

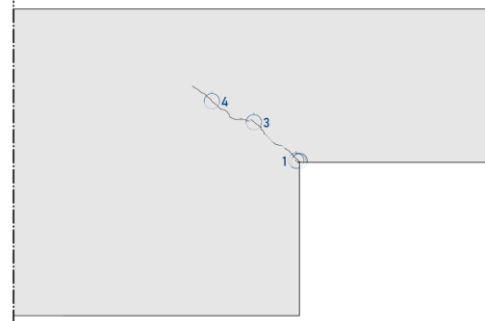
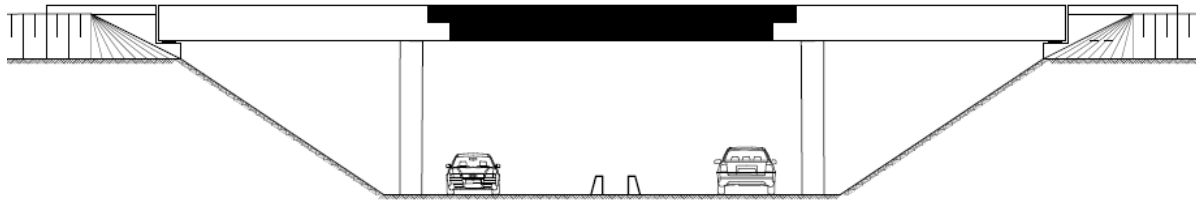
Crack Monitoring during Load Testing of Full-Scale Dapped-End RC Beams with Varying Reinforcement Layouts

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Motivation & Objectives

Why Dapped-End Beams Matter



- Dapped-end beams transfer high shear forces
- Re-entrant corner cracks → accelerate corrosion
- Cracking + chloride ingress = rapid loss of capacity
- Limited experimental data exist for aging and deteriorated DE-beams.

Experimental Programme

Type test	Phase 1: Reference test	Phase 2: Creep test (3M)	Phase 3: Corrosion test (18 M)
Lightly reinforced DE-beam	RE-L	CR-L	CO-L
Moderately reinforced DE-beam	RE-M	CR-M	CO-M
Heavily reinforced DE-beam	RE-H	CR-H	CO-H

