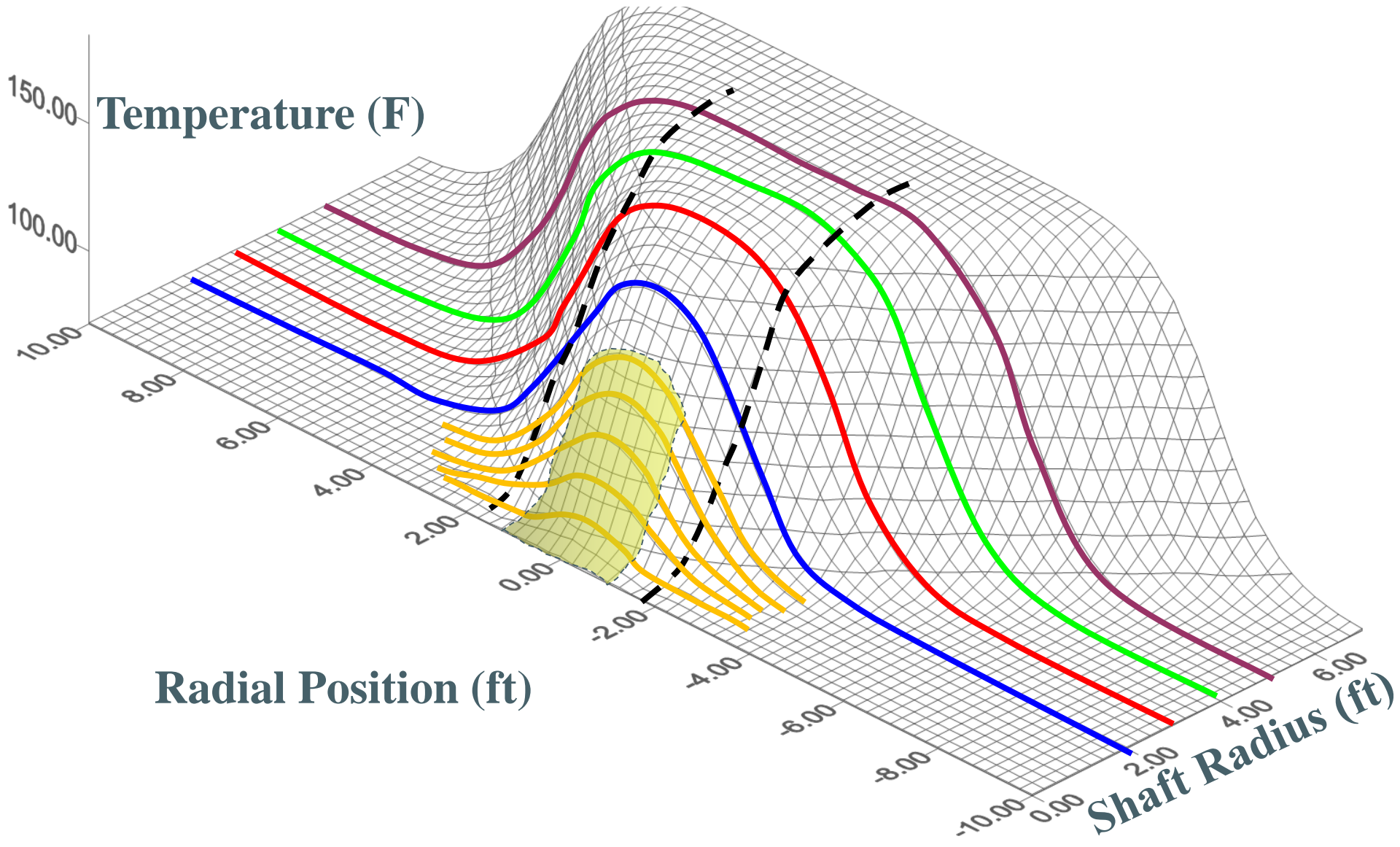
# Research Approach

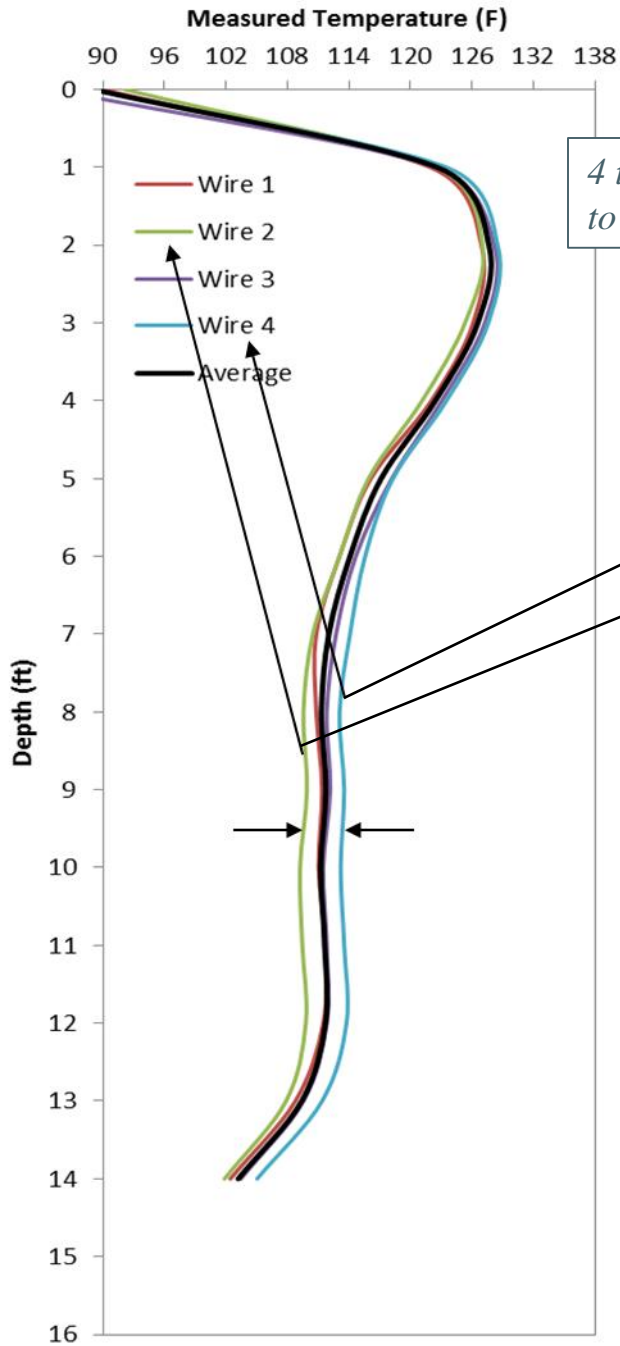


