SPR RESEARCH PROGRAM
SECOND-STAGE PROPOSAL SUMMARY

PROBLEM NUMBER AND TITLE

26-65 Development of New and Non-destructive Techniques for Concrete Acceptance.

PROBLEM SUMMARY

28-day compressive strength tests of concrete cylinders or cube samples is widely used as the only method of concrete acceptance. However, this method of concrete acceptance has some drawbacks, including the amount of time needed for concrete to cure, the cost of these tests, the intrusive nature of the tests, and the reliability of these tests. Some recent technological developments show potential for alternatives methods of concrete acceptance using embedded sensors. Other DOTs across the country are starting to investigate application of non-destructive techniques for concrete acceptance given the benefits.

BENEFITS

The benefits of implementing new technologies for concrete acceptance are several. First, a new method(s) of acceptance that does not require coring preserves the structural integrity of structures by avoiding invasive practices. The alternative method of casting test cylinders requires samples to cure to 28 days prior to testing. Both of these approaches are labor and time intensive. Second, the application of novel approaches for acceptance has the potential to provide a more accurate method to determine concrete strength by the virtually limitless sampling distribution that can be applied. Since these proposed methods are non-destructive, the number of tests made on concrete structures are only limited by the availability of equipment and technicians. Third primary benefit of new technologies in concrete acceptance is a potential a reduction in the cost of performing these tests, since the removal of cores or the casting of samples would be significantly reduced or potentially eliminated.

SCHEDULE, BUDGET AND AGENCY SUPPORT

Estimated Project Length: 24 months.
Estimated Project Budget: $295,000
ODOT Support:
Austin Johnson – Concrete Quality Coordinator Austin.L.JOHNSON@odot.oregon.gov (503) 510-1384
David Dobson – Structural Materials Engineer David.DOBSON@odot.oregon.gov (971) 900-7118
Scott Nelson – Structure Services Engineer Scott.D.NELSON@odot.oregon.gov (503) 986-3056

FOR MORE INFORMATION

For additional detail, please see the complete STAGE 2 RESEARCH PROBLEM STATEMENT online at:
https://www.oregon.gov/odot/Programs/ResearchDocuments/26-65.pdf

SPR RESEARCH PROGRAM
SECOND-STAGE PROBLEM STATEMENT
FY 2026

PROBLEM NUMBER AND TITLE

26-65 Development of New and Non-destructive Techniques for Concrete Acceptance.

RESEARCH PROBLEM STATEMENT

28-day compressive strength tests of concrete cylinders or cube samples is widely used as the only method of concrete acceptance. However, this method of concrete acceptance has some drawbacks, including the amount of time needed for concrete to cure, the cost of these tests, the intrusive nature of the tests, and the reliability of these tests. Some recent technological developments show potential for alternatives methods of concrete acceptance using embedded sensors or applying non-destructive technologies such as ultrasound acoustic sensors. Other DOTs across the country are starting to investigate application of non-destructive techniques for concrete acceptance given these potential benefits.

RESEARCH OBJECTIVES

- Research and document currently available non-destructive tools used for concrete acceptance across the industry and transportation agencies.
- Understand operating principles, reliability and sensitivity of applicable NDT devices.
- Establish critical properties of concrete components and appropriate acceptance criteria for use in acceptance specifications.
- Validate promising NDT tools to demonstrate effectiveness.

WORK TASKS, COST ESTIMATE AND DURATION

Task 1 - Literature Review
Task 2 - Selection of Feasible Technologies
Task 3 - Test Plan Development
Task 4 - Correlation Analysis of Compressive Strength and other properties
Task 5 - Error and Uncertainty Evaluation
Task 6 - Final Report and Final Presentation

Key Deliverables: *Literature review, Test plan,* Correlation Analysis.

Estimated Project Length: 24 months.
Estimated Project Budget: $295,000

IMPLEMENTATION

Implementation of the research findings will include the development of procedures for the use of selected technologies along with a guidance for the interpretation of measurements. For example, ultrasound pulse velocity (UPV) technology has been shown to closely correlate with compressive strength as well as other material properties such as water to cement ratio, and others. Using this example, an outcome of this research would include the development of criteria for interpretation of UPV measurements and possibly the development of procedures for operation of UPV devices if already commercially available.

POTENTIAL BENEFITS

The benefits of implementing new technologies for concrete acceptance are several. First, a new method(s) of acceptance that does not require coring preserves the structural integrity of structures by avoiding invasive practices. The alternative method of casting test cylinders requires samples to cure to 28 days prior to testing. Both of these approaches are labor and time intensive. Second, the application of novel approaches for acceptance has the potential to provide a more accurate method to determine concrete strength by the virtually limitless sampling that can be applied. Since these proposed methods are non-destructive, the number of tests made on concrete structures are only limited by the availability of equipment and technicians. Third primary benefit of new technologies in concrete acceptance might be a reduction in the cost of performing these tests, since the removal of cores or the casting of samples would be significantly reduced or potentially eliminated.

PEOPLE

ODOT champion(s):

Austin Johnson – Concrete Quality Coordinator Austin.L.JOHNSON@odot.oregon.gov (503) 510-1384
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Problem Statement Contributors:

Cristhian Galvez, David Dobson, Austin Johnson

REFERENCES

GDOT Research Report 20-15 “Recommendations for Nondestructive Testing (NDT) of Concrete Components for Performance-Based Specifications” (2022).

STAFF REVIEW PAGE

LITERATURE CHECK

TRID&RIP

☒ A review of TRID & RIP databases found no existing research that answers the research question

A literature review looking at the level of use of non-destructive technologies by other Department of Transportation across the country shows some recent work does exist (2022), however the research performed is focused on the use of these technologies to detect defects such as voids or dislocated rebar. Existing research confirms that non-destructive techniques can be applied for concrete acceptance, however additional investigation is needed.

ODOT DECISION LENSES

Climate:

This research project presents a potential for cost and material savings by providing a more accurate and reliable method to assess properties of hardened concrete and avoid unnecessary rework that might otherwise be mandated if test results are too close to acceptance limits.

Equity:

None

Safety:

This research projects presents a potential for greater accuracy when assessing the integrity of concrete that may have require structural integrity to ensure safety of infrastructure. The research outcomes of this research include a method to sample a structure in virtually unlimited of locations thus enabling Quality Assurance personnel to evaluate a concrete components more thoroughly and with greater speed than traditional methods.

TECHNOLOGY & DATA ASSESSMENT

☒ No Identified T&D output

☒ At the end of this project, the implementing unit(s) within ODOT will need to coordinate the adoption of new technology or data in order to realize the full potential of this research.

CROSS-AGENCY IMPACTS

- List ODOT partners or impacted units: **Structure Services, Construction Section**
- Identify any issues of concern raised by an ODOT partners. Note expected mitigation that addresses these concerns: **None**