Completed

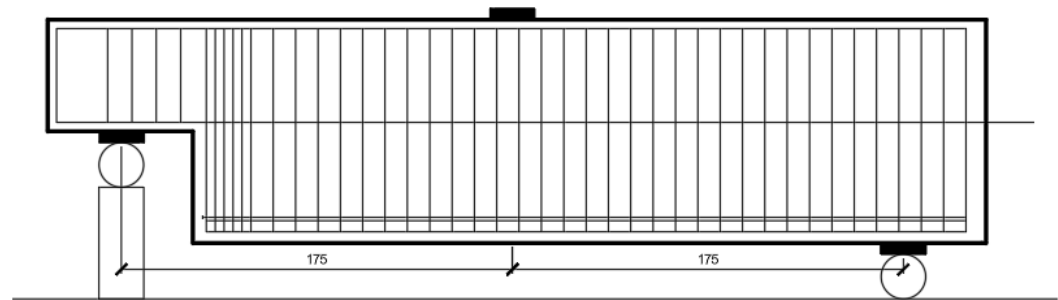
Being analysed

In progress

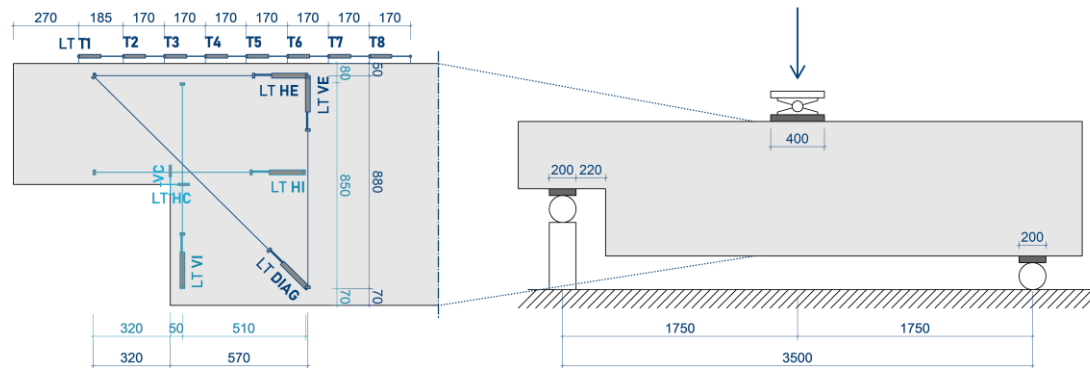
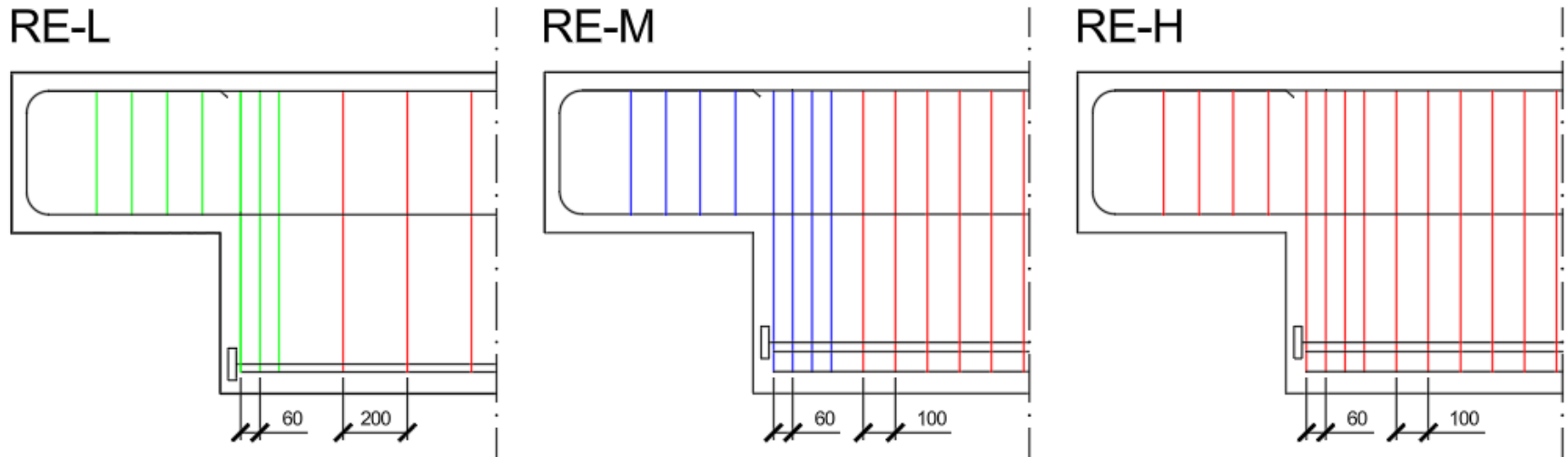


CoCoM

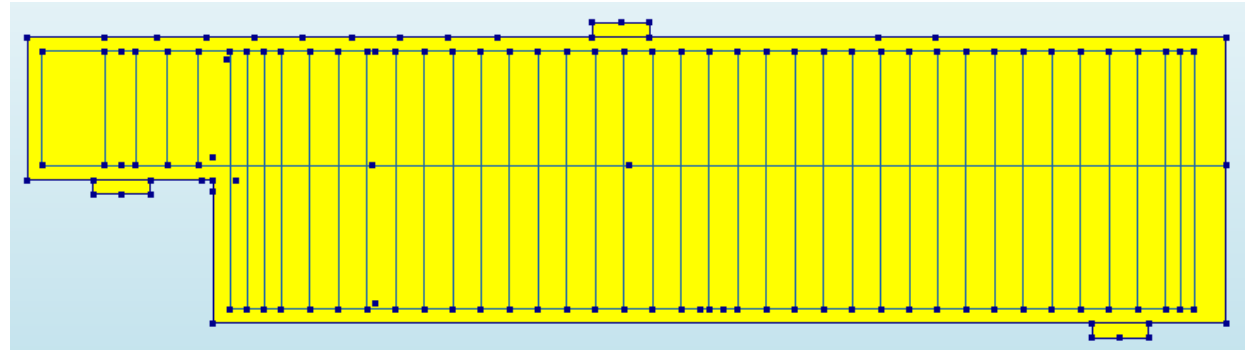
Coupled Corrosion-Mechanical Assessment of RC Members