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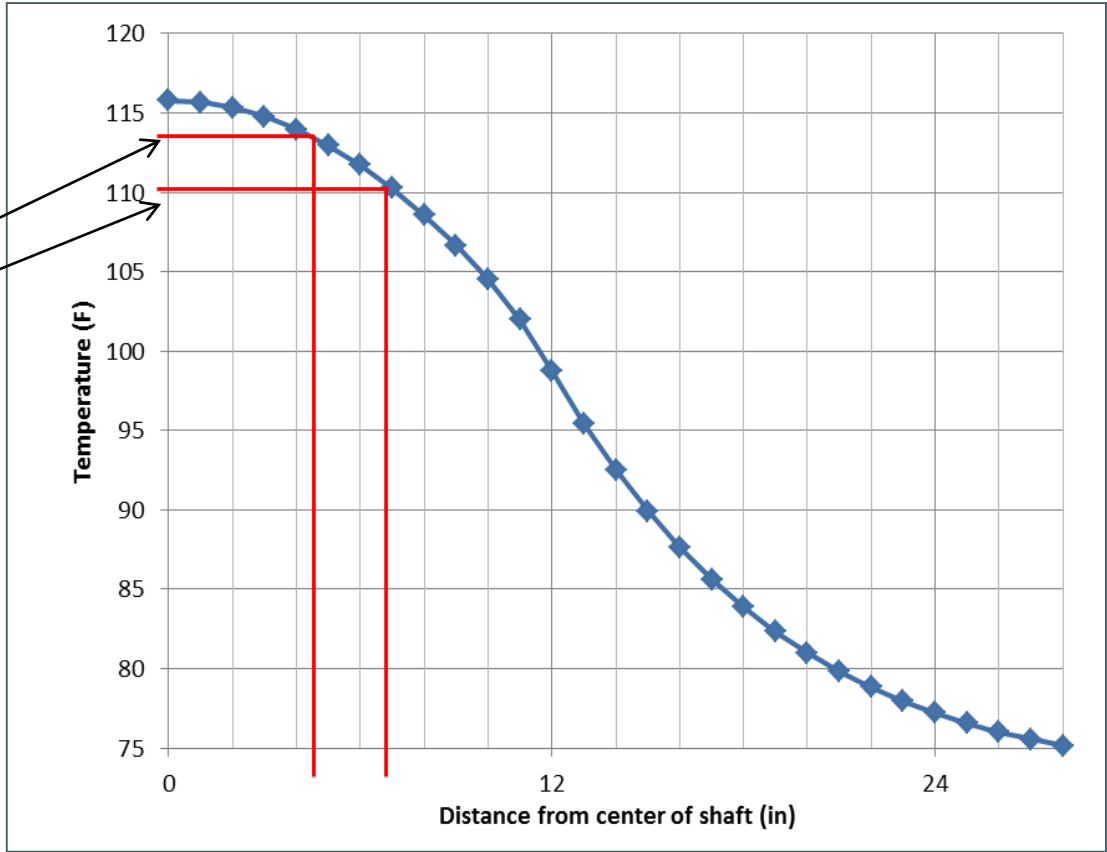


