Seismic Testing of Full-Scale Structural Concrete Insulated Wall Panels (SCIPs)

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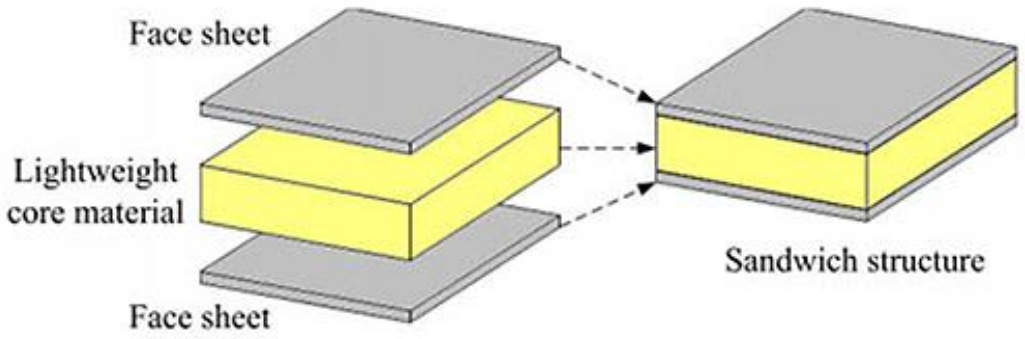
Concept for Structural Concrete Insulated Panels (SCIPs)



Materials

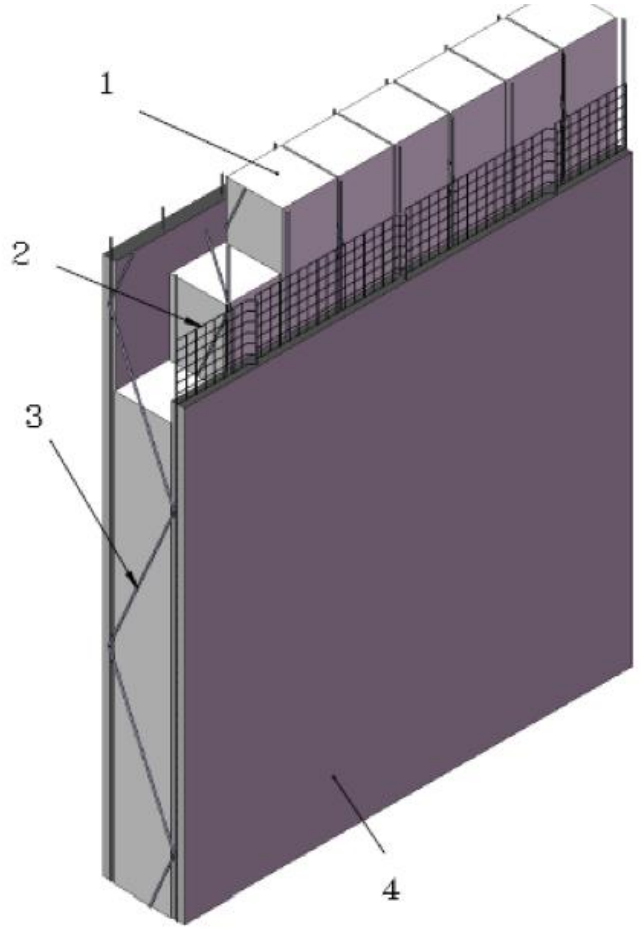
- EPS: Type I Cello foam insulation
- Steel mesh: 14-Gauge galvanized cold rolled steel wire mesh
- Shear truss: 3/16-inch galvanized steel 120 Lox all trust connectors

Fabrication

- Assembled using a portable hydraulic jig press and pneumatic hog rig tie
- Can produce panels that are up 18 feet long, 4 feet wide and 10 inches thick