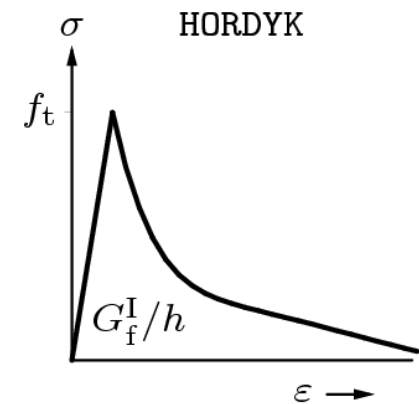
Specimen design and instrumentation



FE - models

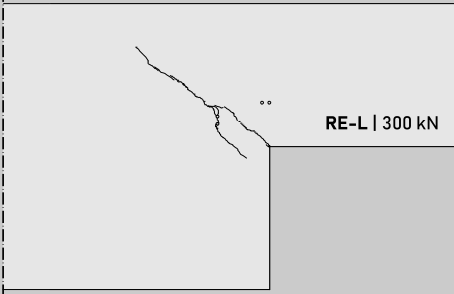
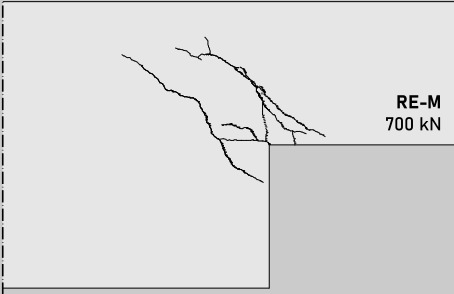
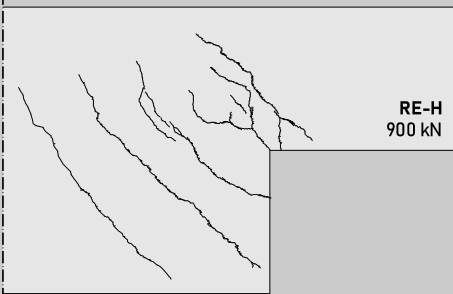
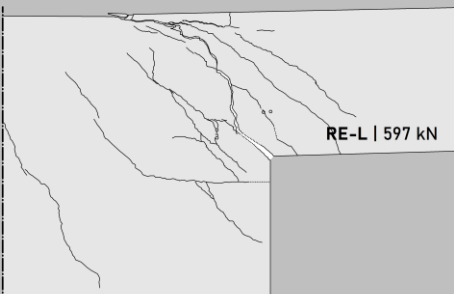
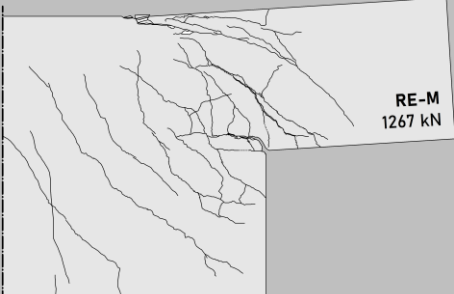



- Model properties concrete:
 - Tensile curve: Hordijk
 - Compression curve: Parabolic
 - Reduction model: Vecchio and Collins 1993
 - Stress confinement model: Selby and Vecchio
- Model properties steel:
 - Nonlinear model: Von Mises plasticity
 - Bond-slip* interface failure: Doerr





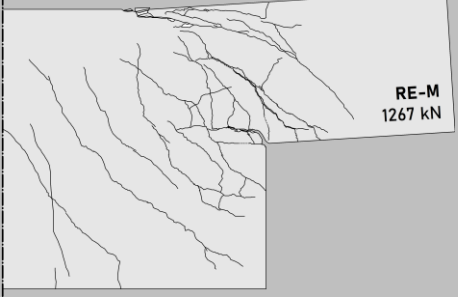
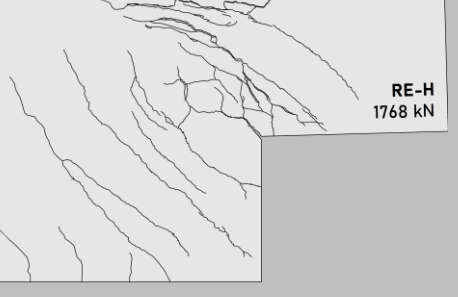


