

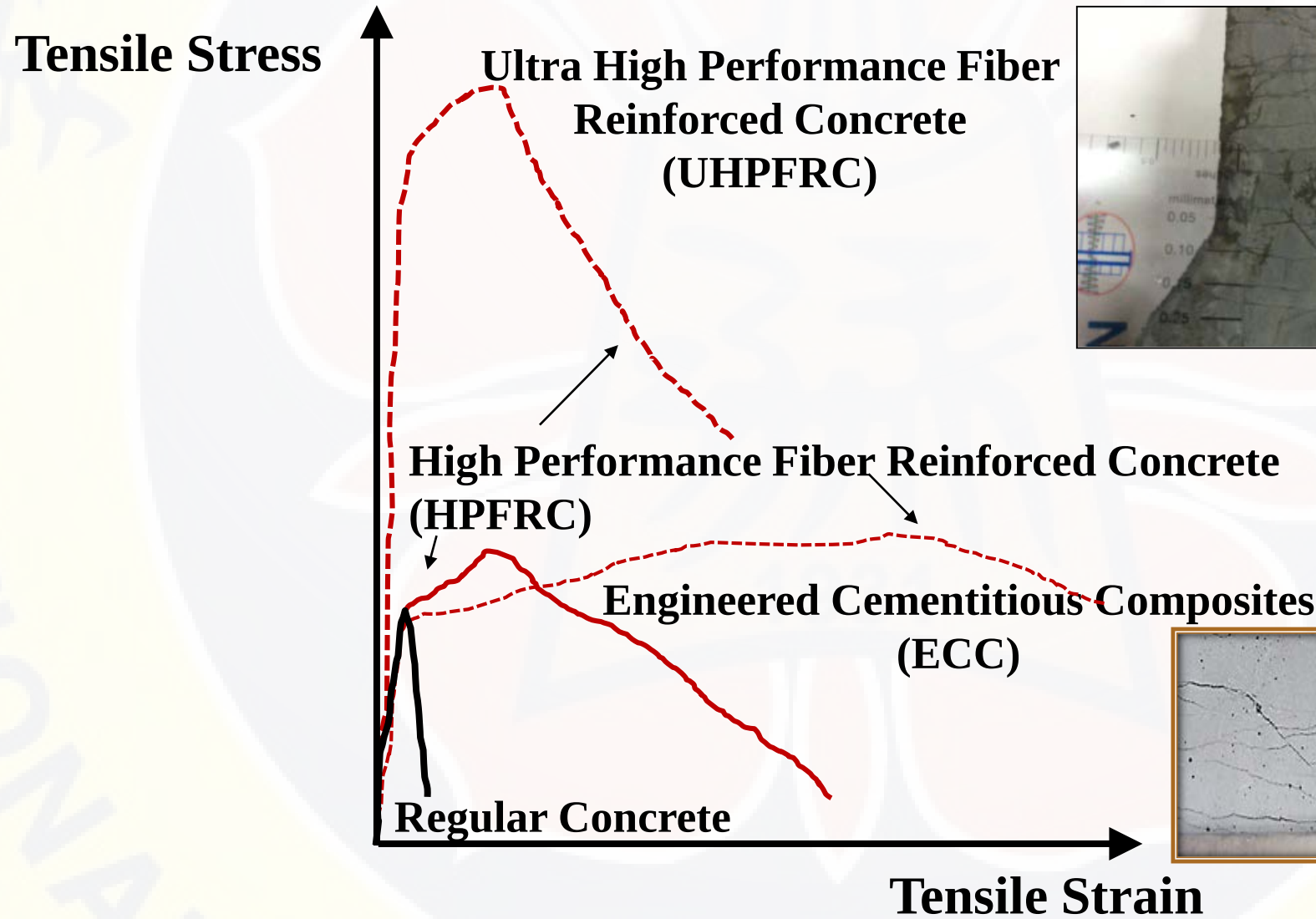
Potential of High Performance Fiber Reinforced Concrete for Damage Mitigation and Reinforcement Detailing Simplification



Chung-Chan Hung

*Professor of Civil Engineering
National Cheng Kung University*

High Performance Fiber Reinforced Concrete (HPFRC)

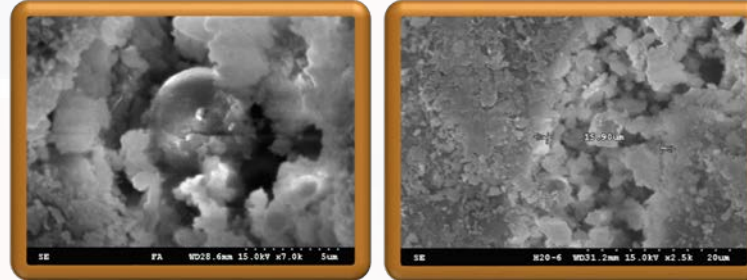


Multi-Scale Research on HPFRC at NCKU

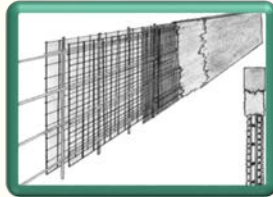
materials optimization



self-healing performance



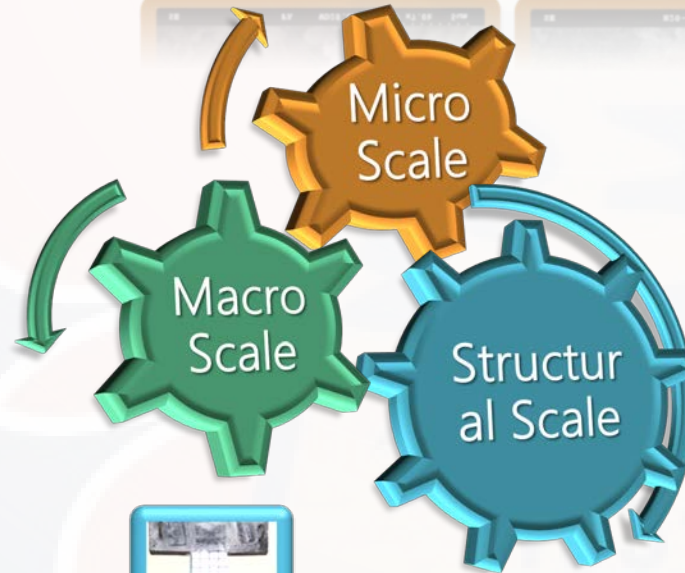
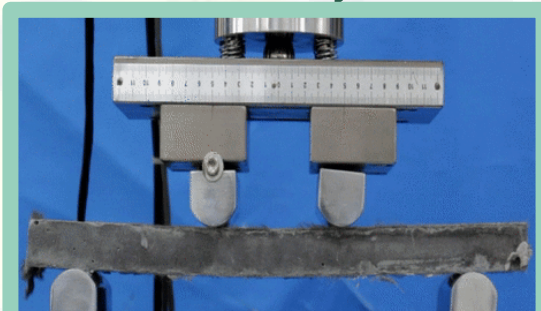
HPFRC ferrocement