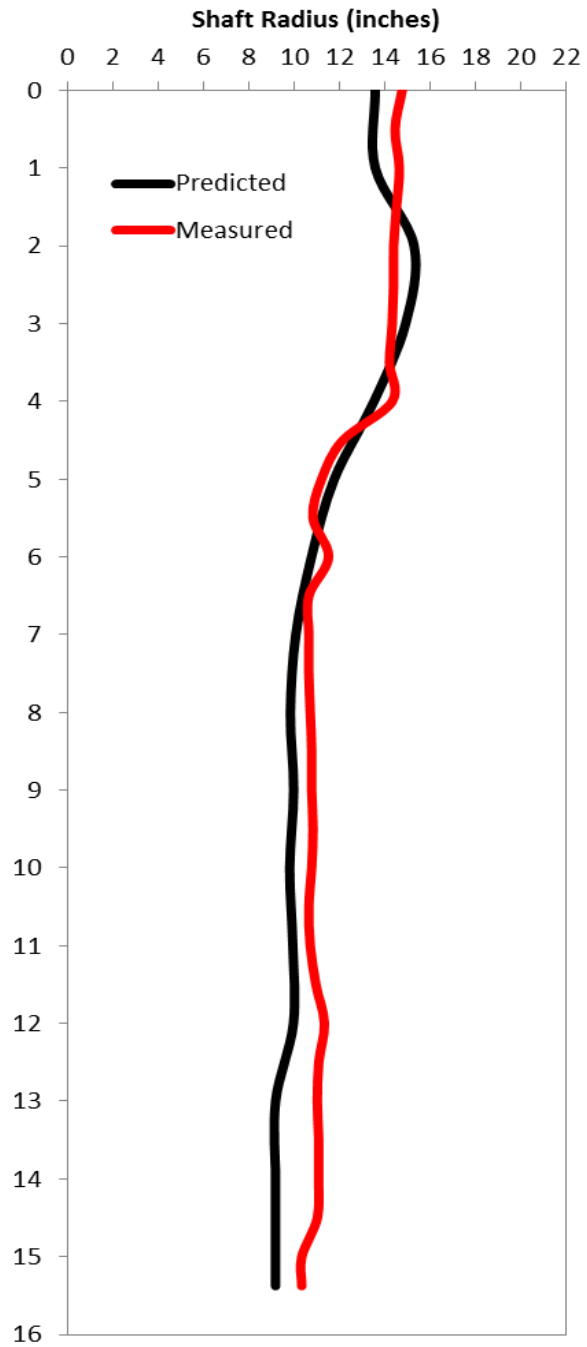
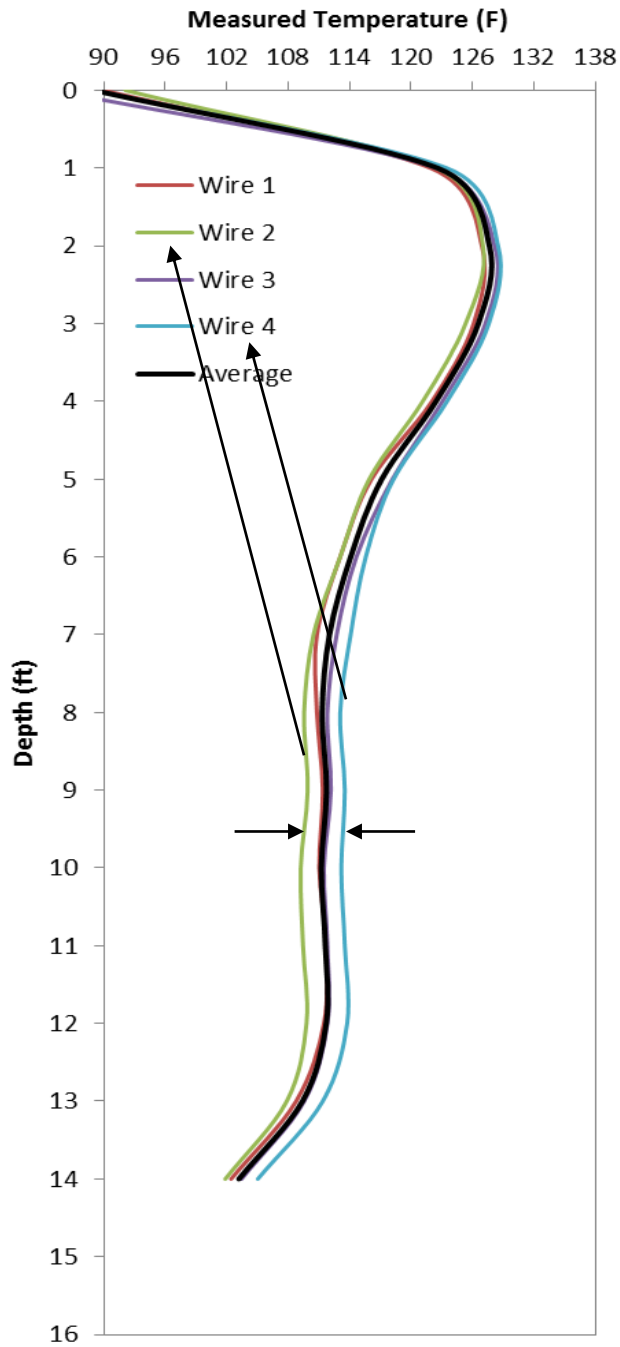
# Effects of Alignment and Shaft Radius