Experimental Results – reference tests

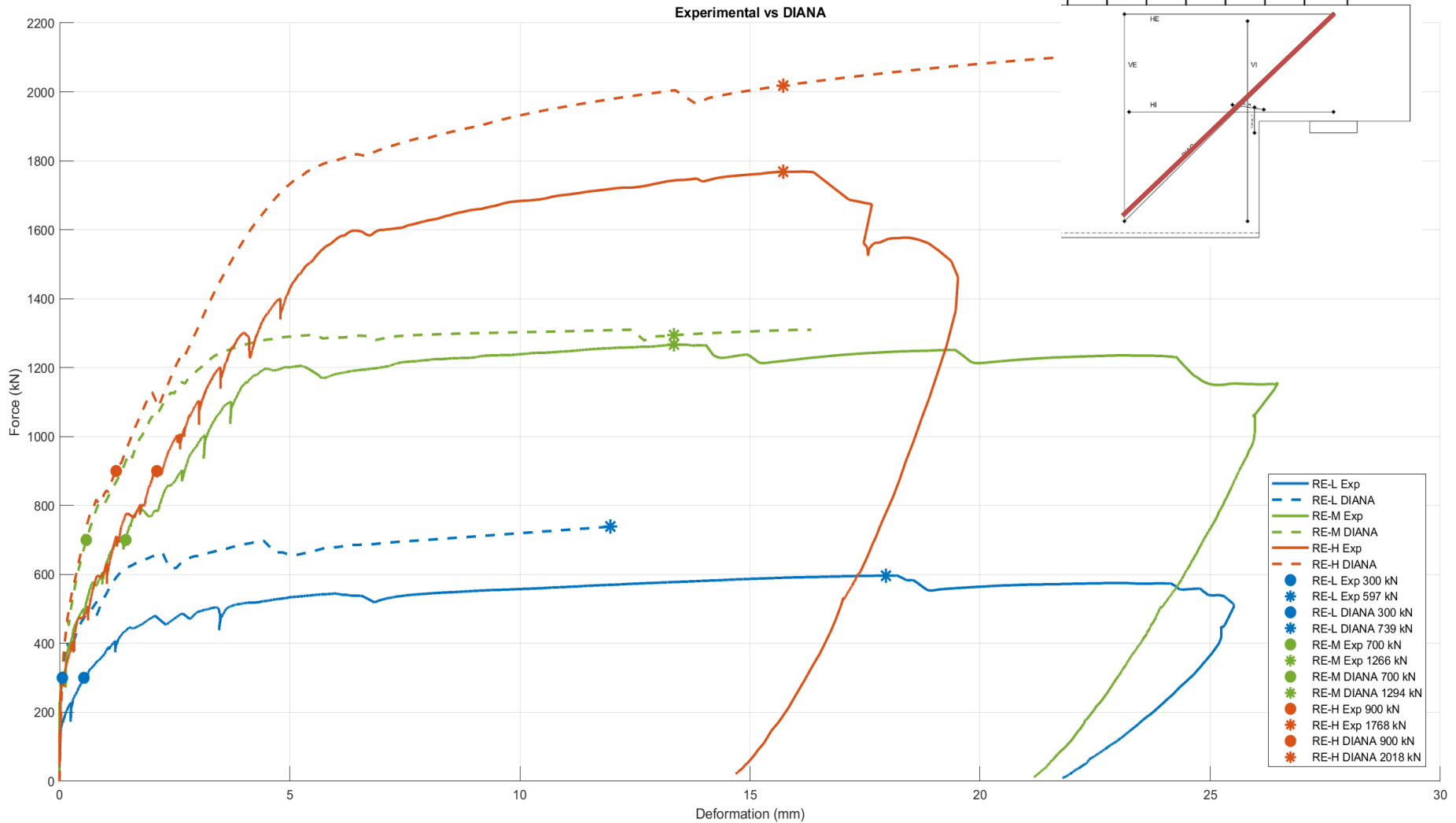
Crack Development

Load level	RE-L	RE-M	RE-H
50%	 <p>RE-L 300 kN</p>	 <p>RE-M 700 kN</p>	 <p>RE-H 900 kN</p>
Crack width	0.79 mm	0.49 mm	1.01 mm
Failure	 <p>RE-L 597 kN</p>	 <p>RE-M 1267 kN</p>	 <p>RE-H 1768 kN</p>
Crack width	2.47 mm	1.6 mm	2.14 mm

