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

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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

- Cement Content
- Temperature
- Shaft Serviceability
- Strength
- Shaft Radius/Cover
- Durability
TIP Methods
Infrared Probe

Thermal Probe w/ Infrared Sensors
Depth Encoder Assembly
Data Collection System
TIP Methods
Thermocouple Wire

- Thermocouples
- Data Loggers
- Thermal Wire
Convection to air

Conduction to soil

Cage Diameter

Excavation Diameter

Temperature (F)

Depth (ft)
Convection to air

Conduction to soil

Cage Diameter

Excavation Diameter

Temperature (F)

Depth (ft)
ACIP Piles Construction

Source: Dan Brown et al., FHWA-HIF-07-03
ACIP Piles
Construction

[Image of construction site with ACIP piles]

[Image of construction site with ACIP piles]
ACIP Piles
Quality Control
Surface methods involving stress wave propagation analysis are the most common form of integrity testing for ACIP piles.
Even with only a minimal set of temperature measurements, anomalies can be easily detected by direct observation of thermal profiles.
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Temperature at radii of cages (e.g. 1.5, 2.5, 3.5, and 4.5 ft)

Temperature change caused by change in radius

Centerline of Shaft

Radial Position (ft)
Effects of Alignment and Shaft Radius

Temperature (F)

Radial Position (ft)

Shaft Radius (ft)
4 thermal wires tied to center bar
Signal matching approach yields good results but can be time consuming for everyday practice.
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Inclination Measurements
Inclination Measurements
Research Approach

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Questions?