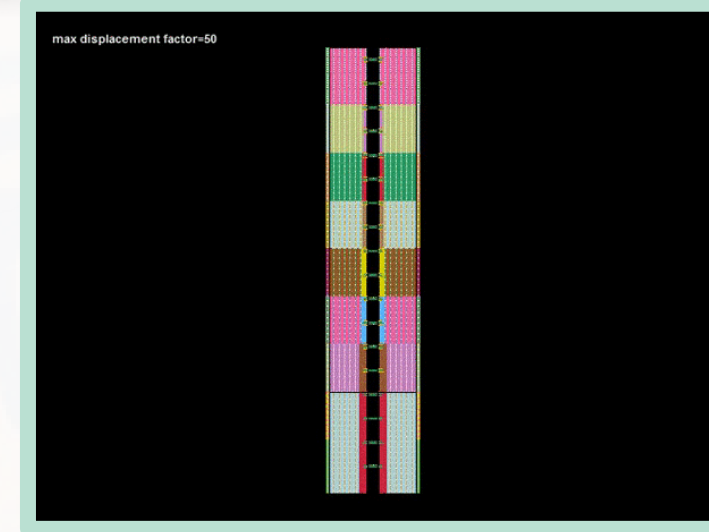
tension stiffening



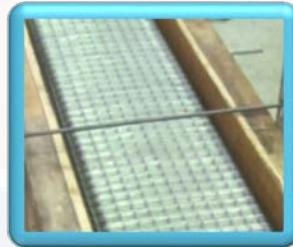
ductility



high-rise structural walls



columns



strengthening



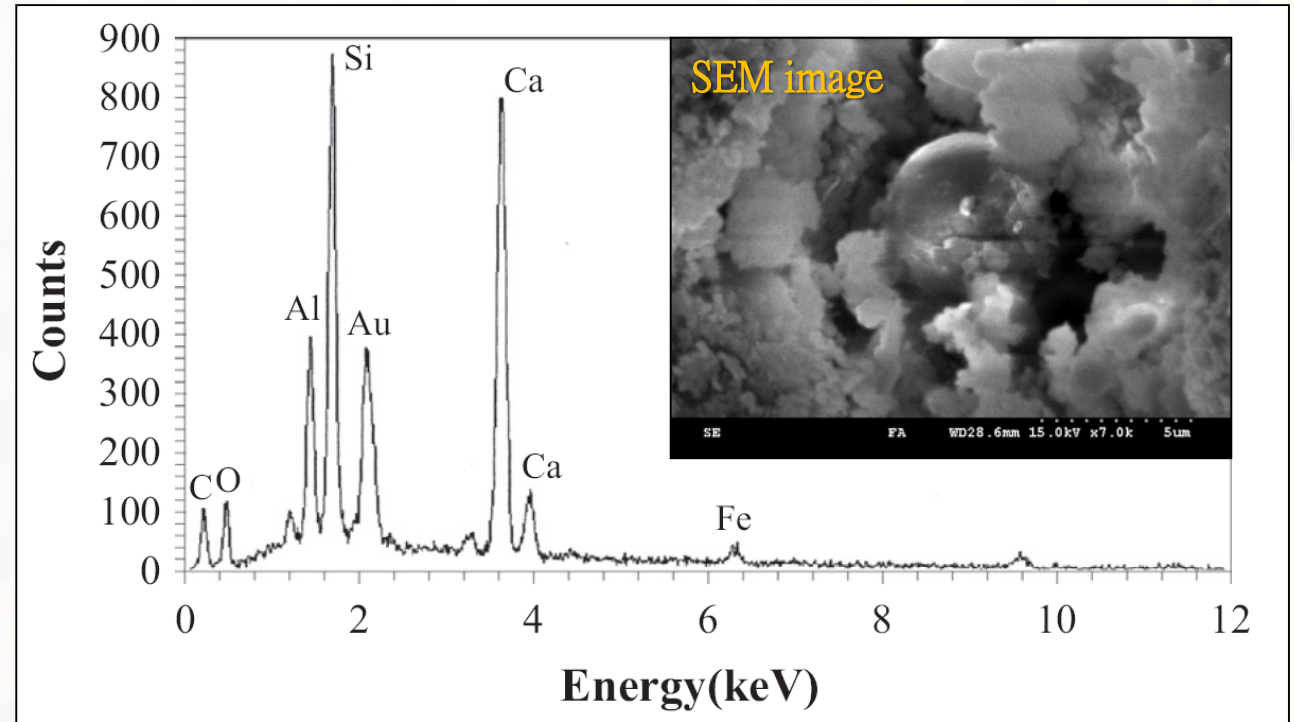
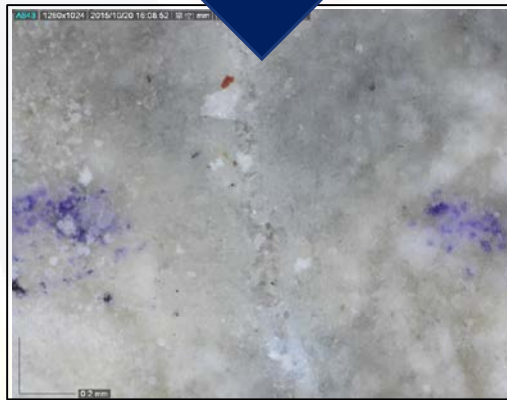
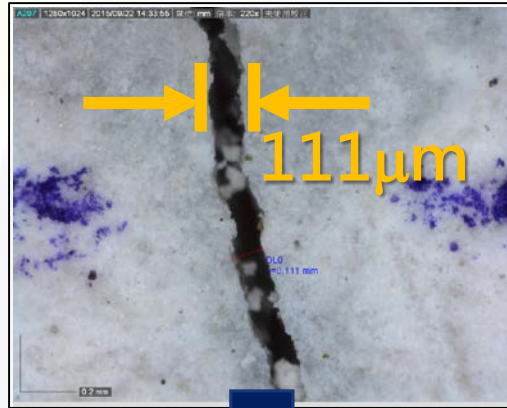
shear walls