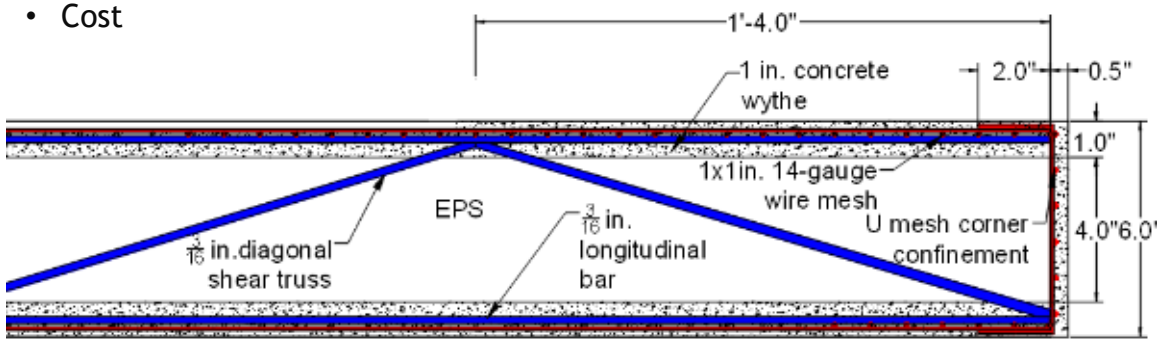
SCIPs Produced by Producer 'A'

1. 6x4 in. EPS block
2. 1x1 in. 14 gauage wire mesh
3. 3/16 in. shear truss
4. 1 in. concrete skin both faces

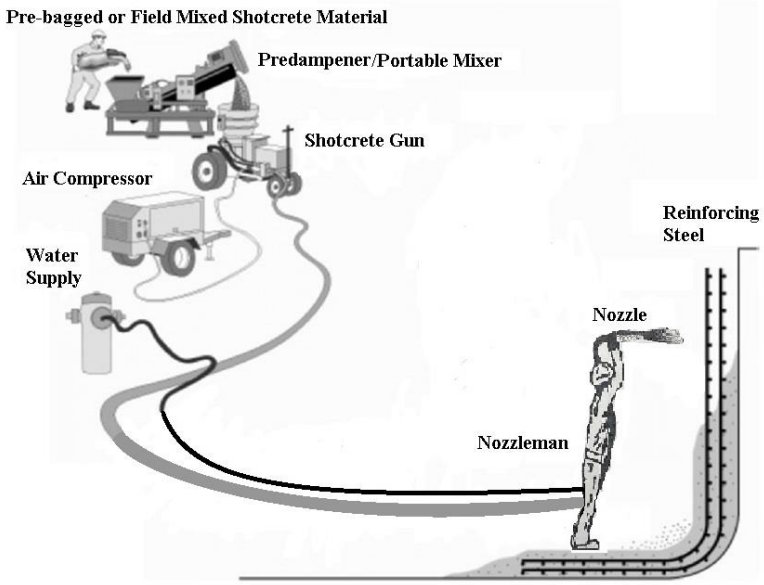


Advantages of SCIPs:

- Faster construction
- Reinforced concrete
- Lightweight
- Use of recycled materials (e.g. EPS)
- Better thermal/sound insulation
- Better fire resistance
- Higher stiffness
- Good ductility
- Simple fabrication
- Durability
- Cost



SCIP Construction Technology

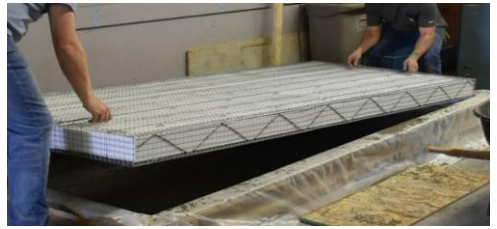


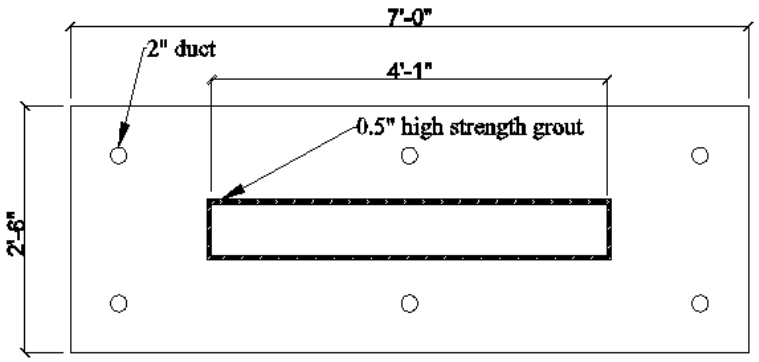
- SCIP typically uses on-site shotcreting
- A precast approach, using SCC, was incorporated to prepare the test samples
- Socket connection for wall-to-footing









