

**Transportation Infrastructure Precast Innovation Center**

**(TRANS-IPIC)**

**University Transportation Center (UTC)**

Evaluating Scanning Technology for Process Monitoring and Quality Control in Precast Concrete Fabrication

LS-23-RP-02

Quarterly Progress Report

For the performance period ending June 30, 2024

**Submitted by:**

Isabelina Nahmens, PI, nahmens@lsu.edu

Mechanical and Industrial Engineering

Louisiana State University

**Collaborators / Partners:**

Tindall Corp and FARO Technologies

**Submitted to:**

TRANS-IPIC UTC

University of Illinois Urbana-Champaign

Urbana, IL

**TRANS-IPIC Quarterly Progress Report:**

**Project Description:**

1. Research Plan - Statement of Problem

The main objective of this project is to evaluate and propose an efficient quality control (QC) method incorporating state-of-the-art scanning technology that ensures consistent, high quality precast concrete (PC) products delivered to site.

Companies producing PC products are expected to continuously increase production capacity, maintain high product quality, and use a flexible pricing policy. However, to expand to markets such as transportation, PC companies must not only guarantee high quality of the manufactured goods but also sell them at attractive prices. PC fabrication plants have yet to realize the full benefit of a controlled manufacturing environment as some operations are still using old/onsite approaches. Currently, operators use tape measures to obtain critical overall dimensions and embedded part locations. While providing quantitative measurements, this approach is not accurate and efficient enough to constantly fabricate high quality PC products. Operators may deviate in measurements and methods, and other factors may affect measurement precision. The current approach is not sustainable or cost efficient and is a time-consuming task that requires some experience. This QC approach results in product quality inconsistency and increased risk for alteration after fabrication or having to scrap a product resulting in waste onsite.

1. Research Plan - Summary of Project Activities (Tasks)

Task 1. Document current QC processes in a PC facility, document any deficiencies or areas for improvement in the process.

Task 2. Document transportation and installation steps of PC components once they leave the facility. Document any major QC checks and “pain points”.

Task 3. Collect historical QC records as baseline data, including QC issues on site after delivery.

Task 4. Select scanning measurement technology and pilot test in the PC facility for feasibility.

Task 5. Develop QC process incorporating scanning measurement technology using a kaizen approach, including transporting and installation in the field.

Task 6. Test the QC process on an actual project and measure impact at the facility and in the field by noting any QC issues.

**Project Progress:**

1. Progress for each research task

Task 1. The team is in the process of documenting the current QC processes in a PC facility, document any deficiencies or areas for improvement in the process (100% completed).

* The team met with Tindall Corp’s Director of Industrial Engineering to discuss the project scope and identify the plant for the study. The Mississippi plant and employees that will support the project were identified, including the General Manager and Quality Director.
* An initial meeting was held with Tindall Corp’s General Manager of the Mississippi Division. The QC process and main issues and deficiencies were discussed. The team identified several documents and data needed. Tindall Corp will provide this data in January.
* LSU team visited the Mississippi plan on March 22. The team took a tour of the facilities and discussed the production and QC processes with the Quality Director and process engineer.
* The team created documentation to illustrate the QC process and potential “hot spots” for quality problems to occur.
* The LSU research assistants visited Tindall to shadow the daily QC process April 15, 2024.

Task 2. Document transportation and installation steps of PC components once they leave the facility. Document any major QC checks and “pain points” (20% completed).

* The team jointly with Tindall Corp identified the data needed.
* The LSU team is gathering data on the transportation and installation process. The QC process and main issues and deficiencies were discussed with the general manager.
* Tindall Corp will provide this data in January 2024.

Task 3. Collect historical QC records as baseline data, including QC issues on site after delivery (90% completed).

* The team jointly with Tindall Corp identified the data needed. The company will provide records of the past year for QC issues found on site by January 2024.
* The team received several documents containing all nonconformances for the past year and other quality metrics from the Tindall QC personnel.
* The team will be analyzing and summarizing this data to determine areas most in need of attention.
* The team is analyzing Tindall’s nonconformance records, from production to installation, to identify most frequent quality issue.
* In the next trip to Tindall in July the team will conduct a time study of the current QC process at the plant.

Task 4. Select scanning measurement technology and pilot test in the PC facility for feasibility (90% completed).

* On June 5, the team visited Tindall, the Mississippi plant, to meet with a representative from Faro and view a demonstration of their scanning and tracking technology.
* The team conducted research on other existing scanning companies and summarized the pros/cons of each technology.
* In the next trip to Tindall in July the team will observe a full-scale demonstration of Faro’s laser tracking device.

Task 5. Develop QC process incorporating scanning measurement technology using a kaizen approach, including transporting and installation in the field.

Task 6. Test the QC process on an actual project and measure impact at the facility and in the field by noting any QC issues.

1. Percent of research project completed

Estimate 50% of total project completed through the end of this quarter.

1. Expected progress for next quarter

The team expects to complete Tasks 1, 2, 3, 4 and start 5 by the end of next quarter (October 2024).

1. Educational outreach and workforce development

The team plans to hold an educational meeting with Tindall Corp’s employees to share issues found and key improvements, including a rationale for selecting the measurement technology, steps of the QC process, and description of how to analyze and interpret the resulting data.

The team is partnering with LSU College of Engineering existing summer camps to showcase this project. In particular, how Industrial Engineers can support the Precast industry to improve our Transportation system. The target summer camps are Recruiting into Engineering High-Ability Multicultural Students (REHAMS) on June 26th, 2024, and eXploration Camp Inspiring Tomorrow’s Engineers (XCITE) scheduled for July 17th, 2024.

* XCITE is a 7-day camp for rising 9th-12th grade female students that encourages them to pursue engineering/computer science/construction management careers. All girls will reside on campus in a residential hall while supervised by college student counselors. Participants will explore, create, experiment, build, code, design, and compete while learning about a variety of engineering majors and college life. LSU faculty and engineering students will interact with attendees in Engineering 101 information sessions and activities.
* REHAMS camp is for 10th–12th grade male and female students from all backgrounds who want to learn about various disciplines of engineering during a 7-day camp while residing on campus.
1. Technology Transfer

The team plans to develop guidelines for integrating scanning technology in the process for monitoring and quality control in precast concrete fabrication.

**Research Contribution:**

1. Number of papers

Planned: Manuscript on project results submitted to quality management journal such as *Journal of Manufacturing Technology Management*

1. Number presentations (when, where)
* 2024 TRANS-IPI UTC Workshop, April 22, 2024
* TRANS-IPIC Webinar June 2024

Planned: IISE Annual Conference, Atlanta, May 2025

Planned: TRB Annual Meeting 2025

**References:**

 *[List all the references associated with this research project]*