coupling beams

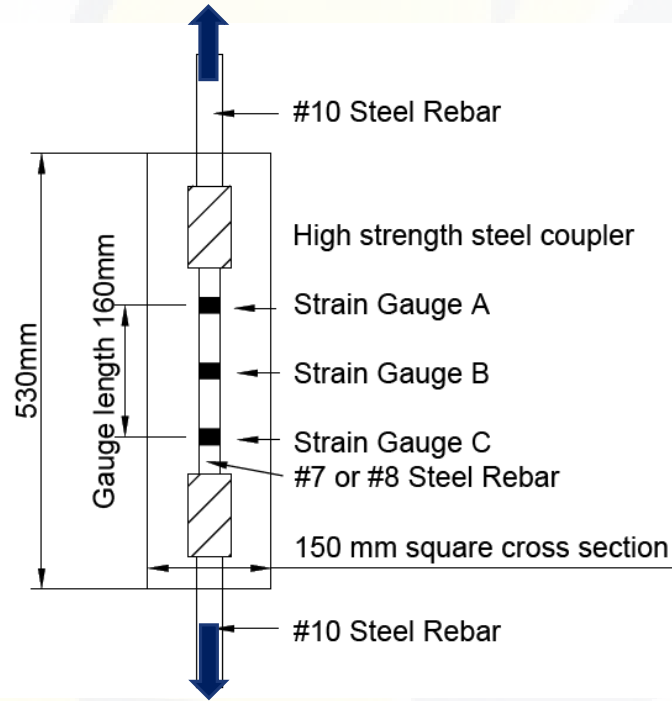
Self-healing Performance of HPFRC

➤ Energy dispersive x-ray (EDX) analyses

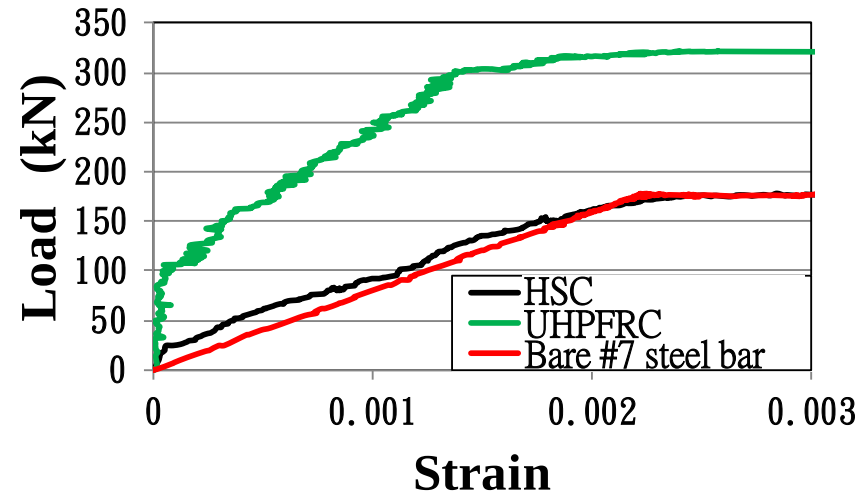


➤ C.-C. Hung, Y.-F. Su. Mechanical properties and self-healing evaluation of strain-hardening cementitious composites with high volumes of hybrid pozzolan materials.

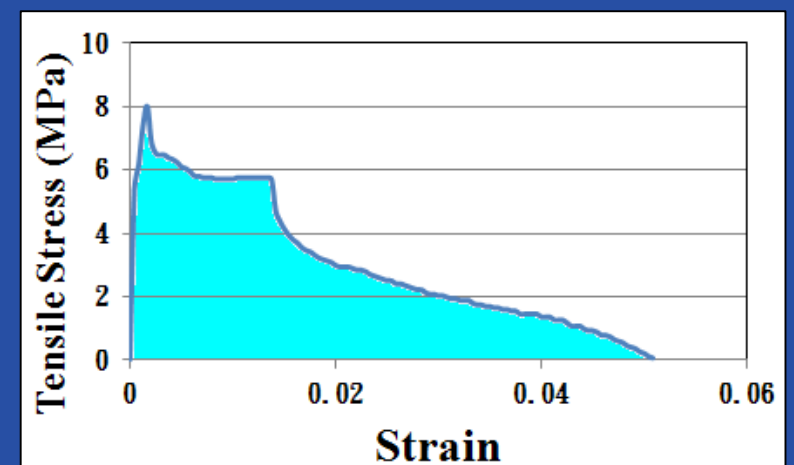
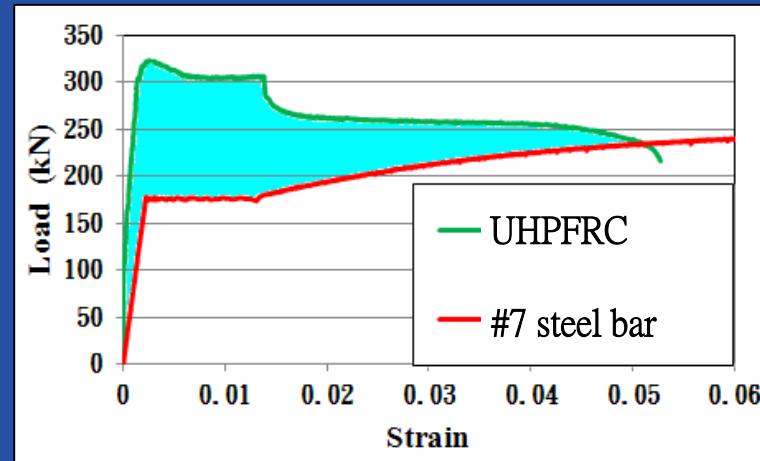
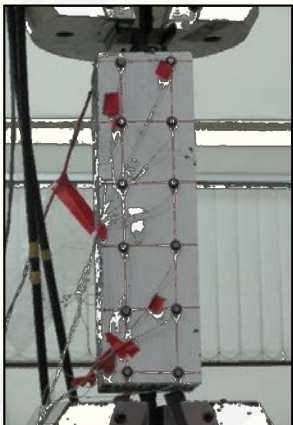
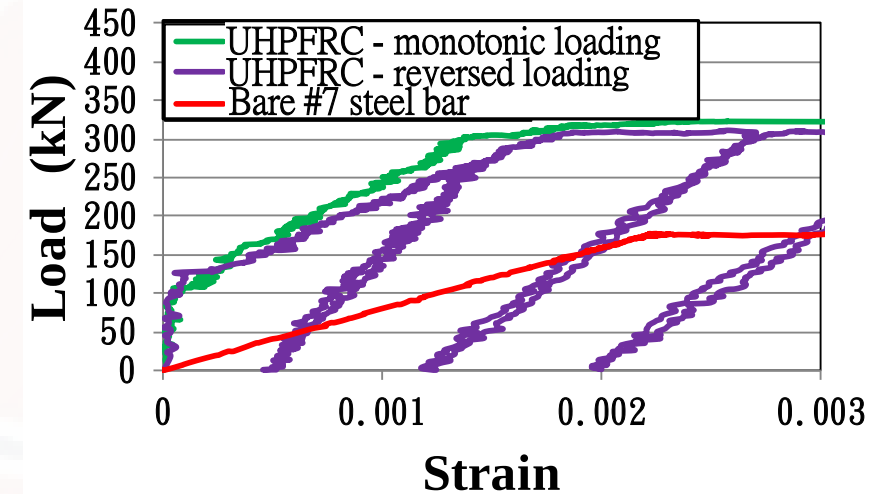
Tension Stiffening Performance of UHPFRC