*4 thermal wires tied to center bar*





Signal matching approach yields good results but can be time consuming for everyday practice.



# Research Approach

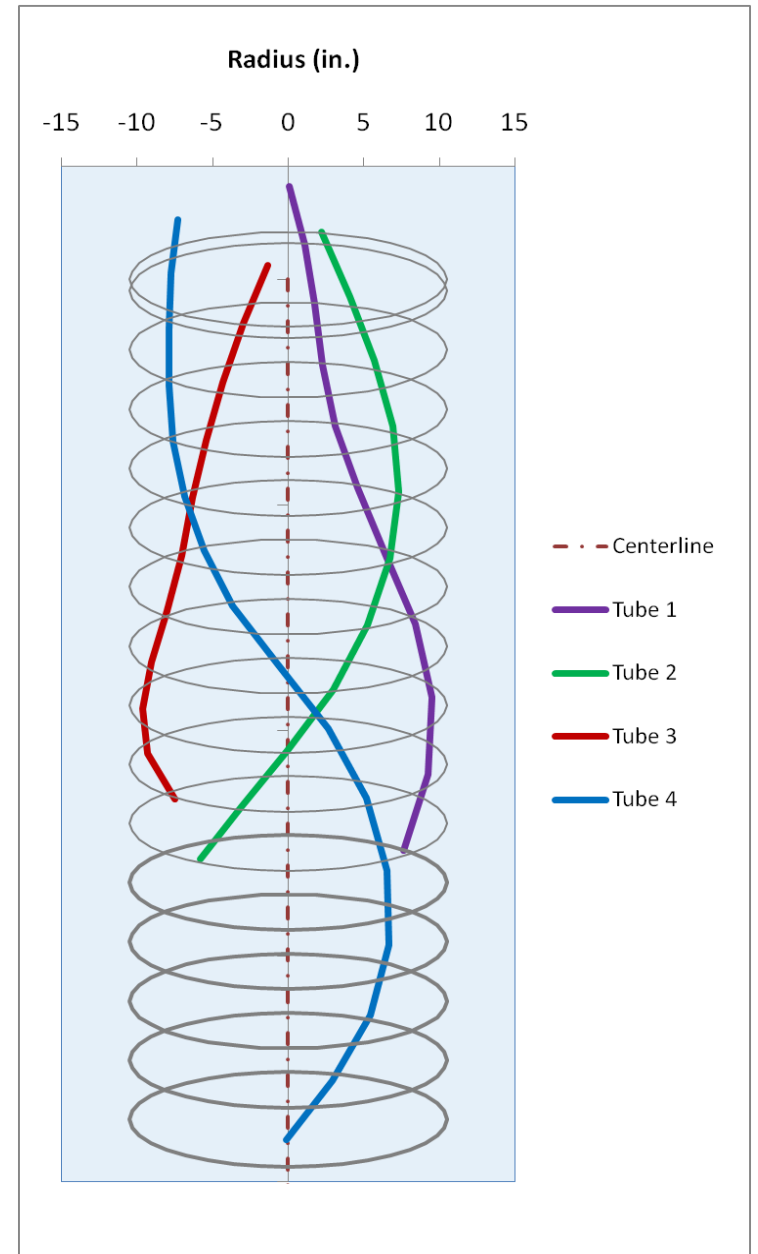