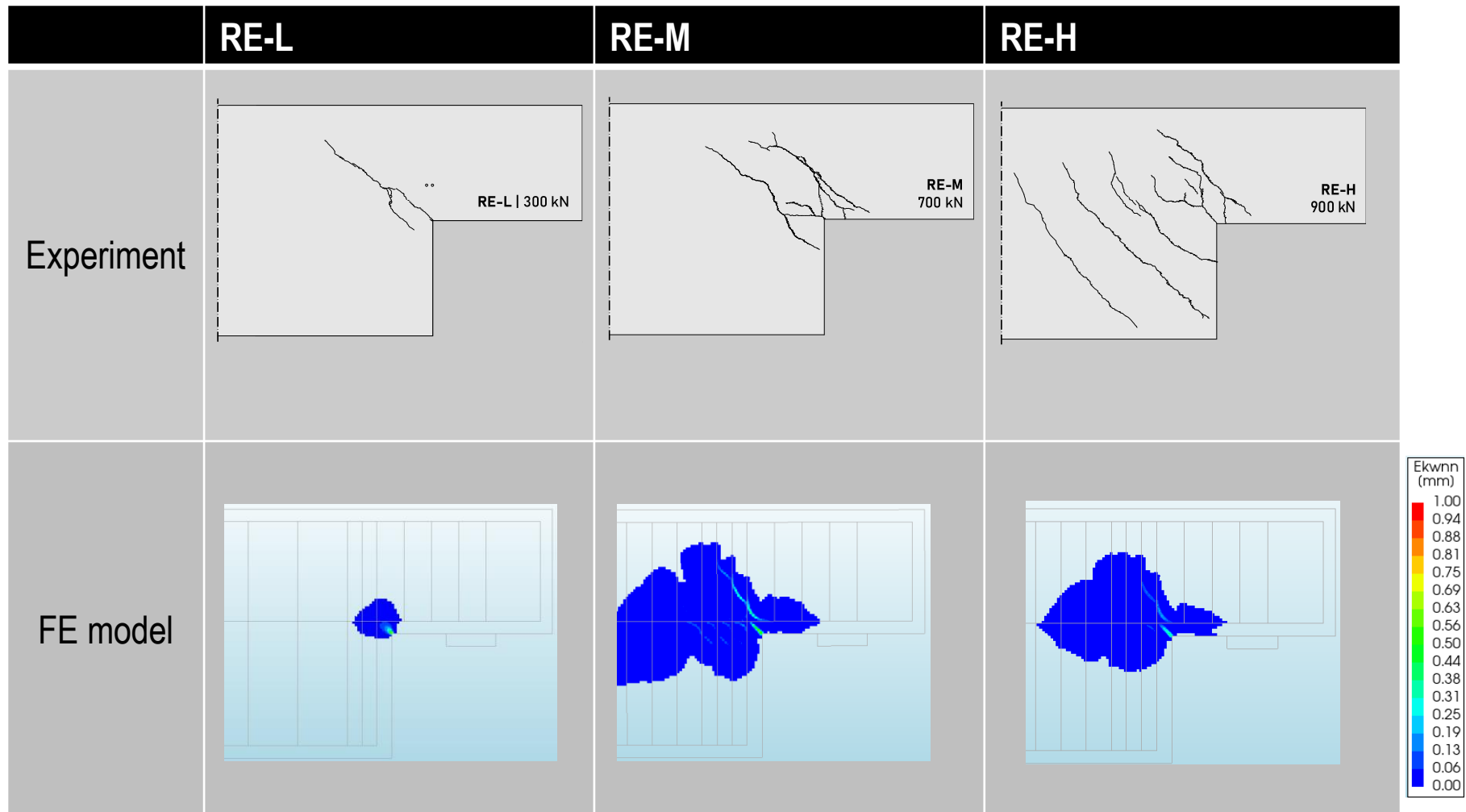
Failure Mechanisms

	RE-L	RE-M	RE-H
Experiment			
Failure	 RE-L 597 kN	 RE-M 1267 kN	 RE-H 1768 kN
	Flexural failure	Flexural failure	Flexural-shear failure