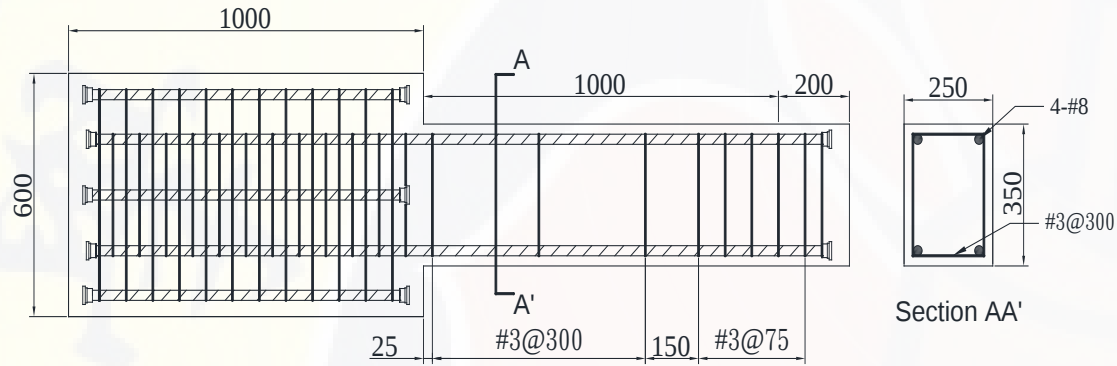
➤ monotonic behavior



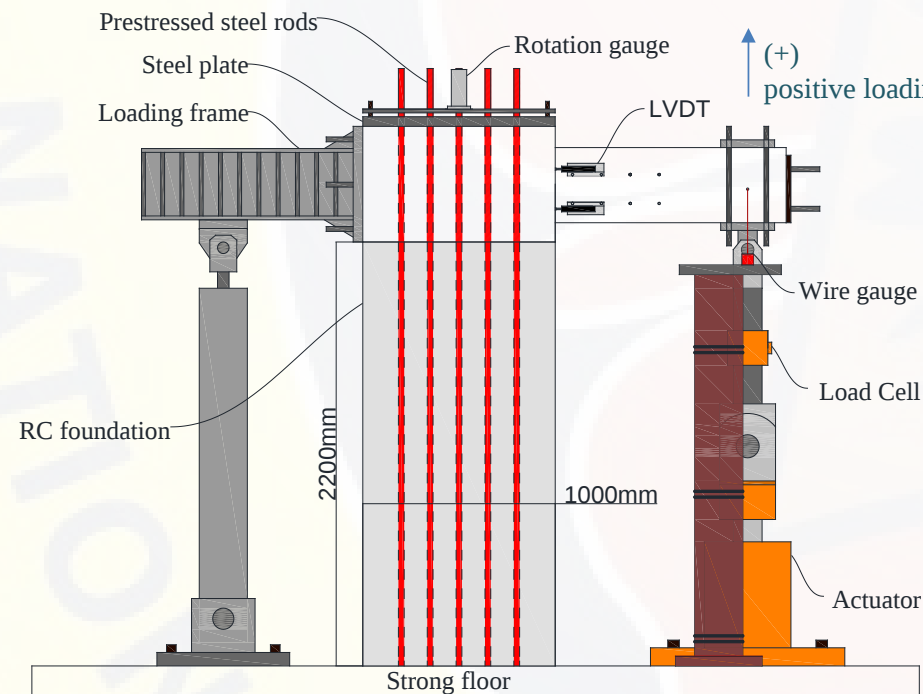
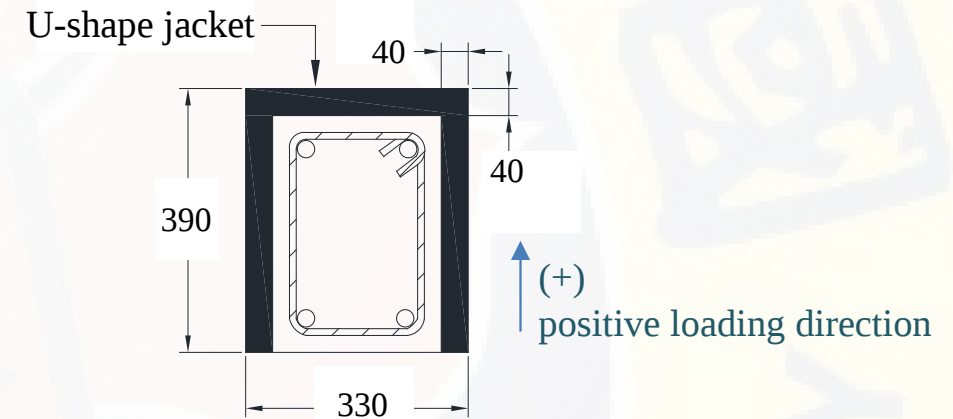
➤ cyclic behavior



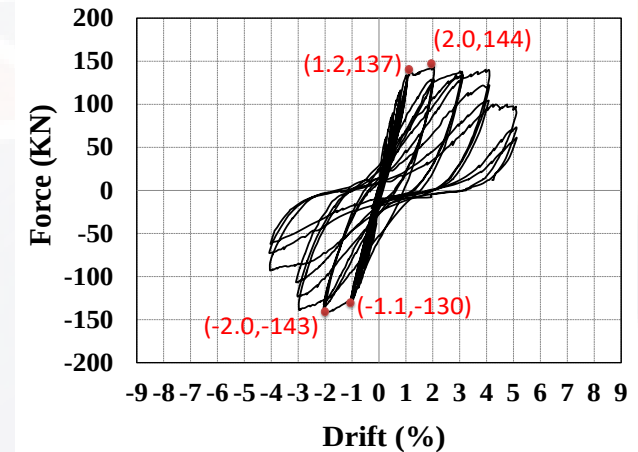
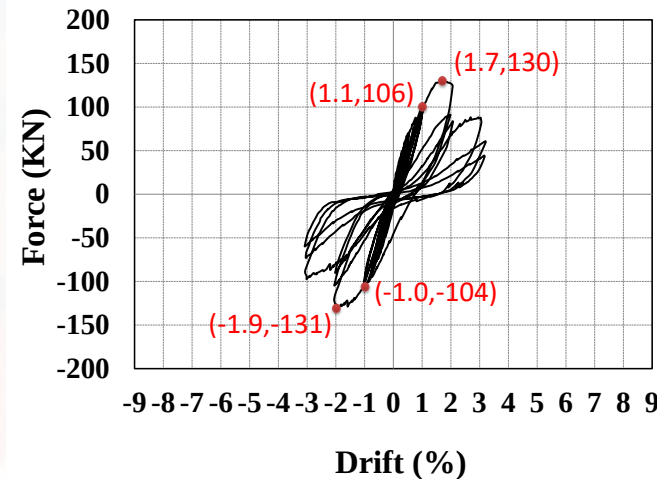
HPFRC Jacketing for Structural Retrofitting



