



Simulation of Cold-formed Steel Framed Shear Walls for Buildings: Efforts within CFS-NHERI



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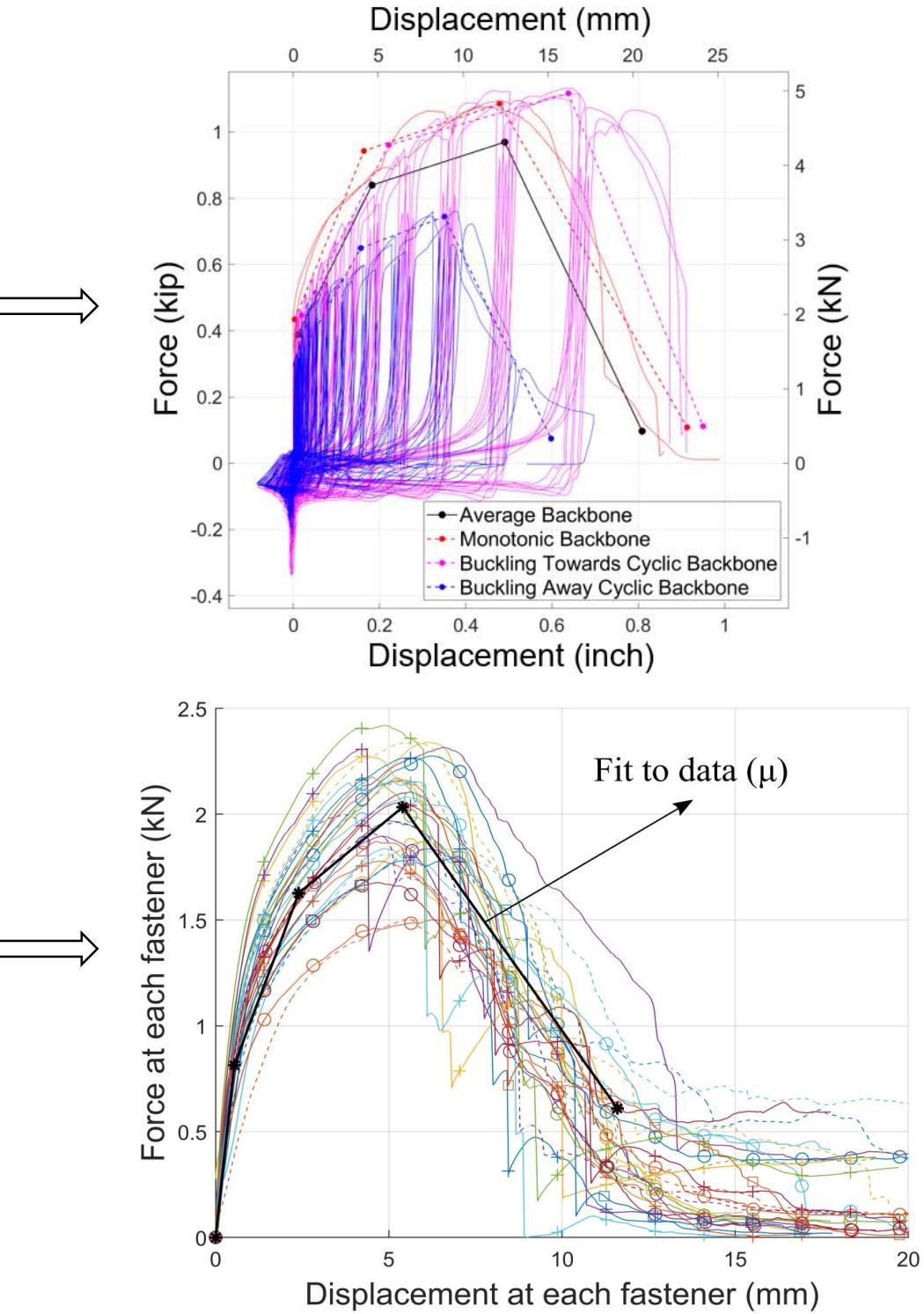
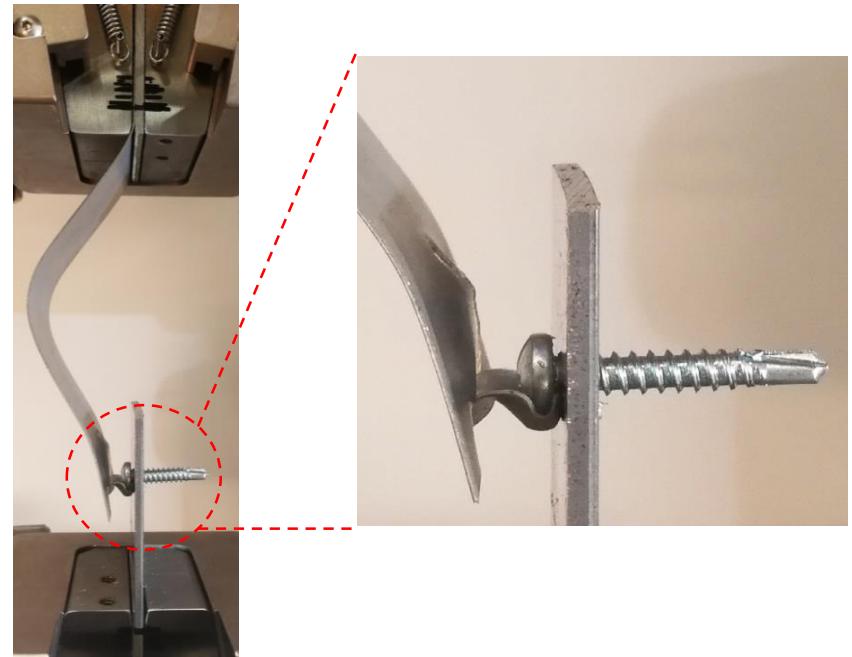
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Introduction

