

RWTH Aachen University Construction and Robotics

Master's Thesis

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Evaluating the Influence of Admixtures on Concrete Maturity and Strength Development: Pathways to Low-CO₂ Concrete Solutions

- How chemical admixtures (accelerators, retarders, superplasticizers) influence the accuracy of maturity-based strength estimation?

- The aim of this theme is to systematically investigate how different chemical admixtures influence the relationship between concrete maturity and strength. The goal is to determine whether standard maturity curves need to be adjusted for concretes containing admixtures to ensure accurate strength estimation.

The advantage is that we can compare the concrete mixes with different accelerators that we are currently examining at the plant, such as the 1003 and 1004 recipes, which differ by 300 kg and 350 kg of cement, respectively. This way, we can use the results of this thesis to improve Net Zero concrete.

- I can use the sensor's software tool such as ComSoft, that automatically collects temperature data from temparature sensor and implement the algorithm to calculate maturity indices and generate maturity-strength curves for different mixes and admixtures from lab tests.
- I integrate real-time data visualization dashboards for monitoring concrete curing.
- I create an automated reporting system that generates PDF or web-based reports summarizing test results, maturity curves, and recommendations.
- All data is stored securely and can be accessed remotely by project stakeholders.

Life-Cycle Assessment Integration into Digital Concrete production workflows

- Research Questions

How can LCA be embedded into digital concrete production processes?

- What data from digital workflows (e.g., sensors, batching systems, mix designs) are needed for real-time LCA?
- How can automated feedback loops be created to optimize concrete production for sustainability?

Start and end time of the maturity sensor