➤ Jacketing without steel reinforcement

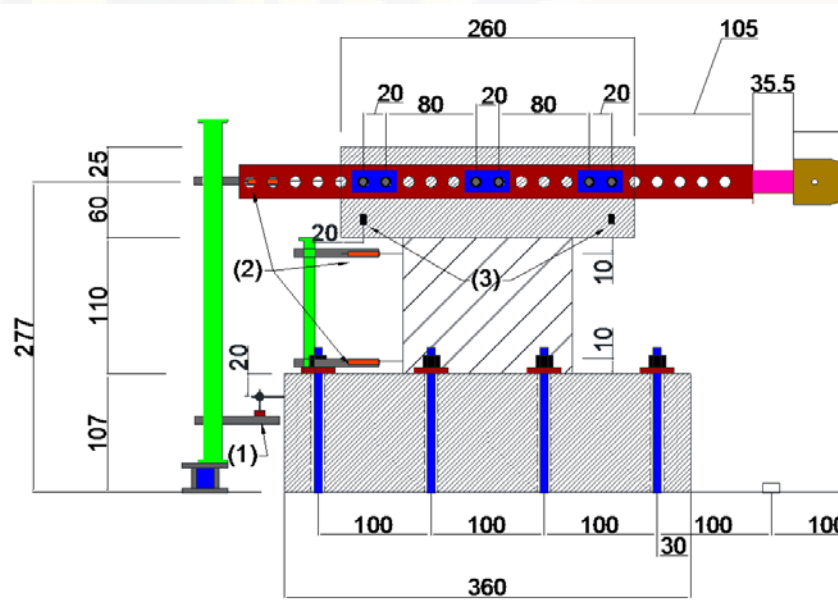


unit:mm

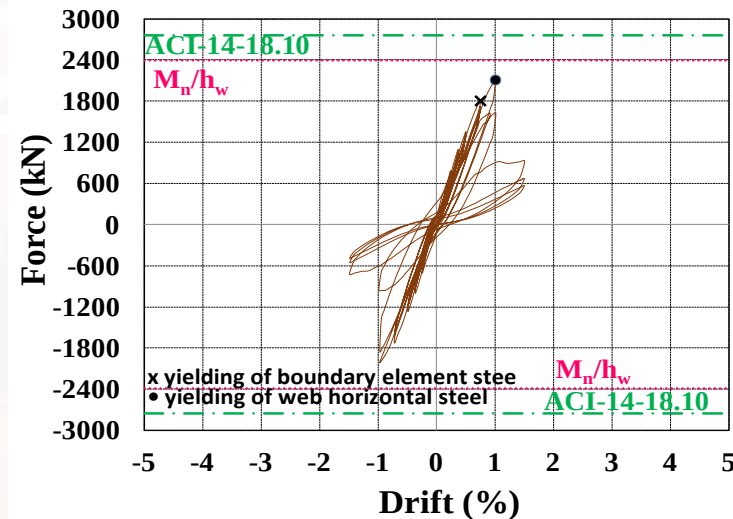


High Strength Steel Reinforced Squat UHPFRC Shear Walls

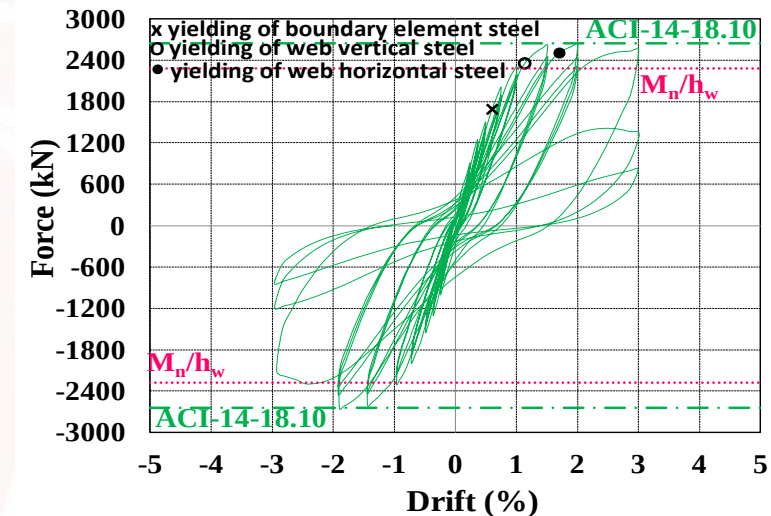
- Wall design shear = $5V_c$



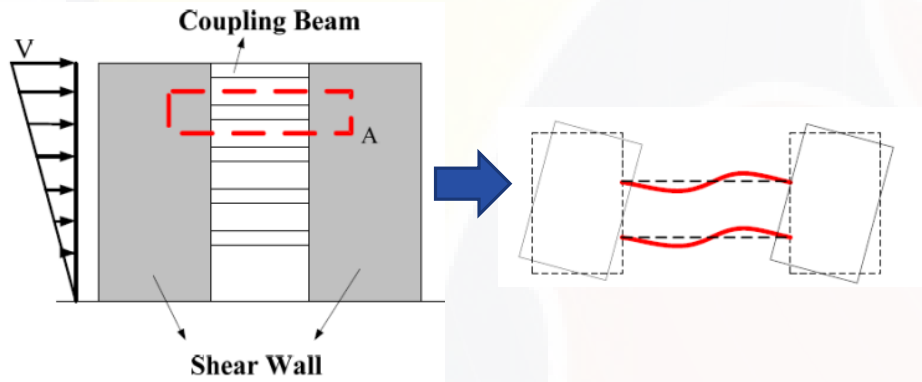
- High strength concrete



- UHPFRC



High Strength Steel Reinforced FRC Coupling Beams

