



Cross Laminated Timber (CLT)

• New kind of wood building material that can build high buildings



New Mass-timber material (Cross Laminated Timber) enables building tall with wood



Sustainable solid wood material; Fast and environmental friendly construction process due to prefabrication

































Instrumentation: Know your REUs!

Special Thanks to

LELLI VAN DEN EINDE

Plan for a week at minimum

UCSD has over 300 channels to use.

Need to work with site crew to hook all into DAQ.

Monica (Berkley) Joycelyn (UCSD) and Ali (UT Austin)

Over 350 Channels of Instrumentation

(about an entire week to set-up...)

	Structural Component and response of interest	Instrumentation used
	Global overall building Inter-story drift 	10 string potentiometers from diaphragm to fixed reference towers by the shake table
	TorsionAcceleration	36 accelerometers on floor and root diaphragms
	Rocking wall	16 load cells for post-tension rod forces
	 Post-tension force 	30 (20 at rocking base, 10 between walls) LVDT
	 Rocking uplifts 	displacement sensors for wall uplift and panel relative slip
	Panel deformation	16 String potentiometers to measure panel shear deformation
	Diaphragm	50 Strain gages on tension straps
	 Panel deformation 	53 LVDT at panel splices and concrete/wood for slip
	 Concrete-wood slip 	26 String potentiometers for out-of-plane diaphragm
	Chord forces	deformation
	Gravity frame	16 string pots attached at column face to measure uplift and
	 Rotation at column joints 	join rotation
	Shear key • Shear force transfer	24 Strain gages on the shear keys

A total of 14 earthquake tests conducted Phase 1 Test Program Ground Motion Hazard level PGA (g) Sa @ 0.9 sec (g) Acceleration response spectrum SLE 2.5 • Why 14? ---DBE MCE • Day 1: Feel it out (test 1~5) Accelertation[g] **Baby steps** • Day 2: Public test 1 (test 6) NSF public test • Day 3: Public test 2 (test 7~8) CA commissioner & congress woman Period[sec] Pushing the limit (test 9~14) MCE X 1.2 Still Day 3, after the visitors left SLE: Service Level Earthquake (frequent) DBE: Design Basis Earthquake (Design code) MCE: Maximum Considered Earthquake (2500 yr return period)

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The MCE+ Shake (Test 14)5% driftClose up on Rocking WallImage: Close up on R

Removal of the Rocking Wall

No Damage after 14 earthquakes

Slight compression deformation at the rocking wall corner

Chipping of wood at the rocking wall corner

Phase 3: Platform CLT shear walls

- Designed based on "fresh" seismic factors from P695 project
- Damage expected on shear walls during large seismic events
- 7 earthquake tests
- Collaborated with FPL on this

Lessons learnt

- Need to involve industry
- Plan ahead and manufacture ahead get comparative quotes before you arrive on site (or prepare a ton of cash)
- Think about staffing, plan for PI rotation (Always have a leader on site to make the call)
- Rely on experience of the site staff (Because they are awesome!)
- Do a budget, then x1.5 (or x2 is better)
- Plan for change of plan