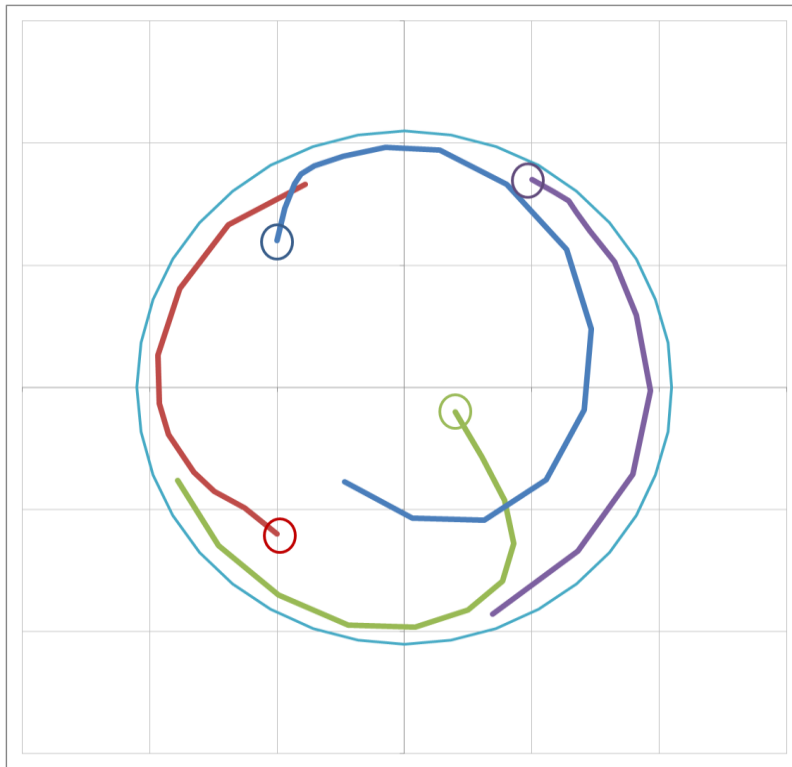


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# Inclination Measurements



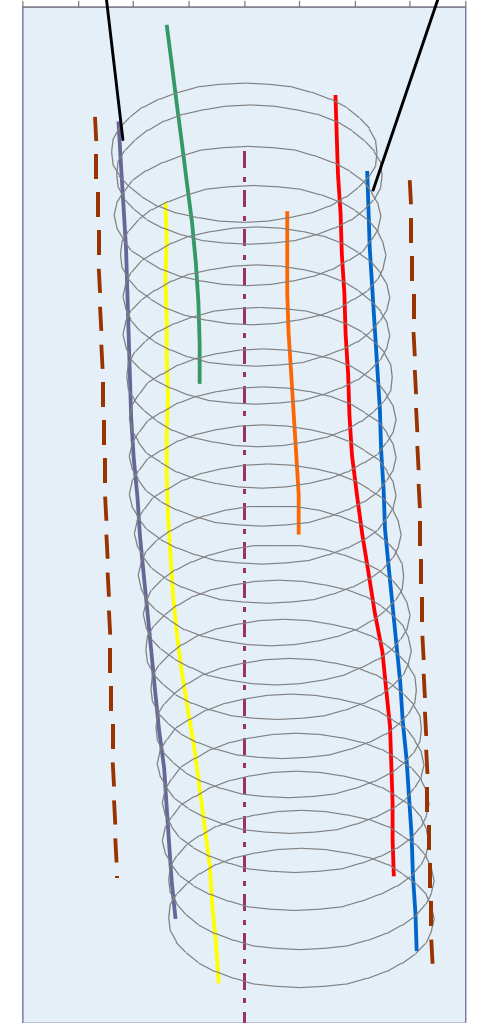
# Inclination Measurements



T-1

T-4

Radius (in.)