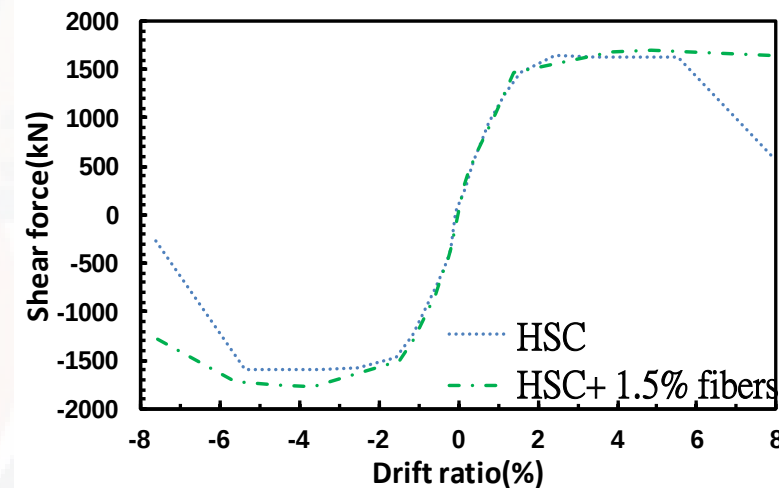
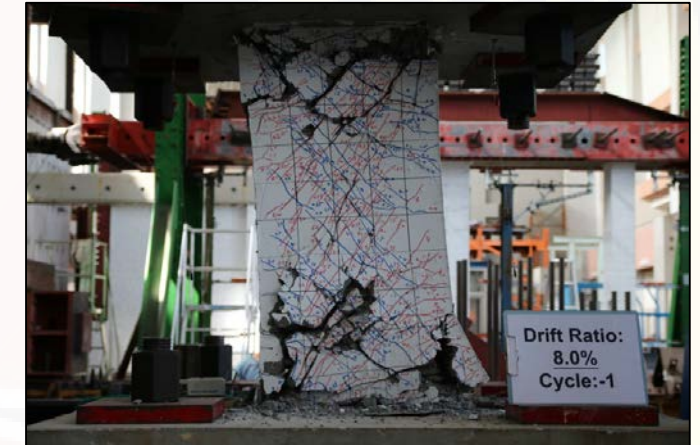


➤ Beam shear demand = $8V_c$

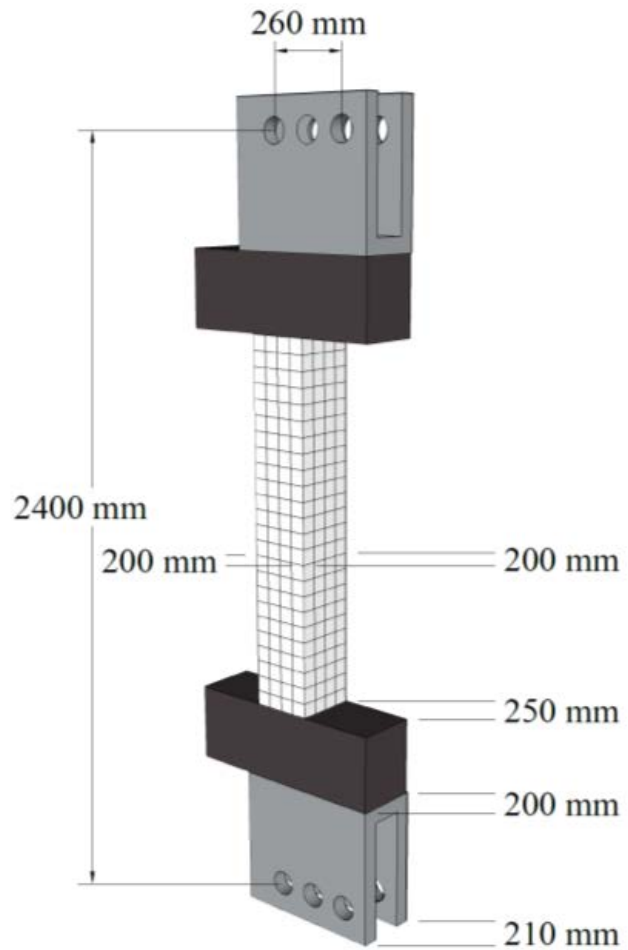
- without fibers



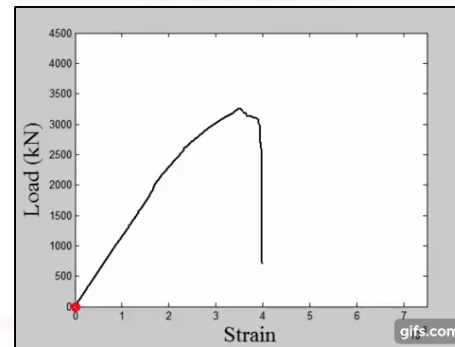
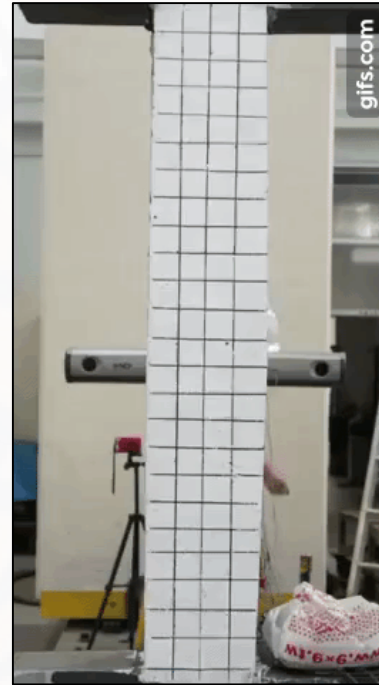
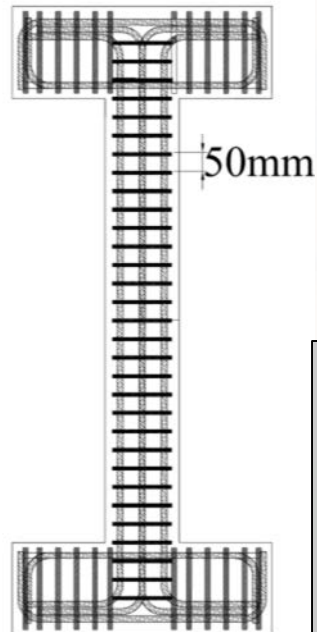
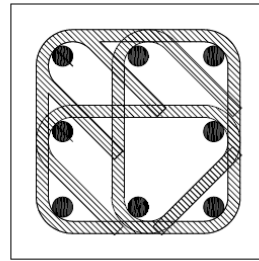
- with 1.5% fibers