The main objective of this work is to develop and validate high fidelity finite element models for the prediction of lateral response of **Steel Sheet and Wood Structural Panel** sheathed CFS-framed shear walls

This work is part of 'CFS-NHERI' project, a multi-university collaborative effort to gain a comprehensive understanding and expand the possibilities for effective CFS systems for mid-rise buildings under high lateral demands

CFS-to-Steel/OSB Connection Tests

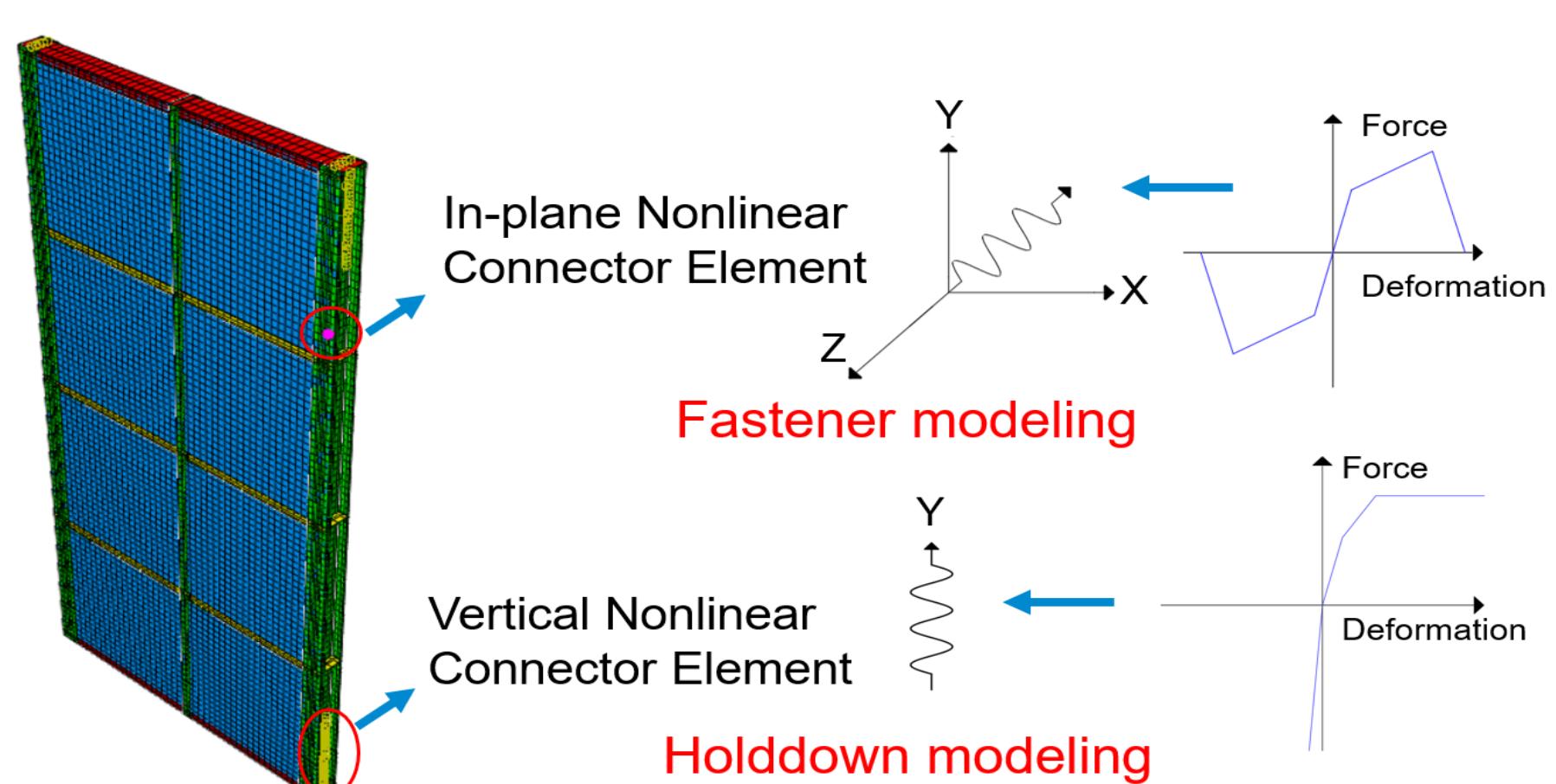