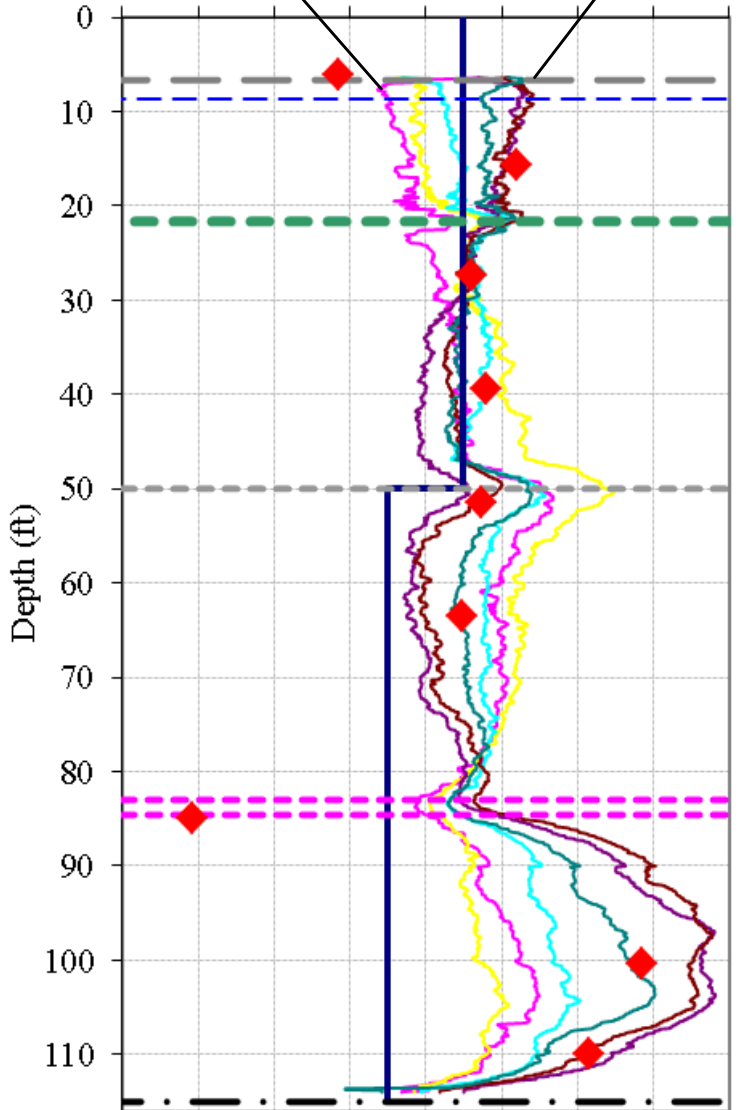


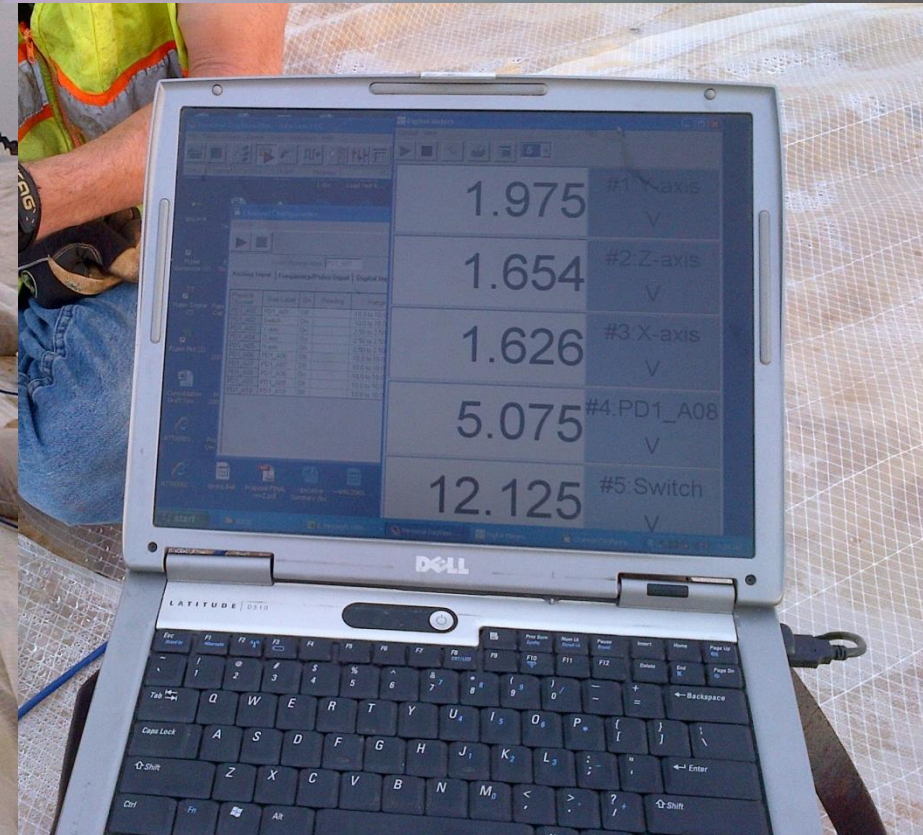
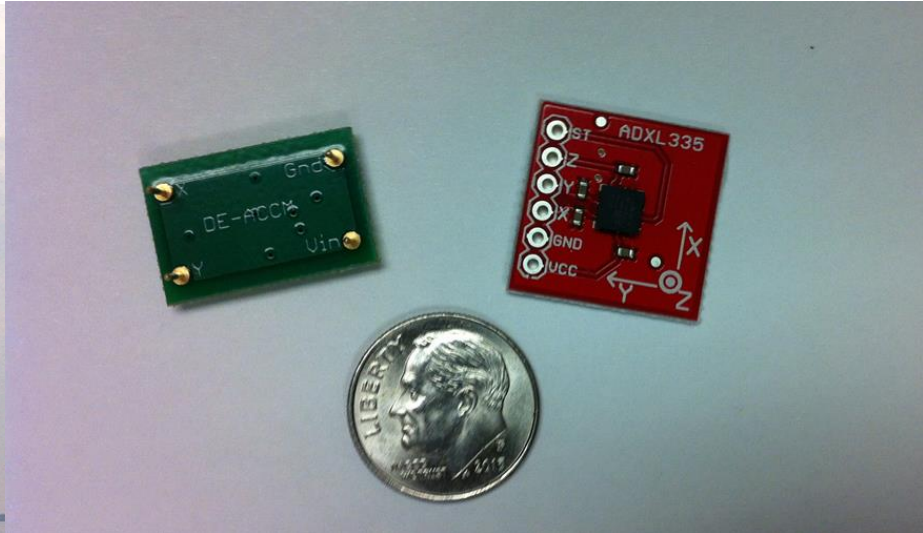
