

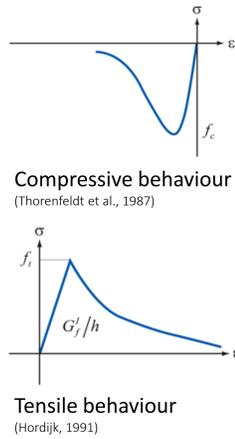
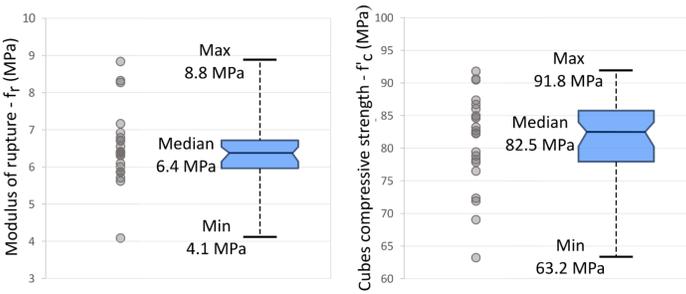
Finite Element Modelling of the SEISMIC BEHAVIOUR OF HOLLOW-CORE FLOORS

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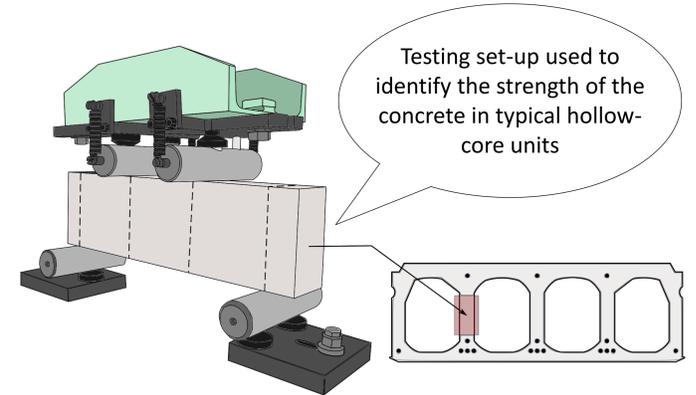
- The vulnerability of modern buildings with precast concrete floors was highlighted during the 2016 Kaikōura earthquake.
- As a result, an urgency to advance the understanding of the performance of precast floors was unleashed.
- Subsequently, a research program named **ReCast Floors** was initiated consisting of two streams: real-world and lab-based investigations.
- This paper presents a comprehensive campaign of nonlinear finite element (FE) analyses, validated against lab-based experimental data.

WHAT ARE THE RESEARCH PHASES?

Material characterization of extruded concrete validated through **compression and indirect tension tests on sawed specimens**



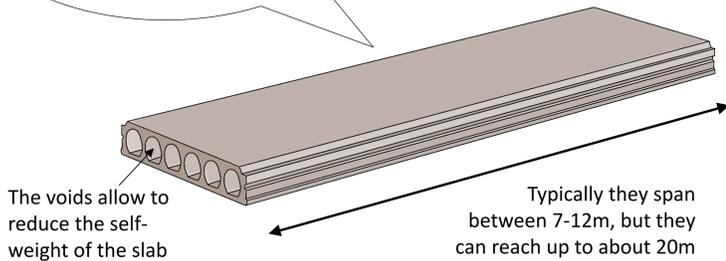
EXTRUDED CONCRETE



Testing set-up used to identify the strength of the concrete in typical hollow-core units

! The results show that the concrete in hollow-core units has about twice the strength of normal concrete.

A hollow-core unit is a concrete plank with voids widely used around the world in the construction of floors in multi-storey buildings and warehouses

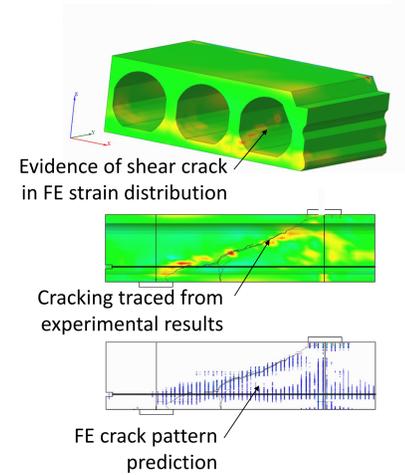
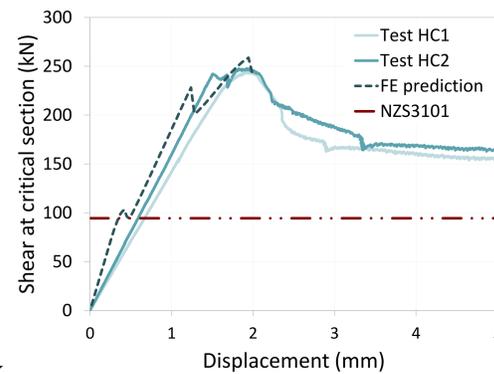


The voids allow to reduce the self-weight of the slab

Typically they span between 7-12m, but they can reach up to about 20m

UNITS

Assessment of **web-cracking behaviour** under shear, flexural and torsional actions.

