

# NHERI TALL WOOD PROJECT

**Full-scale seismic test of a 10-story  
mass timber building in 2020**

Shiling Pei, Ph.D. P.E.



Keri Ryan, PhD



# MASS TIMBER

## “Solid WOOD Construction”



Structural components are MASSIVE Engineered wood products

Concept



CLT Panel



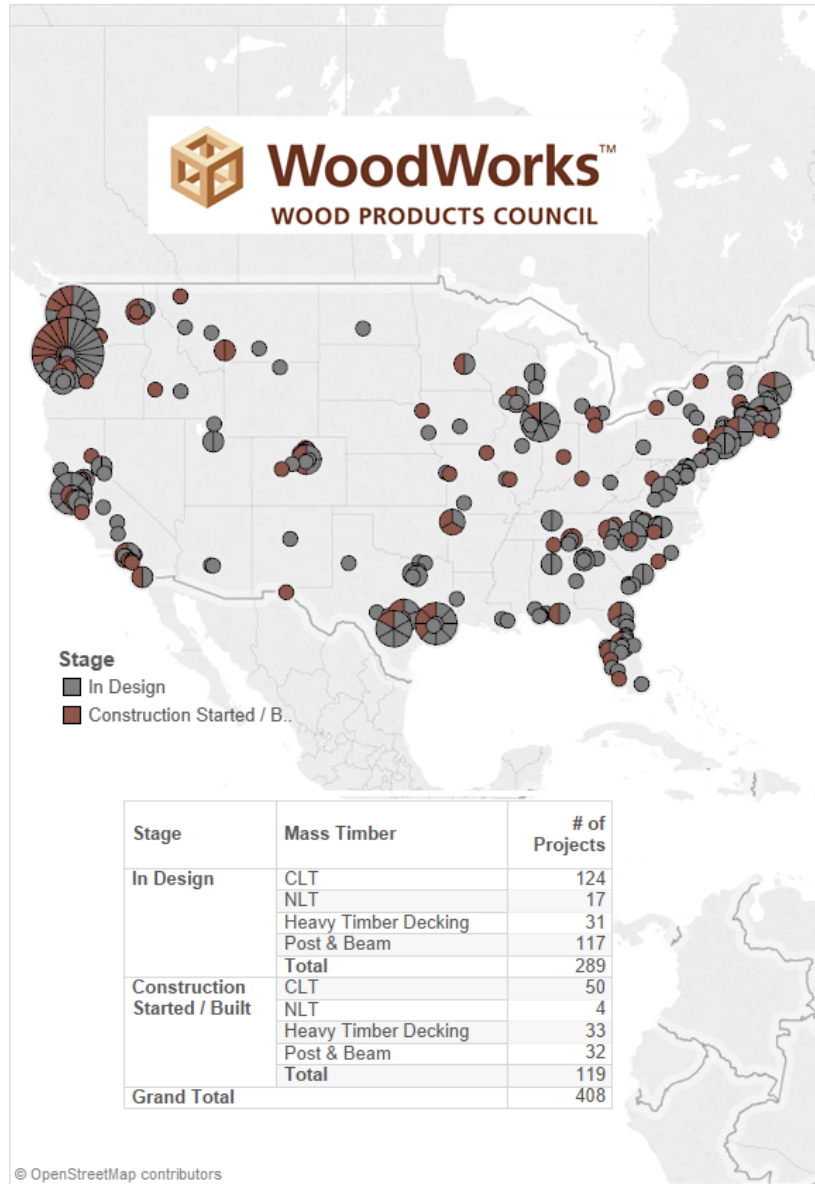
CLT was invented in the 1990's in Europe. It is a key component for the Global Mass Timber movement starting around 2010

# Mass Timber is Coming to U.S.



Carbon 12 Building, Portland OR

## Mass Timber Projects In Design and Constructed in the US (June 2018)



State	Stage		State	Stage	
AL	In Design	5	NC	In Design	13
	Construction Started / Built	1		Construction Started / Built	5
AR	In Design	2	ND	In Design	1
	Construction Started / Built	2	NE	In Design	1
AZ	In Design	2		Construction Started / Built	1
CA	In Design	40	NH	In Design	1
	Construction Started / Built	15	NJ	In Design	3
CO	In Design	7	NM	In Design	1
	Construction Started / Built	7	NY	In Design	12
CT	In Design	4		Construction Started / Built	4
	Construction Started / Built	2	OH	Construction Started / Built	1
DC	Construction Started / Built	2	OR	In Design	25
DE	In Design	1		Construction Started / Built	12
FL	In Design	19	PA	In Design	2
	Construction Started / Built	9		Construction Started / Built	2
GA	In Design	10	RI	In Design	1
HI	In Design	1		Construction Started / Built	1
IA	In Design	1	SC	In Design	4
ID	In Design	2		Construction Started / Built	4
	Construction Started / Built	1	TN	In Design	2
IL	In Design	9		Construction Started / Built	2
	Construction Started / Built	3	TX	In Design	32
IN	Construction Started / Built	1		Construction Started / Built	8
KS	In Design	1	UT	In Design	3
KY	Construction Started / Built	1	VA	In Design	8
LA	In Design	2	VT	In Design	2
MA	In Design	17		Construction Started / Built	1
	Construction Started / Built	9	WA	In Design	25
MD	In Design	7		Construction Started / Built	14
	Construction Started / Built	1	WI	In Design	8
ME	In Design	5		Construction Started / Built	1
	Construction Started / Built	1	WV	In Design	1
MI	In Design	2		Construction Started / Built	1
	Construction Started / Built	1	WY	In Design	1
MN	In Design	1			
	Construction Started / Built	1			
MO	In Design	2			
	Construction Started / Built	2			
MT	In Design	3			
	Construction Started / Built	3			

## EXPANDING THE U.S. CONSTRUCTION MARKET FOR WOOD

WoodWorks is a non-profit organization working to increase the use of wood in buildings other than single-family homes—including multi-family/midrise and all non-residential building types. The opportunity for market share growth is significant.

help@woodworks.org  
www.woodworks.org/project-assistance/

### A UNIQUE AND NECESSARY ROLE

WoodWorks connects the broader wood industry with individuals who design wood buildings and specify wood products.