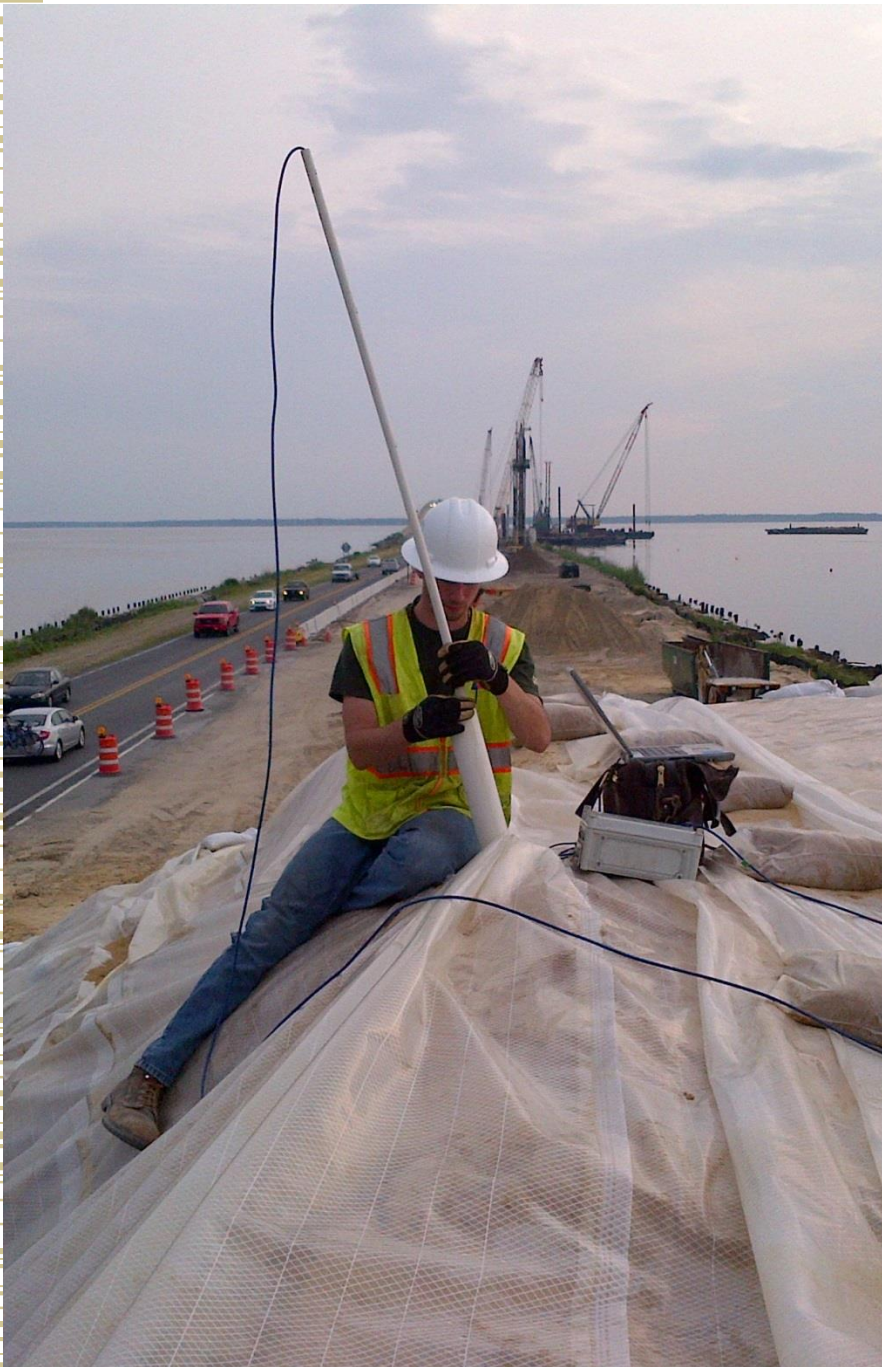
- - - Centerline
- Tube 1
- Tube 2
- Tube 3
- Tube 4
- Tube 5
- Tube 6
- - - Series29