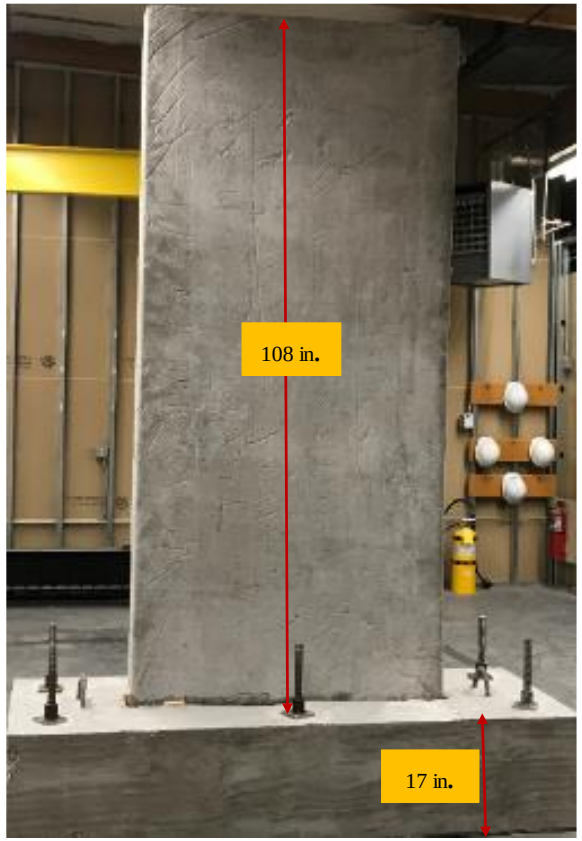



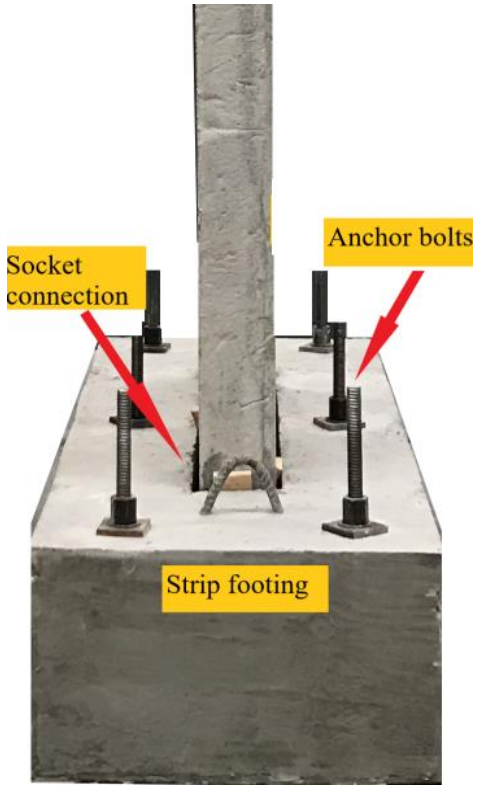


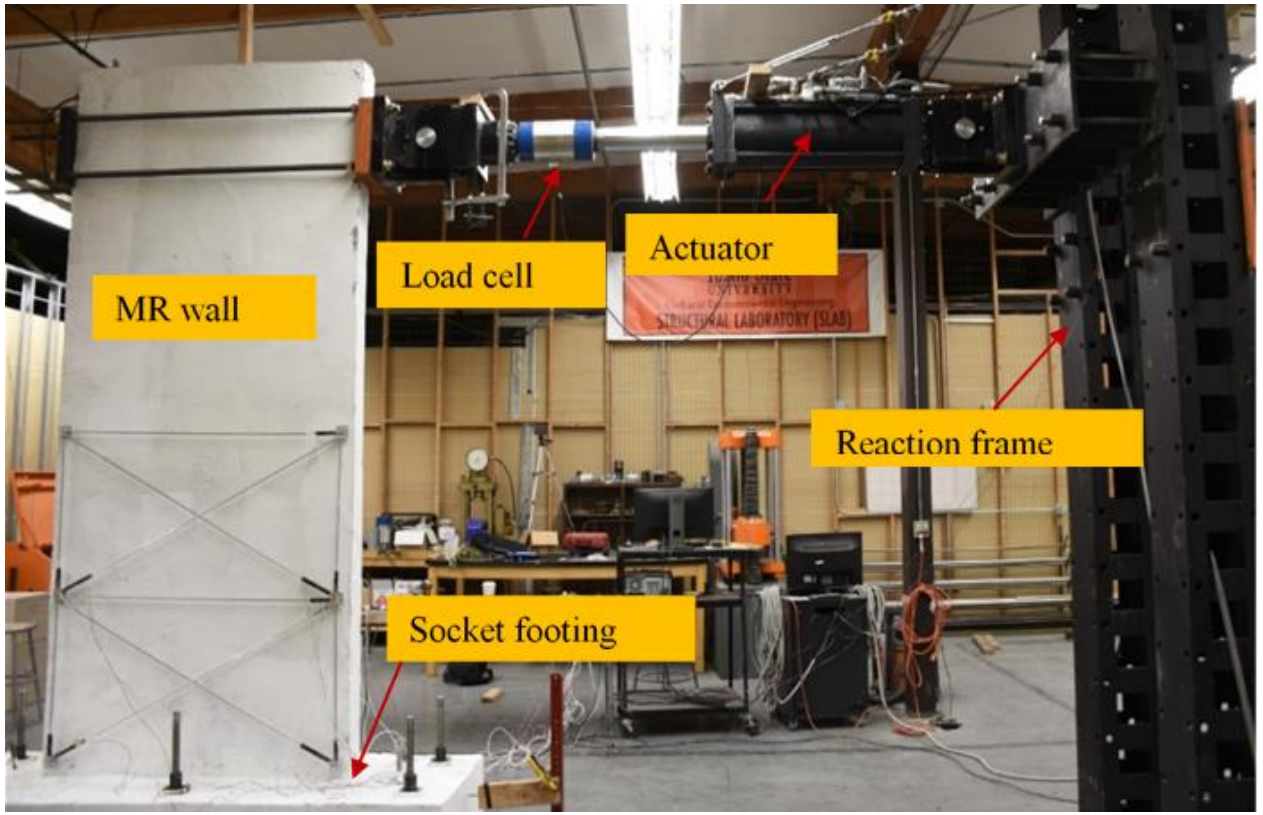
Construction Sequence of SCIPs Wall Panels in the Structural Laboratory at ISU

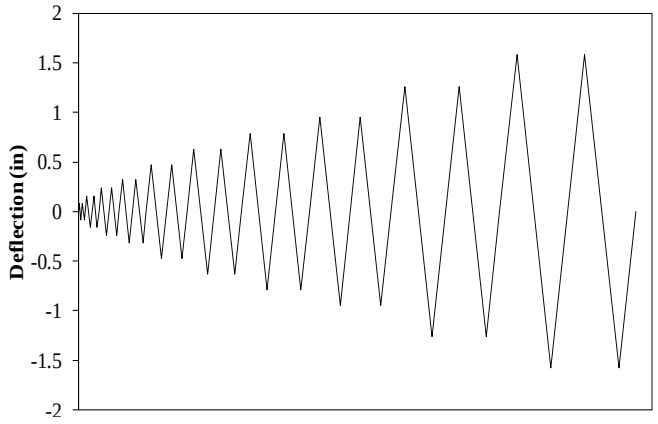
Experimental Testing

- Three identical full-scale cantilever shear-walls (A-4, A-5, A-6)
- Wall dimensions = 123” x 49” x 6” (3.1 mx 1.2 m x 0.15 m)
- Quasi-static reverse cyclic lateral loading in accordance with the ACI 374.2R “Guide for Testing Reinforced Concrete Structural Elements under Slowly Applied Simulated Seismic Loads”
- No gravity loads were applied (e.g. all SCIP walls can be load-bearing in a structure so little axial load will be present)