SS CFS-framed Shear Wall Simulation

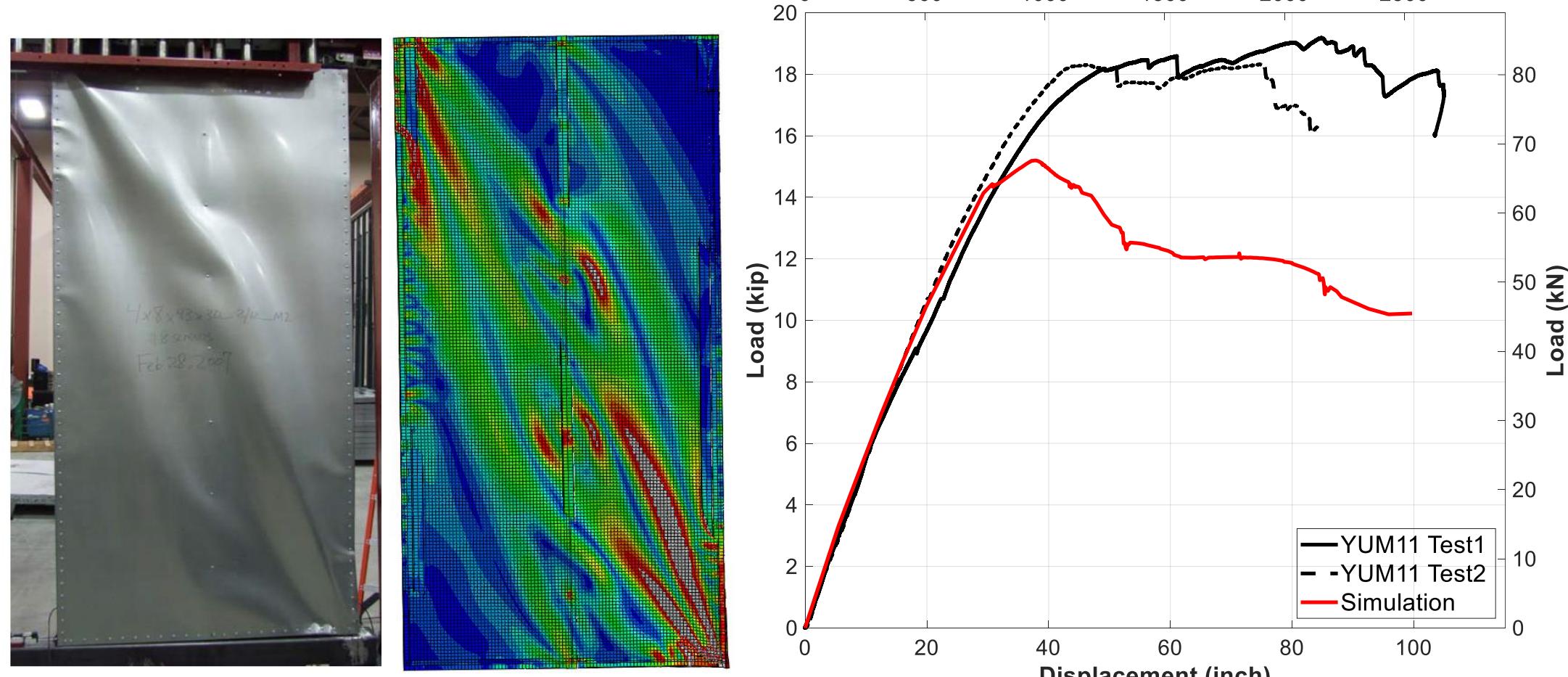
Work underway, simulating one shear wall test done by Dr. Cheng Yu

Modeling assumptions

- S8R Shell elements (0.5 in)
- Plastic isotropic material for CFS framing & Steel Sheathing
- MPC_PIN adopted for CFS-to-CFS connections
- Nonlinear connector elements for CFS-to- Steel Sheathing connections (Tao and Moen, 2016)
- Nonlinear connector elements for hold downs
- Loose convergence criterion