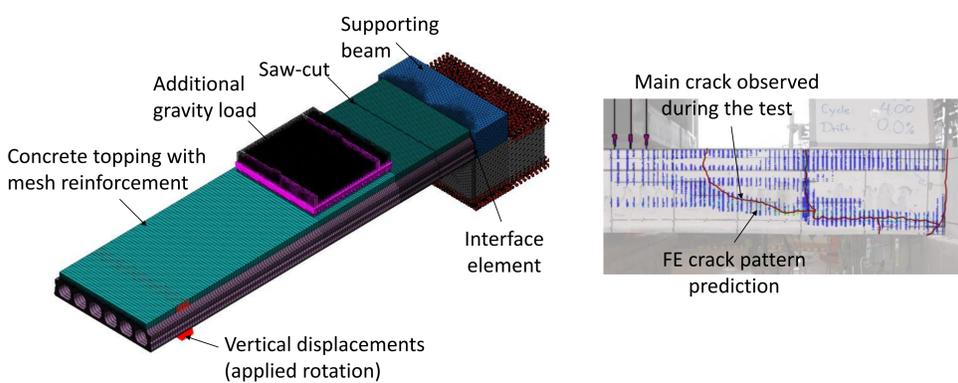


Evidence of shear crack in FE strain distribution

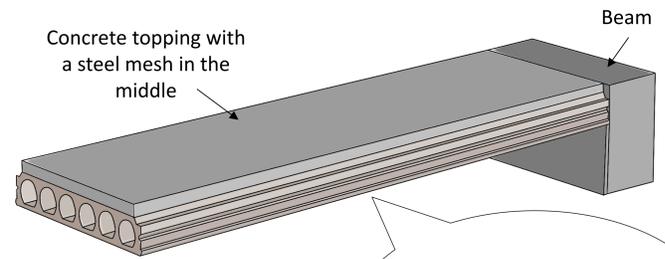
Cracking traced from experimental results

FE crack pattern prediction

Modelling of floor seating connections to identify the **drift levels** that cause critical failure modes such as **loss of seating** and **negative moment failure**.

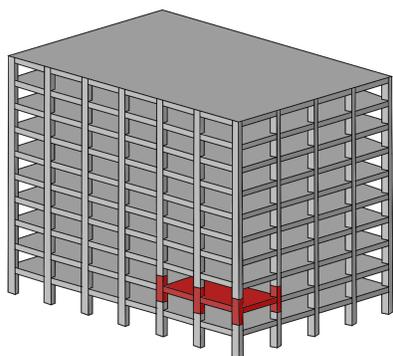


SUB-SYSTEM



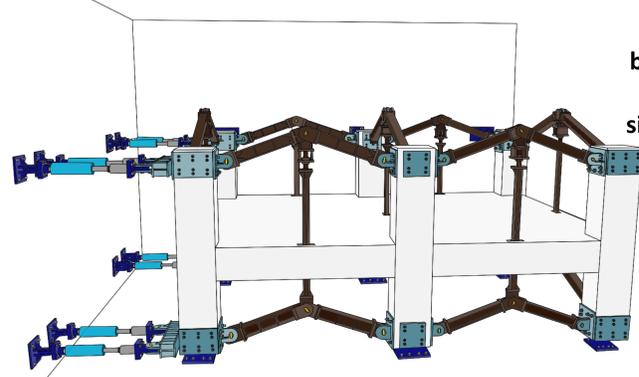
In a building, the hollow-core units are placed side by side, sit on top of the beams and are joined together by a thin layer of concrete, placed on top

We can use numerical models to try and predict the behaviour of buildings with hollow-cores during earthquakes



As part of the **ReCast Floors Project** results of this research are helping inform methods for assessing and improving the seismic performance of precast concrete floors in New Zealand.

SYSTEM



Analysis of the **post-cracking behaviour** of hollow-core floor diaphragms and revision of **simplified analysis approaches** for precast concrete floors.

Models developed will be validated against experimental data collected from ongoing experimental research on a 2 bay frame with hollow-core floor diaphragm.

Reference

Sarkis A, Sullivan T, Brunesi E, Nascimbene R. (2020). Numerical simulation of the seismic behaviour of precast pre-stressed hollow-core floor seating connections. *Proceedings of the 17th World Conference on Earthquake Engineering*, Sendai, Japan.



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