ABSTRACT

Patch repair methods are widely considered acceptable when restoring a damaged reinforced concrete member to an acceptable condition. However, in cases where structural repairs are required, it is often assumed that these repairs contribute to the member's load-carrying capacity. This has led to the over-specification of high-strength repair materials that can result in early-age cracking and repair failure.

This research aims to increase the understanding of patch repairs and inform existing guidelines on designing structural patch repairs. The research method is split into an experimental and modelling component.

The experimental component considers composite prisms that are axially loaded in compression. These axial loads either increased steadily until failure or were sustained over time. The composite specimens consisted of a concrete prism that had undergone drying shrinkage or compressive creep and drying shrinkage for an extended period (the substrate). After at least 20 weeks, a section of concrete was removed and replaced with different concrete or mortar-based repair materials, making up the composite prism. The composite prisms were tested three days after the repair material was placed. Digital Image Correlation (DIC) was used to record the repair and substrate deflections of the composite prism when loaded up to failure. To measure the long-term deflections of the composite prisms loaded over time, DEMEC targets were used. Results from the experimental component were then used to inform and validate a FEM model, which was used as a basis for numerous repair scenarios.

The findings from this research give feedback on whether patch repairs do or can contribute to the member's load-carrying capacity and what characteristics should be considered when designing a structural repair.