



Taking a Crack at a Serious Problem

Early age thermal cracking is under examination

Early age thermal cracking in concrete is a significant and costly engineering problem for concrete industries, major contractors and government agencies responsible for maintaining critical infrastructure such as road, rail and ports.

Luckily, the problem is about to be examined by a team of expert researchers led by Associate Professor Arnaud Castel and Dr Ali Akbarnezhad from the Centre of Infrastructure Engineering Safety at UNSW and Boral, Australia's largest integrated construction materials group.

"The aim of this project is to determine the fundamental mechanics of early age thermal cracking in mass concrete elements and in members with high cement contents," explains Dr Ali Akbarnezhad, Lecturer in the School of Civil and Environmental Engineering and one of the chief investigators of this new Australian Research Council Linkage Project.

*We want to develop a **tool to identify the optimal mix proportion** for concrete that minimises the risk of thermal cracking*

"Early age thermal cracking in concrete is a problem in terms of durability and structural performance, not to mention aesthetics and project costs, and is one of the most serious problems in the construction industry today," says Redmond Lloyd, Boral's National R&D Manager.

The risk of thermal cracking is higher for concrete elements with relatively low surface area to volume ratio. "This includes concrete dams, large bridge decks and in large foundations including the foundations of wind turbines," says Dr Akbarnezhad. "Once cracking has started harmful materials can enter the crack and reduce the service life of the concrete."

While taking into account the advances made in measurement, characterisation methods, computational methods, multiphysics simulation and optimisation methods, the research team believes they have devised a novel solution to this old and important

problem. In solving it they hope to provide greatly enhanced reliability to designers and suppliers of cement products. “The damage resulting from early age thermal cracking is complex and our lack of understanding can severely impact the acceptance of new work. If we’re successful, we could potentially save millions of dollars currently spent on restoration and maintenance.”

Working closely with industry throughout the project is what Dr Akbarnezhad is most looking forward to. “This whole project came about after we started listening closely to industry. Through a series of meetings we learned about the issues and started generating ideas. The chance to see the results of our theoretical and mathematical methods applied to a real-life problem is definitely the most exciting part of the project for me.”

At a glance:

Project partners: UNSW Centre for Infrastructure Engineering Safety (CIES) and Boral

ARC Linkage grant: \$299,000

Timeframe: 3 years

Did you know?

The Construction Materials and Cement division of Boral has a turnover of \$3.2 billion and supports more than 5,000 employees across 400 operating sites.