T-1

T-4

Radius (in)



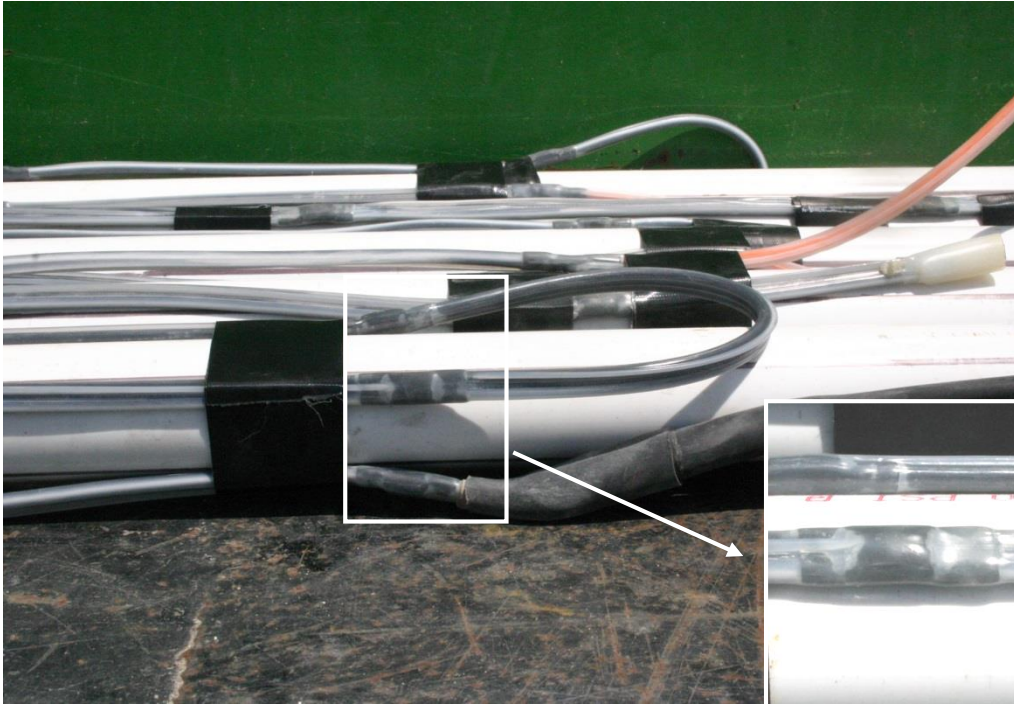




# Research Approach



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# Questions?