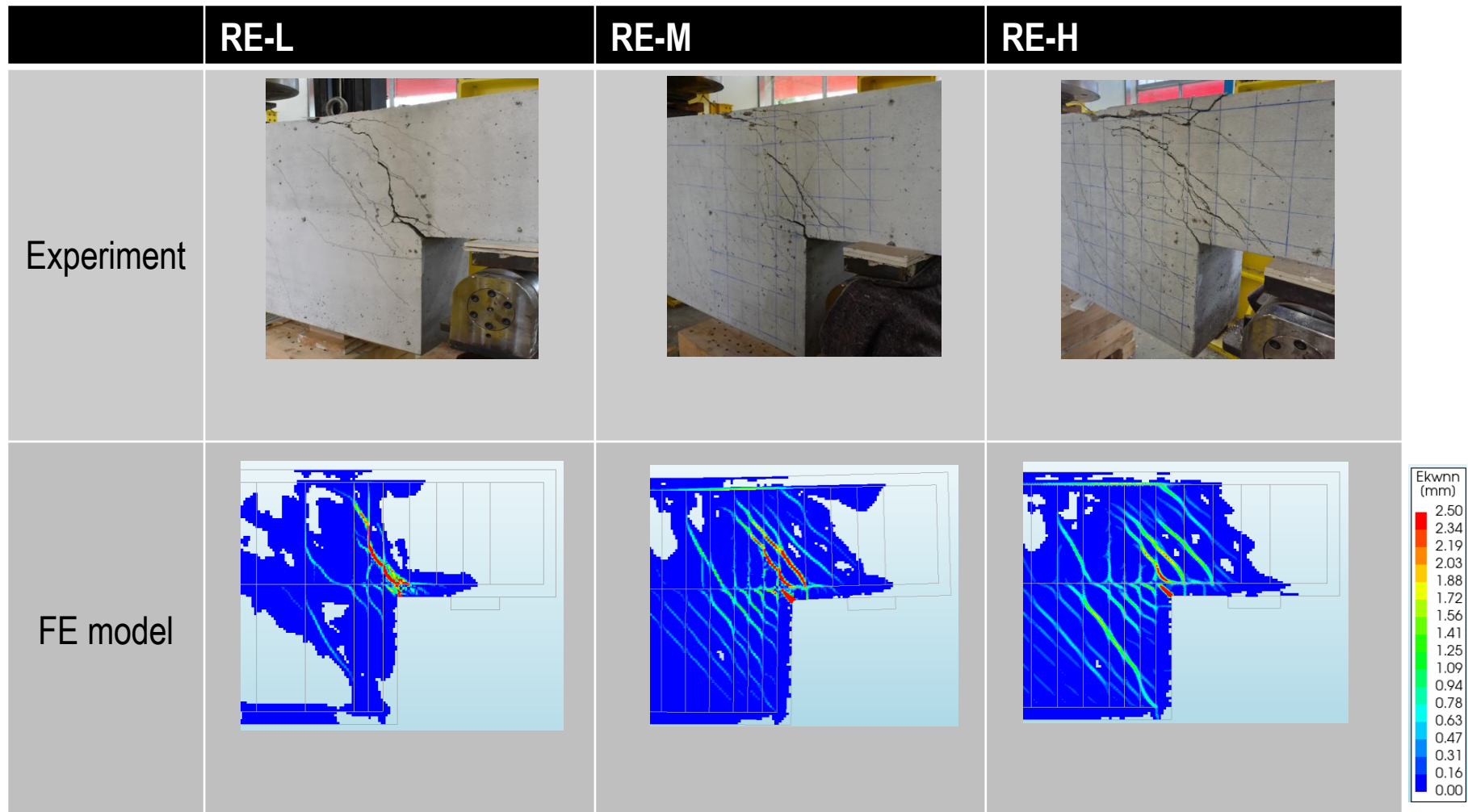
Load–Displacement Behaviour



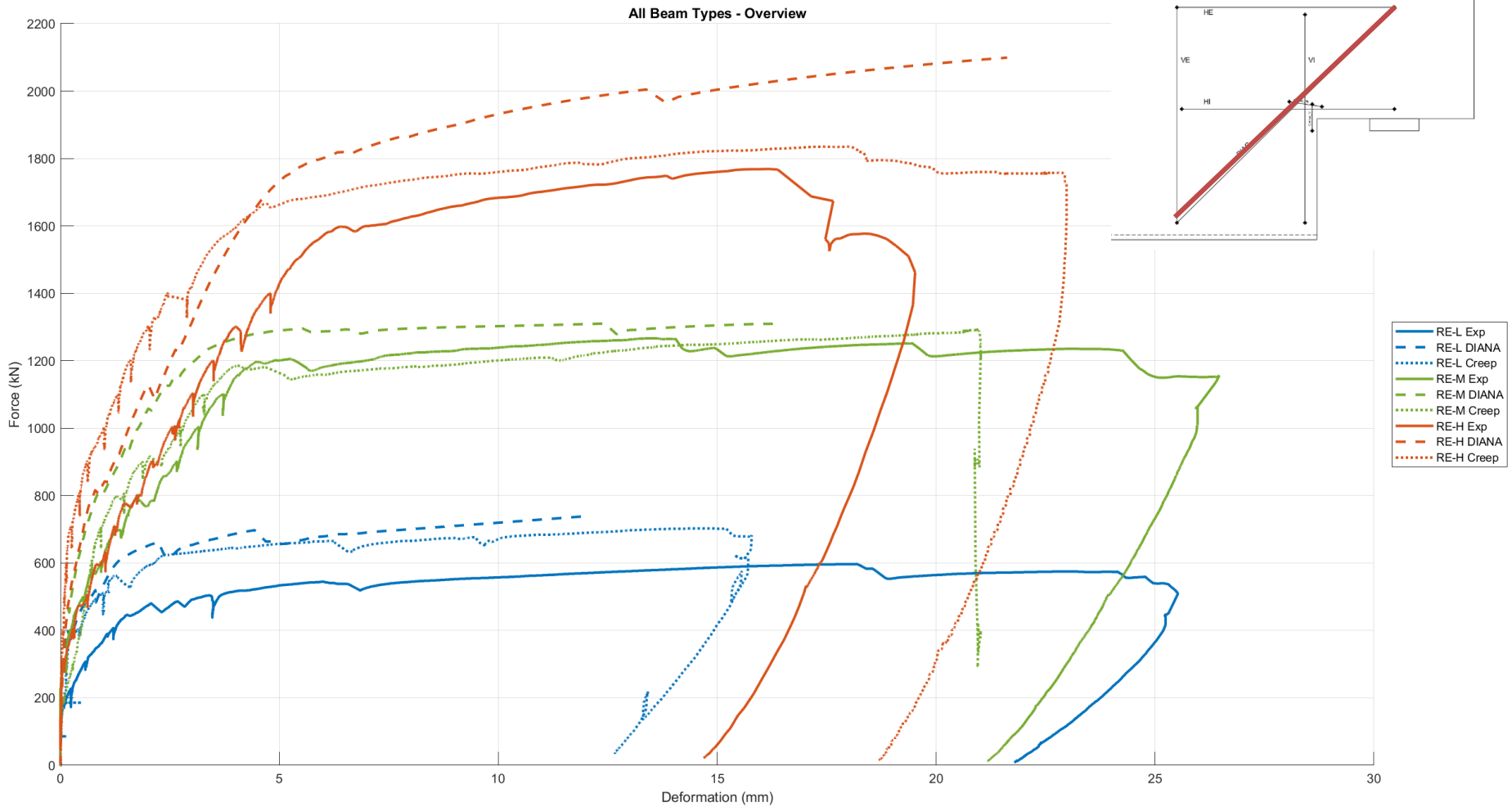
FE Model validation - SLS



FE Model validation - ULS



FE Model validation

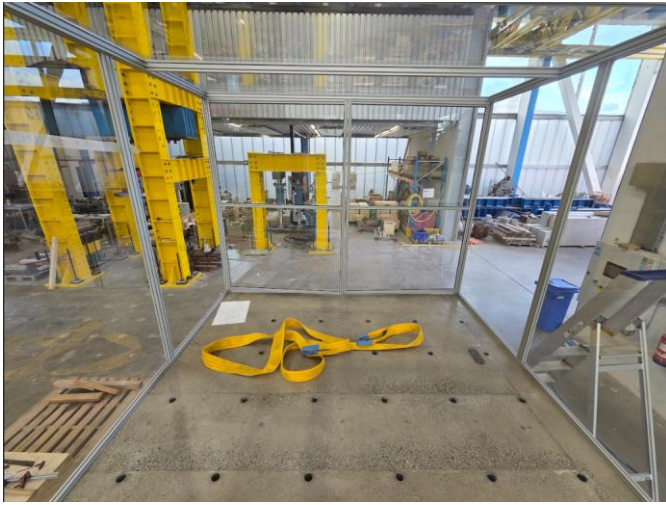


Conclusions

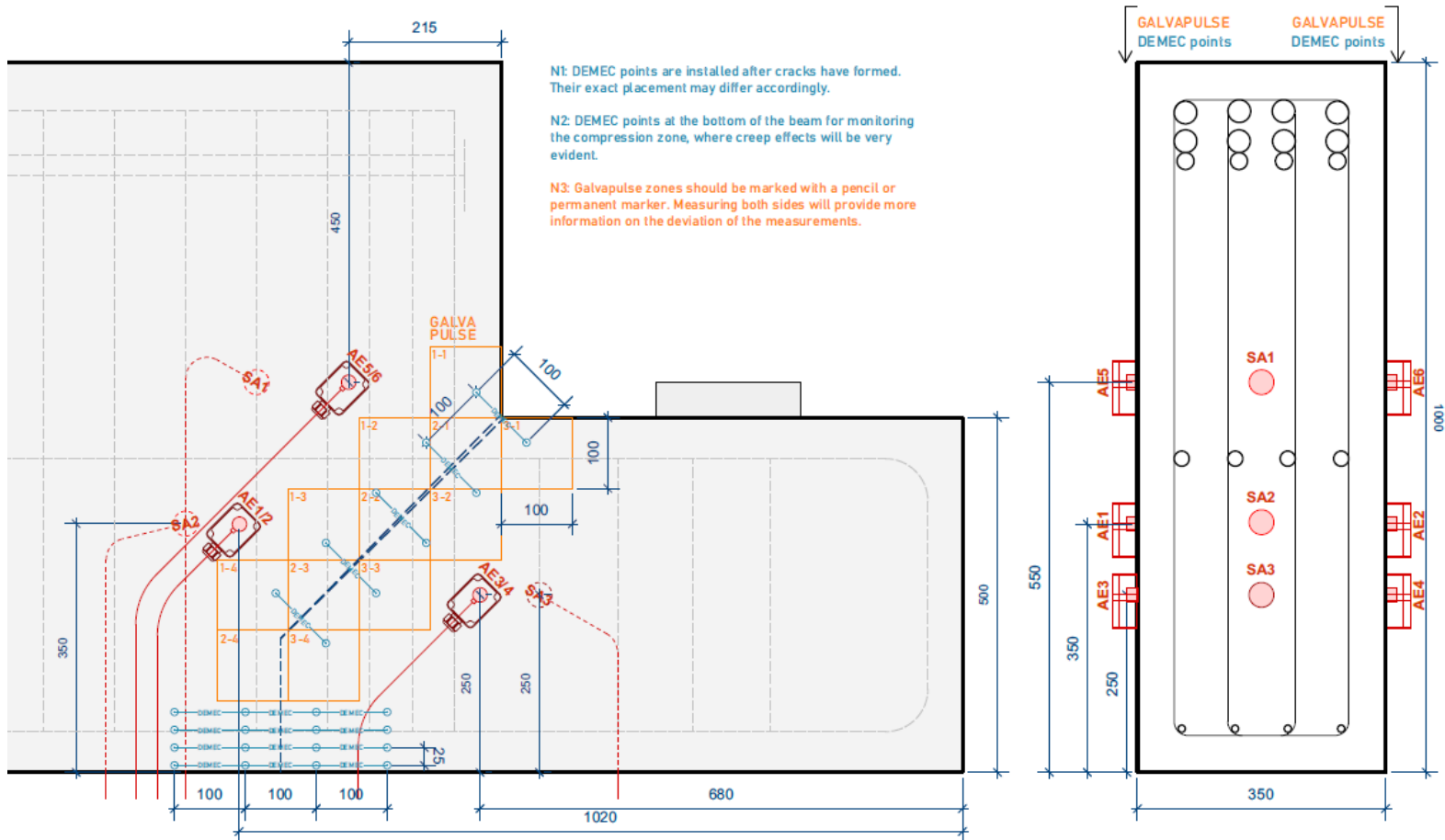
Conclusion

- Crack initiation **consistently occurred in the re-entrant corner** region, confirming this location as the governing damage zone.
- **Increasing the reinforcement ratio modified crack propagation** and crack distribution within the dapped-end region.
- **Lightly reinforced** specimens developed **fewer but wider cracks**, whereas **heavily reinforced** specimens showed a **more distributed cracking pattern**.
- **The reinforcement layout influenced** both the **load–displacement** response and the governing **failure mechanism**.

Future work



Specimen design and instrumentation



Thank you for your attention.
Any questions?