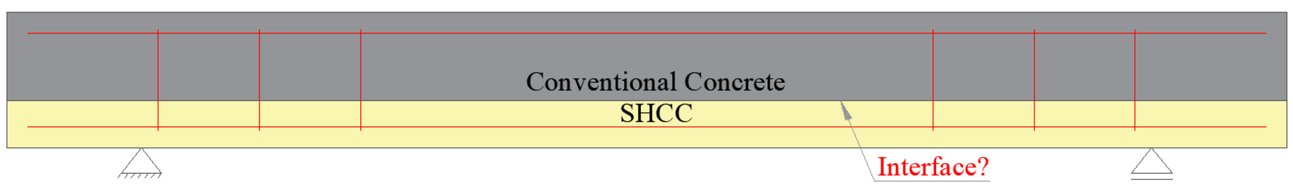
Characterization and Modelling of SHCC-Concrete Interface

Introduction

Conventional concrete has low tensile strength and durability

SHCC is a concrete with better performance and durability but is expensive



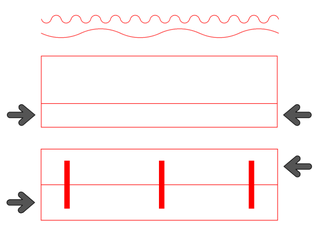
IDEA: Using SHCC and Conventional Concrete in combination with each other with SHCC only where required.

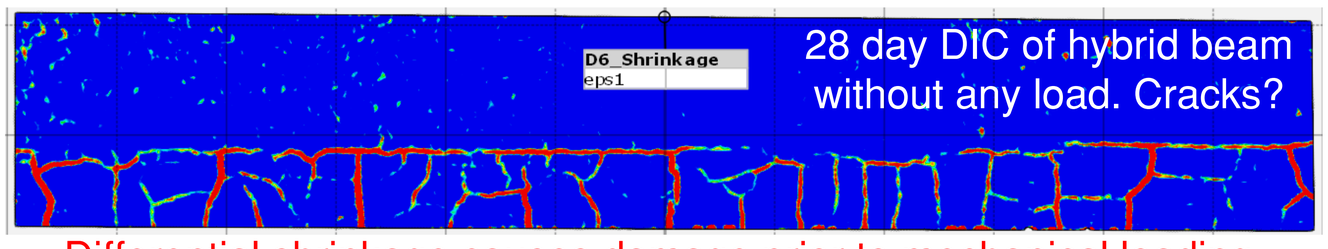
BENEFIT: Cost effective approach allowing optimal material utilization.

PROBLEM: The role of interface on the behavior of the hybrid beam is unclear. No standard test to characterize interface.

Parameters Considered

1. Interface Roughness
2. Differential Shrinkage
3. Reinforcement



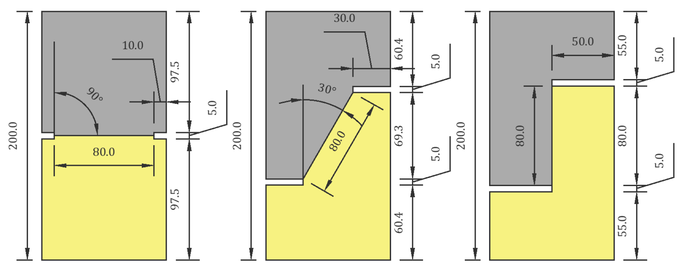


Differential shrinkage causes damage prior to mechanical loading.