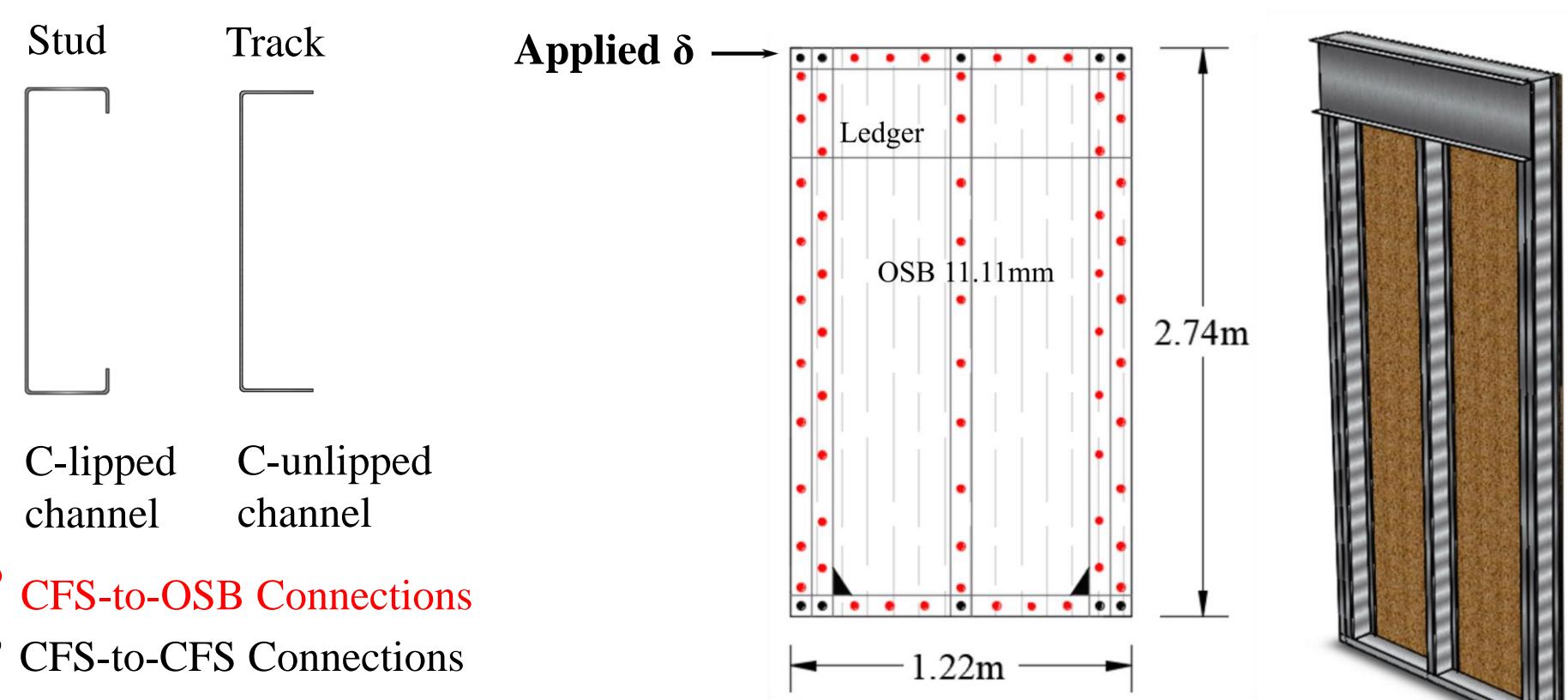


Modeling results



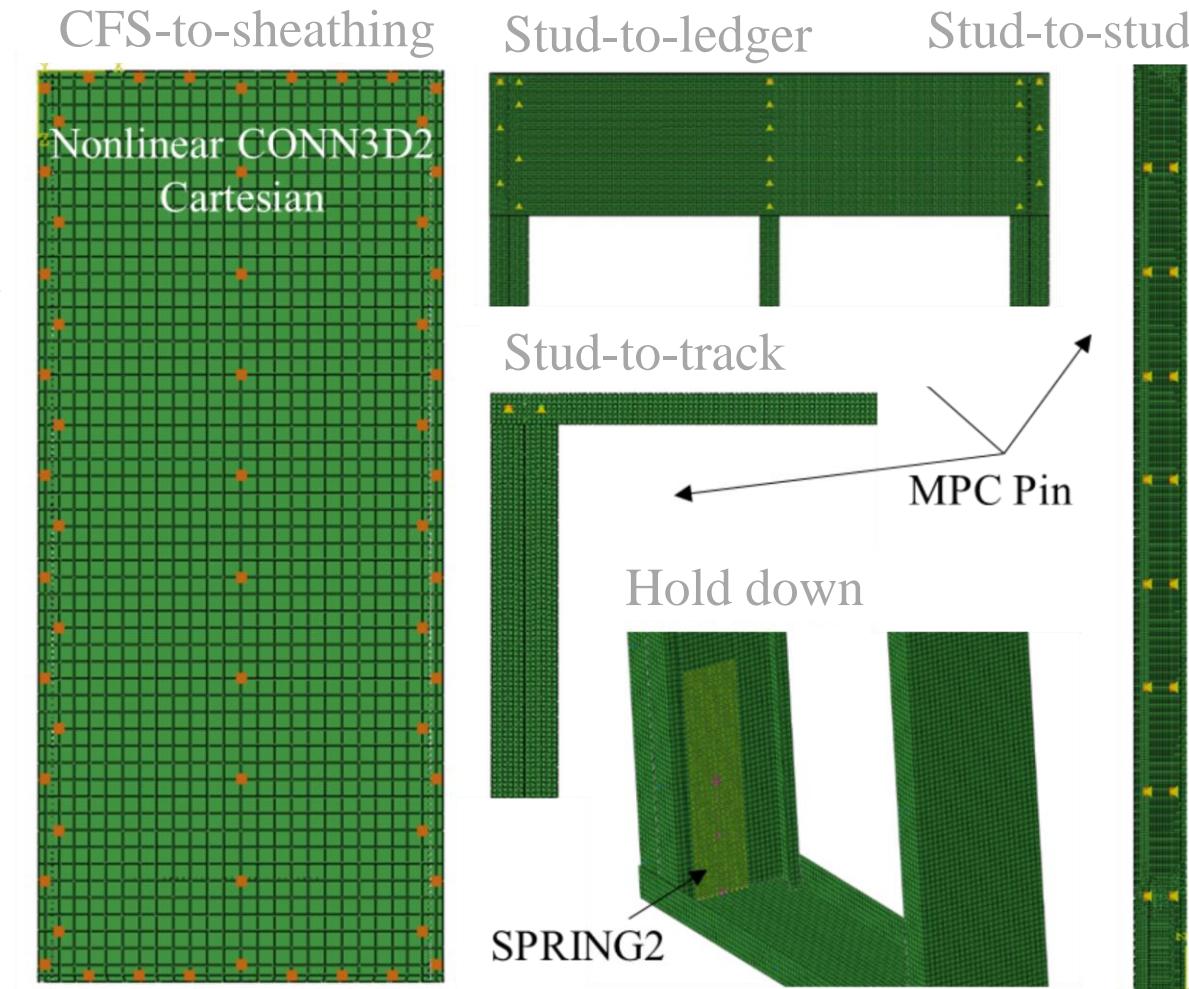
WSP CFS-framed Shear Wall Simulation

Simulation of 10 OSB sheathed CFS-framed shear wall configurations and comparison with a set of different tested walls throughout the literature