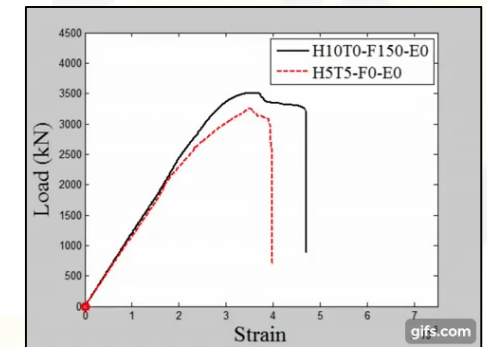
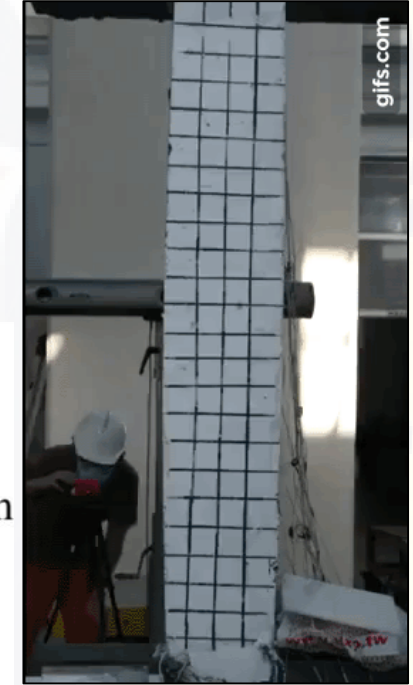
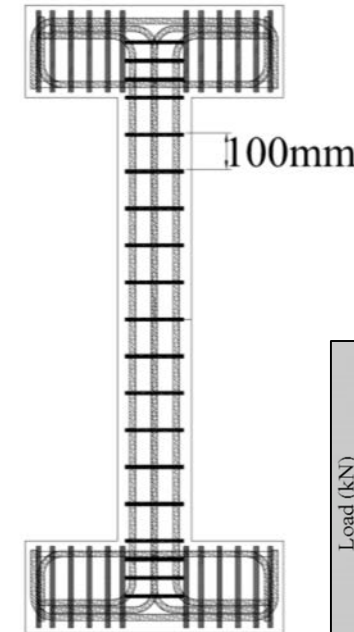
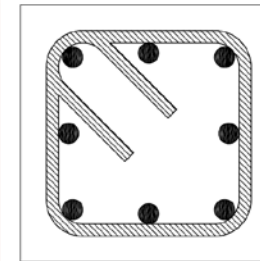
Slender UHPFRC Columns under Concentric Loads



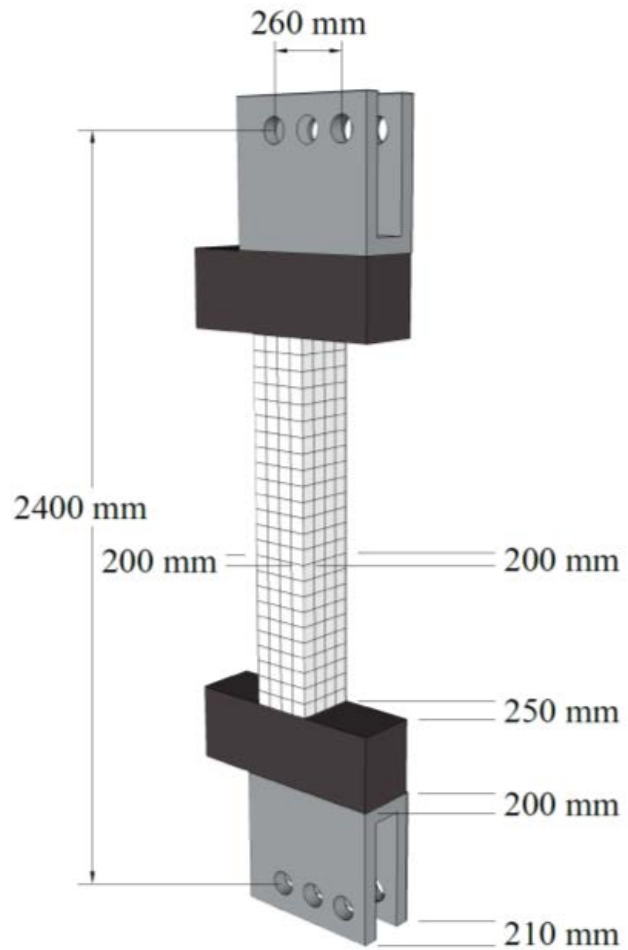
High strength concrete column



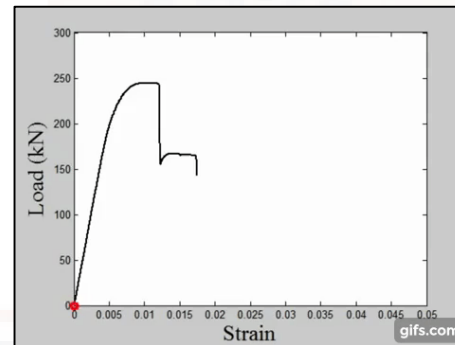
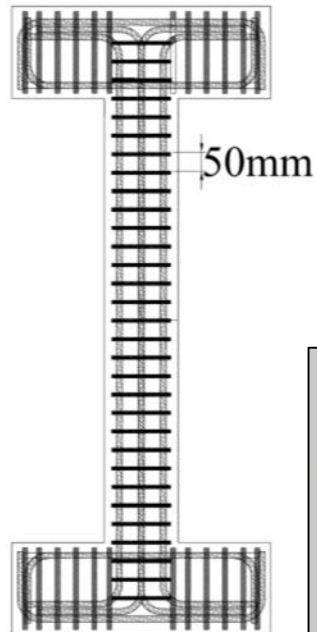
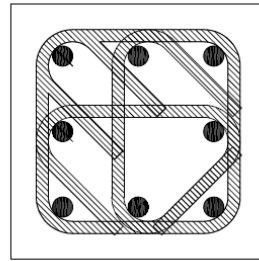
UHPFRC column