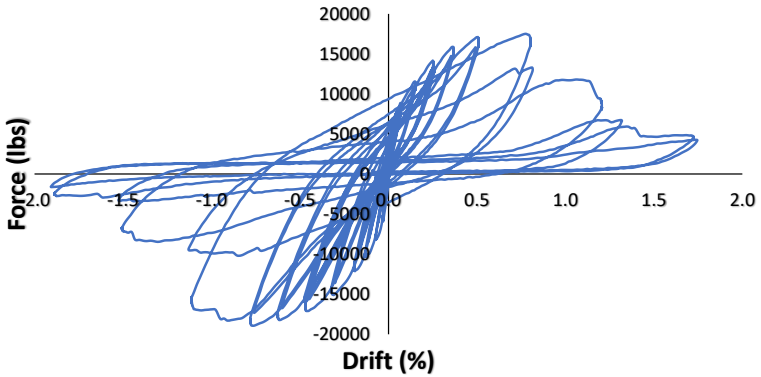


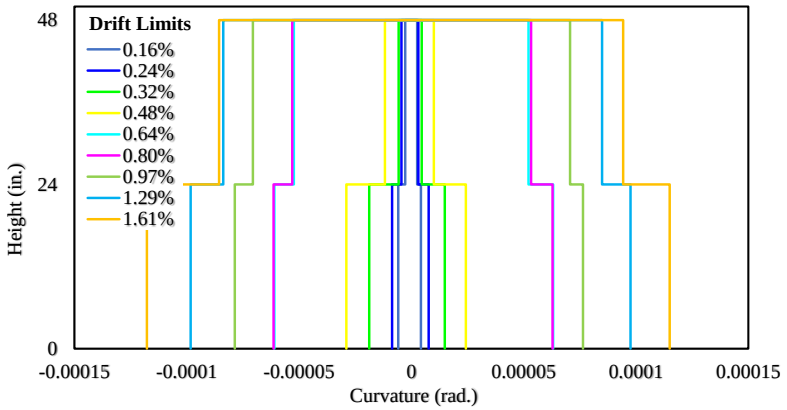


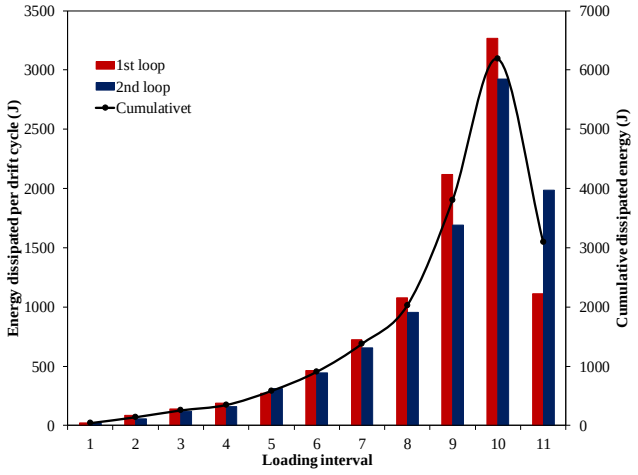
Cycle	Δ (in)	Drift (%)
1/4 φy	0.08	0.08
1/2 φy	0.16	0.16
3/4 φy	0.24	0.24
1 φy	0.32	0.32
1.5 φy	0.47	0.48
2 φy	0.63	0.64
2.5 φy	0.79	0.80
3 φy	0.95	0.97
4 φy	1.26	1.29
5 φy	1.58	1.61
6 φy	1.89	1.93
7 φy	2.21	2.25