Modeling assumptions

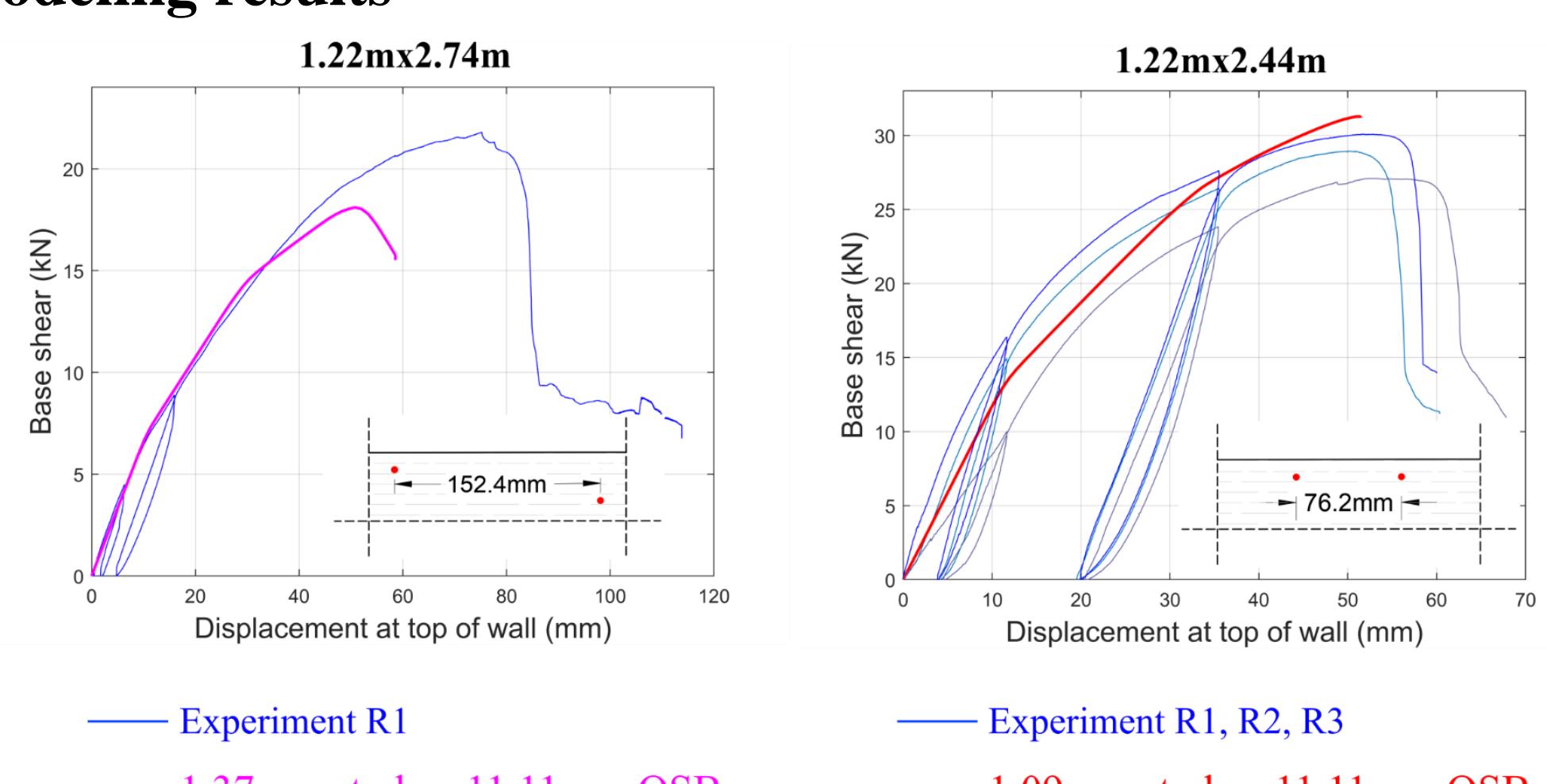
- S4R Shell elements
- Plastic isotropic material for CFS members
- Elastic orthotropic material for OSB sheathing
- Hard contact between CFS members and OSB sheathing
- MPC pinned for CFS-to-CFS connections
- Cartesian nonlinear connectors for CFS-to-OSB connections
- Linear SPRING2 hold downs



Monotonic Backbone Parameters of CFS-to-OSB Connections

1.37mm CFS to 11.11mm OSB	Δ_1 (mm)	Δ_2 (mm)	Δ_3 (mm)	Δ_4 (mm)	P_1 (kN)	P_2 (kN)	P_3 (kN)	P_4 (kN)
	0.54	2.40	5.40	11.60	0.814	1.627	2.034	0.610
1.09mm CFS to 11.11mm OSB	Δ_1 (mm)	Δ_2 (mm)	Δ_3 (mm)	Δ_4 (mm)	P_1 (kN)	P_2 (kN)	P_3 (kN)	P_4 (kN)
	0.74	3.24	6.48	12.16	0.802	1.605	2.006	0.602

Modeling results



Conclusion

- Proposed FE model could capture the response of OSB sheathed CFS shear walls under monotonic loading, in terms of strength, stiffness and failure modes but sensitive to CFS-to-OSB connection behavior
- FE model of steel sheathed CFS shear walls is still under way and CFS-to-Steel connection test results will be incorporated into the model
- Hysteretic connector models will be proposed for stud-to-sheathing connections

Acknowledgement

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