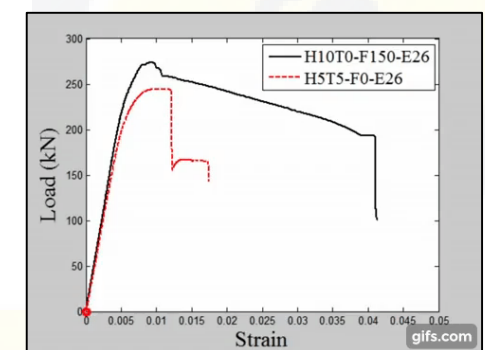
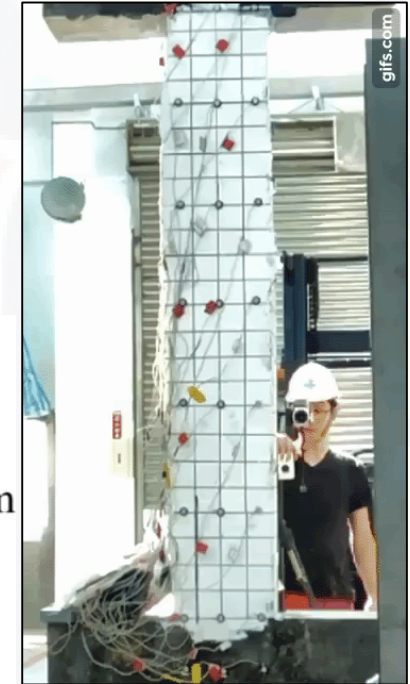
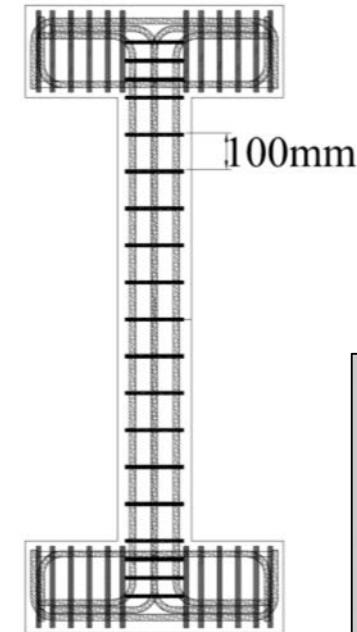
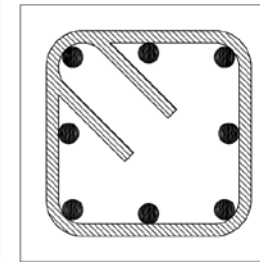
Slender UHPFRC Columns under Eccentric Loads



High strength concrete column



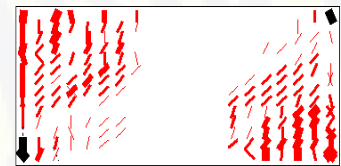
UHPFRC column



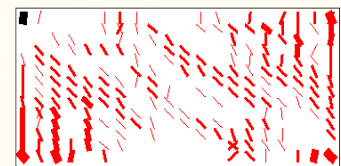
HPFRC Coupled Structural Walls

➤ Crack patterns in coupling beams

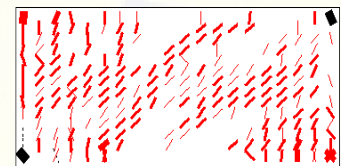
(i) -0.03 beam rotation



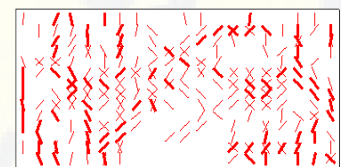
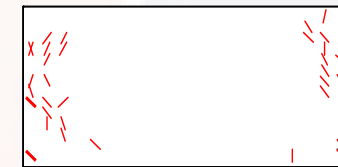
(ii) 0.012 beam rotation



(iii) -0.013 beam rotation

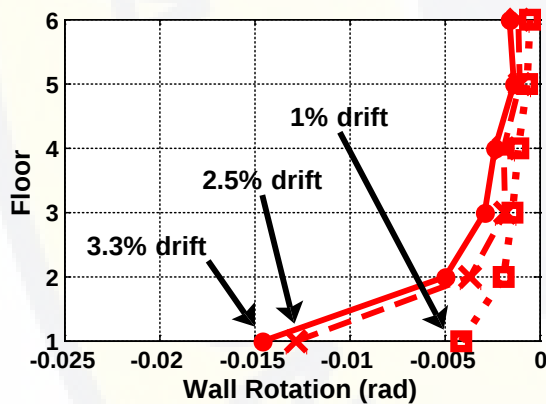
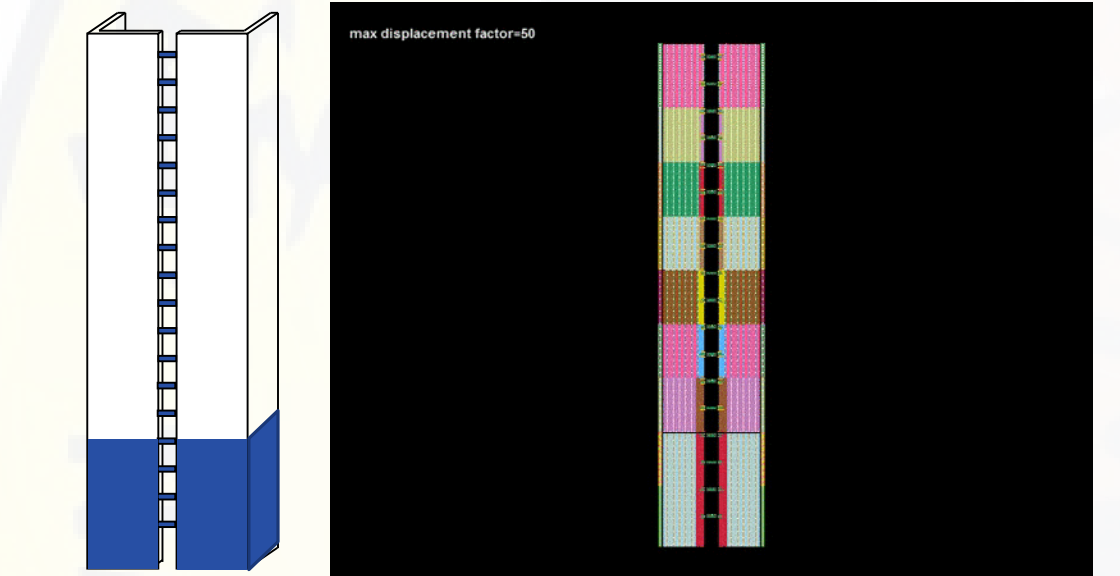


(iv) residual cracks

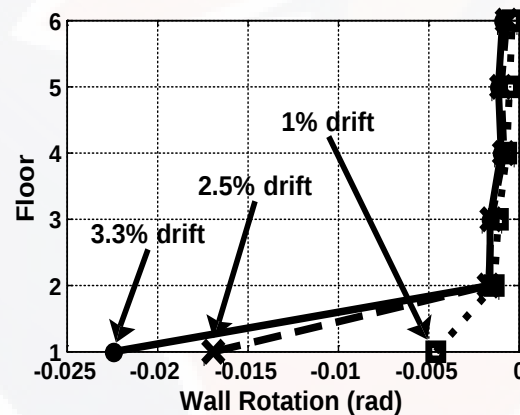


HPFRC coupling beams

RC coupling beams



HPFRC system



RC system



Potential future research directions for HPFRC

- Quantifying the benefits of fibers for
 - ✓ enhancing structural performance
 - ✓ simplifying reinforcement detailing