Loading Protocol and Drift Targets for Reverse Cyclic Loading

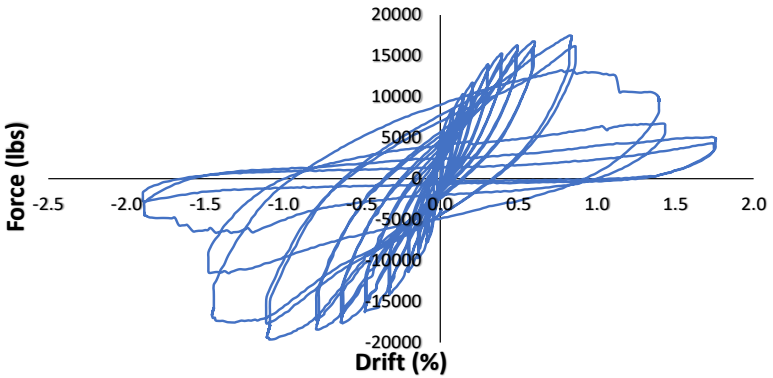
A-4 Specimen

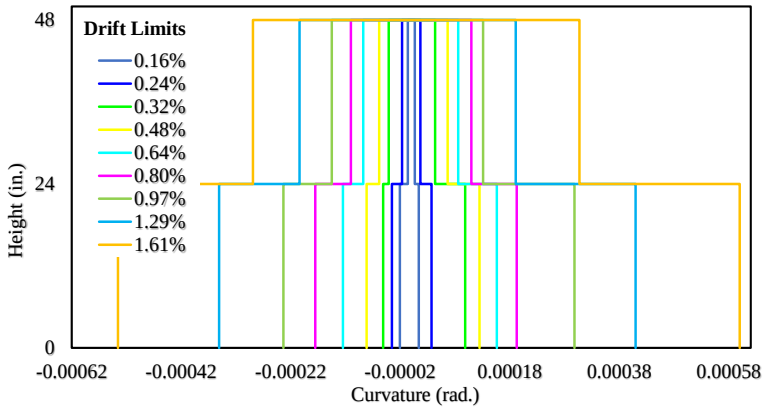


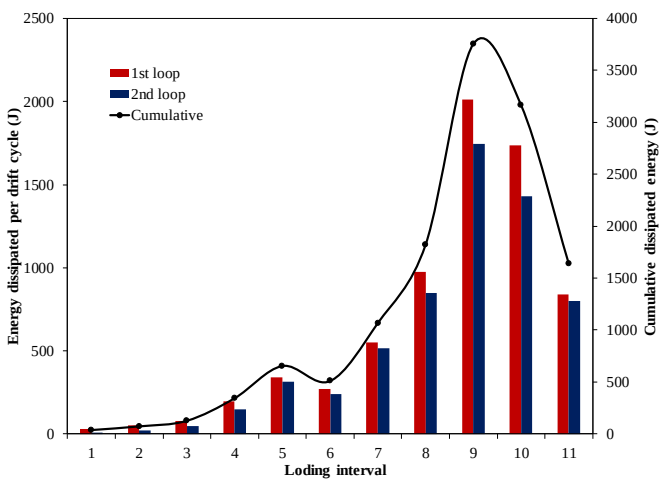




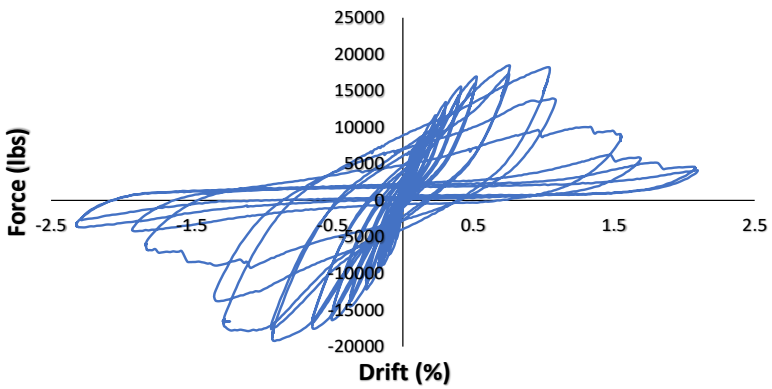
A-5 Specimen

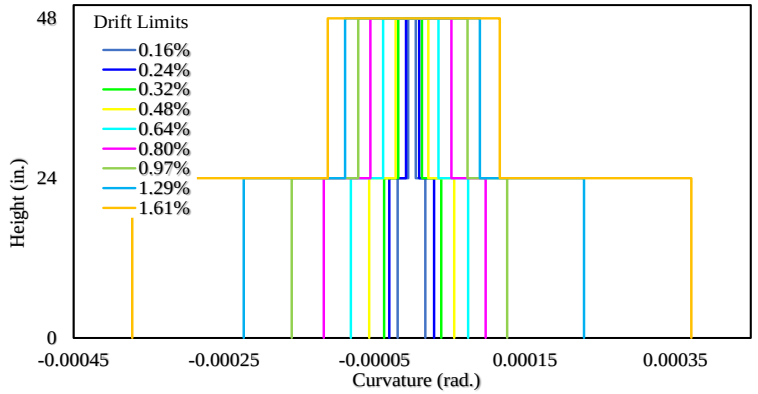


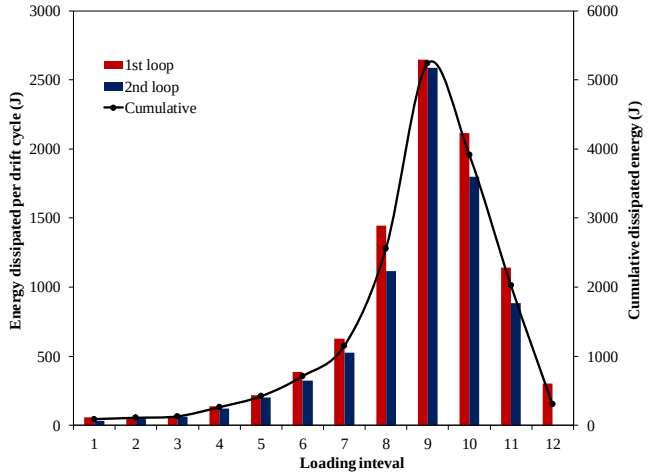




A-6 Specimen

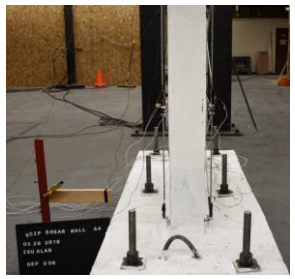






Testing Summary

Specimen	Cycle	Yield moment (kip-ft)	Ultimate moment capacity (kip-ft)	Energy dissipated (KJ)	Base Shear Vy (Kip)	Base Shear Vu (Kip)	Overstrength Factor Ω_o	Deflection δy (inch)	Deflection δu (inch)	Ultimate ductility (μ)
A-4	Pull	65.0	151.1	13.2	8.1	18.9	2.3	0.068	1.13	16.62
	Push	68.5	138.9							
A-5	Pull	61.7	156.5	18.8	7.7	19.6	2.5	0.081	1.48	18.27
	Push	67.7	139.2							
A-6	Pull	58.8	153.2	17.0	7.3	19.3	2.6	0.094	1.31	13.94
	Push	58.0	146.8							
Average		63.3	147.6	16.3	7.7	19.3	2.5	0.08	1.31	16.28



0.08% Drift Ratio

2% Drift Ratio

At failure (Push cycle)

Typical Damage Progression (A-4 Specimen)

At failure (North)

At failure (East)

At failure (South)

At failure (West)

- SCIPs is an alternative construction technology with advantages such as faster construction, cost-effectiveness, better thermal/sound insulation, axial and lateral resistance, higher stiffness and ductility
- A new precast technology and the use of socket connection proposed
- Three identical full-scale cantilever shear wall panels were tested under in-plane quasi-static cyclic loading
- The panels achieved good capacity and ductility under in-plane loading
- The failure mode of the walls was observed to be flexural followed by toe-crushing and subsequent loss of strength
- The socket connection performed well

Specimen	Mode of failure
A-4	Flexural dominated toe failure
A-5	Flexural dominated toe failure
A-3	Flexural dominated toe failure

Acknowledgements

Idaho State University

Pocatello Ready Mix Concrete

Premier Technology, Inc.

Blastcrete