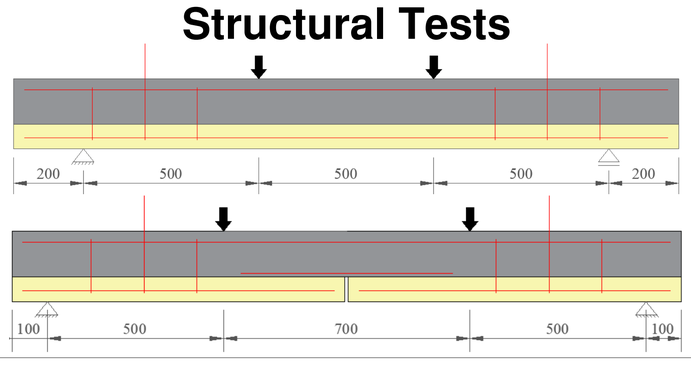
Research Methodology

Experiments

Material and Bond Tests



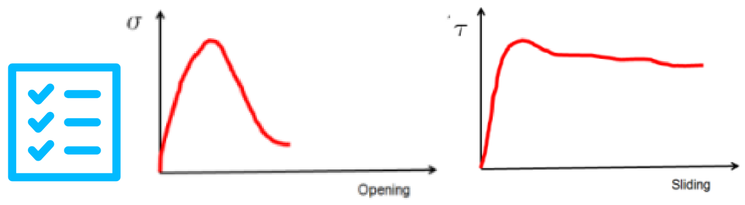
Structural Tests



Inverse Analyses

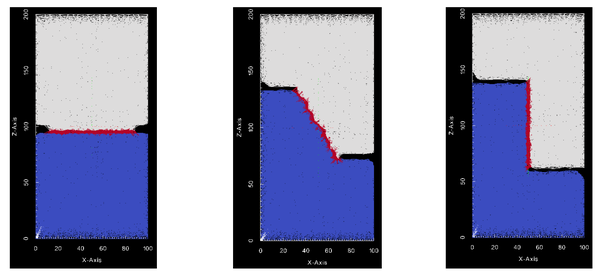
Full-field verification of Finite Element Model using Digital Image Correlation

