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Estimating the As-Placed Grout Volume of Auger Cast Piles – Part 1

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Current Situation

Historically, auger cast piles were typically used for private projects. However, with the development of new technologies developed through FDOT-funded research, public entities are now equipped to incorporate critical components of quality assurance and control, such as measuring while drilling and thermal integrity testing, for auger cast piles in bridges.

As the Florida Department of Transportation (FDOT) pursues achieving the highest quality of structural integrity for its bridges, it remains crucial that quantifiable aspects are accurately captured. FDOT has recognized a remaining challenge in accurately estimating the as-placed grout volume in auger cast piles, as this is information that would help improve quality assurance and enable broader application of auger cast piles in public infrastructure projects.



To be completed in 2027, the I-395 signature bridge will be 1,025ft long and span over NE Second Avenue and Biscayne Boulevard. The center pier construction will include 128 piles (3 ft in diameter with 27-in cages and extend approximately 120 ft below existing grade) as captured here in this image.

Research Objectives

The objective of this research project was to develop a reliable method for estimating the in-pile grout volume of auger cast piles. The study also sought to standardize best practices to ensure compliance with Federal Highway Administration (FHWA) recommendations and State requirements.

Project Activities

The University of South Florida project team analyzed data from over 1,100 auger cast piles—drawing from construction records, inspector reports, thermal integrity profiles, and physical measurements. The team introduced the Auger Fill Factor (AFF) concept, which differentiates between grout that overflows to the ground and grout that remains in the pile as a function of the material that is extracted by the auger flights. Using AFF, the team developed formulas to calculate as-built grout volumes more accurately.

The team evaluated construction practices to identify potential issues, such as auger re-stroking, which disrupts data continuity and affects soil integrity. Additionally, they compared manual and automated grout volume measurement methods, including flow meters and pump stroke counts, recommending specifications that require the two to agree within 3 percent. Finally, the team analyzed the relationship between AFF and grout volume distribution along the pile length.

Project Conclusions and Benefits

The AFF-based method significantly enhanced the accuracy of grout volume estimations. By adopting these methods, construction teams can ensure pile size and integrity align with design specifications. The research team recommended enforcing existing quality assurance standards, such as requiring calibrated flow meters and maintaining rigorous grout volume monitoring during construction.

The benefits of AFF-based volume estimation include reliable foundation performance and structural safety, time and cost-savings through accurate grout volume measurement, and increased viability of auger cast piles for public infrastructure, offering a quieter and less disruptive alternative to traditional foundation methods.

For more information, please see fdot.gov/research.