Expected Outcomes

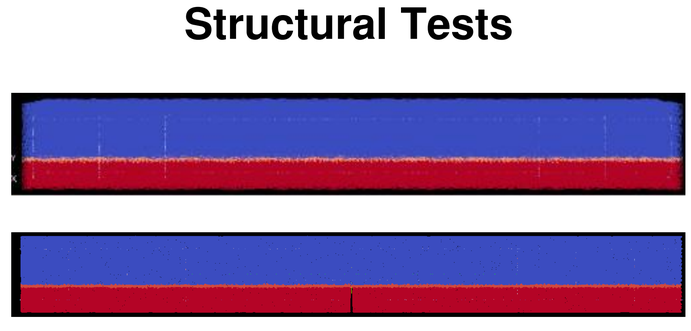


Numerical Simulations

Material and Bond Tests

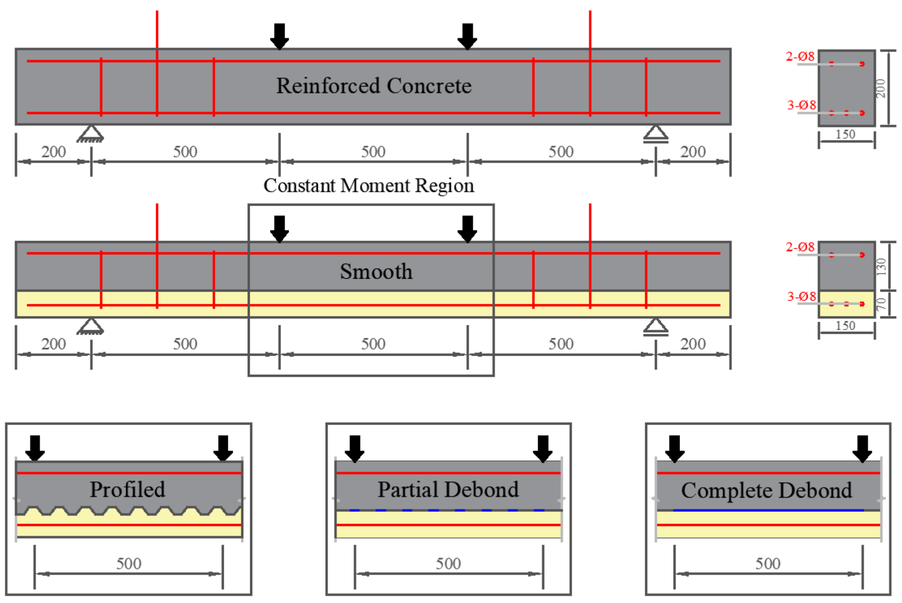


Structural Tests



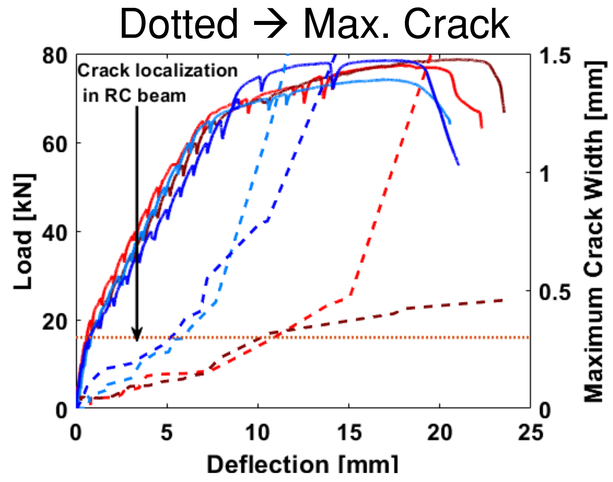
Results - Interface Treatment on Crack-Width Control

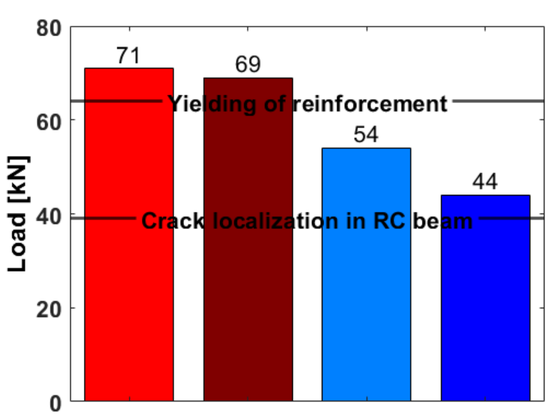
1. Can a better crack control be achieved by replacing bottom concrete with SHCC?
2. How is the crack response of hybrid beam influenced by interface treatment?



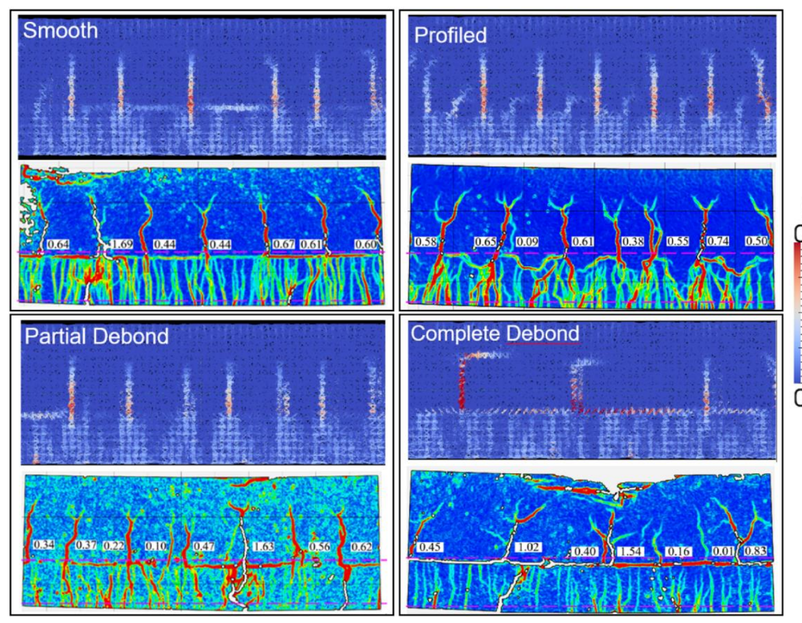
Tested Beams - Yellow is SHCC, Red is Reinforcement, Blue is Artificial Debonding

Solid → P-Delta
Dotted → Max. Crack





Comparison of experimental and numerical crack pattern at ultimate load in constant moment region



Hybrid beams with smooth and rough interface limit cracks below 0.3mm until yielding of reinforcement!!!

Smooth(PVA) — Profiled — Partial Debond — Complete Debond — CW Limit

TU Delft concrete structures

PhD candidate: Shozab Mustafa
Supervisor(s): Dr. Mladena Lukovic
Prof. Dr. Max Hendriks
Prof. Dr. Erik Schlangen
Email: S.Mustafa-2@tudelft.nl