- » Works directly with building designers and owners
- » Removes real-world barriers to wood use
- » Creates wood design experts

Ref: <http://www.woodworks.org/publications-media/building-trends-mass-timber/>

# NHERI TALLWOOD PROJECT



- Objective: Develop and validate a **Resilience-based** seismic design methodology for tall wood buildings
- Website: [nheritallwood.mines.edu](http://nheritallwood.mines.edu)

PI



Shiling Pei



Jeffrey Berman



Keri Ryan



James Ricles



Richard Sause



Dan Dolan



John van de Lindt



Senior  
Personnel



Thomas Robinson



Eric McDonnell



Hans-Erik Blomgren



Andy Buchanan



Marjan Popovski



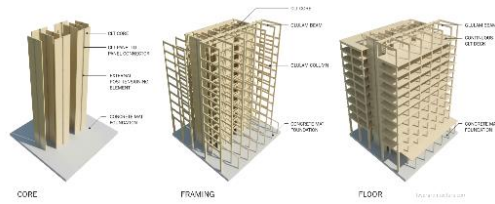
Douglas Rammer



# GAME PLAN

Project duration: 2016~2020

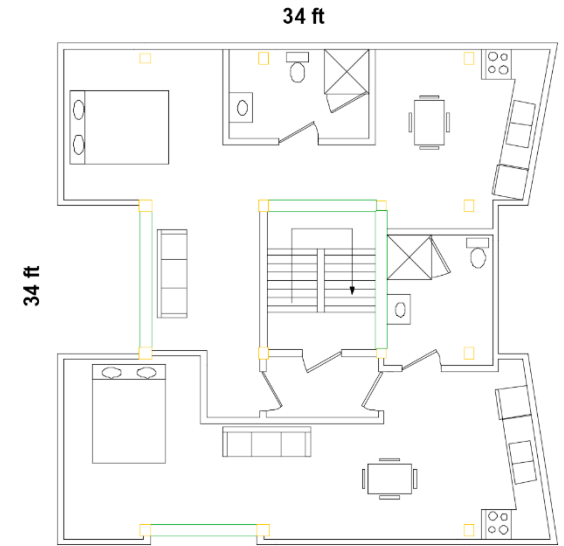
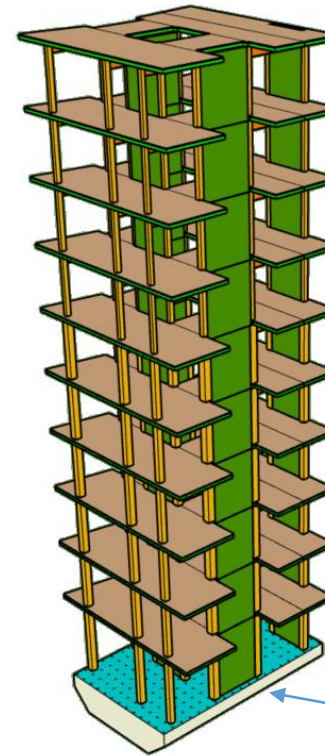
[Nheritallwood.mines.edu](http://Nheritallwood.mines.edu)



Define Tall Wood Archetypes

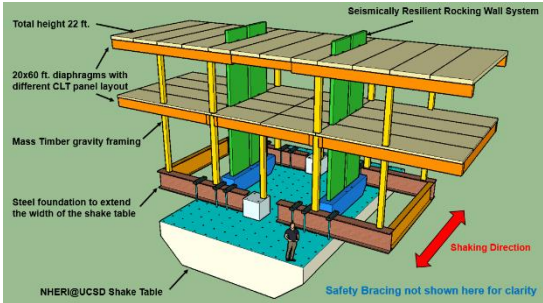
## Full-scale 10-story validation Test (2020)

Mixed-Use building w/ CLT rocking wall lateral system

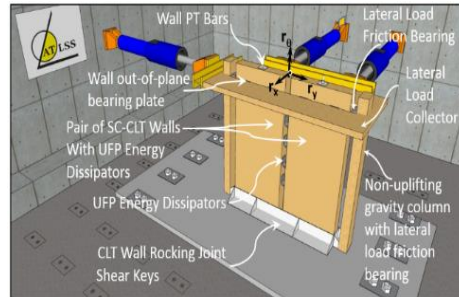


UCSD Shake Table

## Investigative testing at system level



Two-story test at NHERI@UCSD 2017 Summer



Assembly test at NHERI@Lehigh 2019

**Seismic R & D**  
(2018~2019)

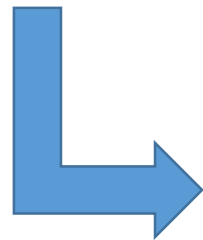


# TWO-STORY TEST AT UCSD IN 2017

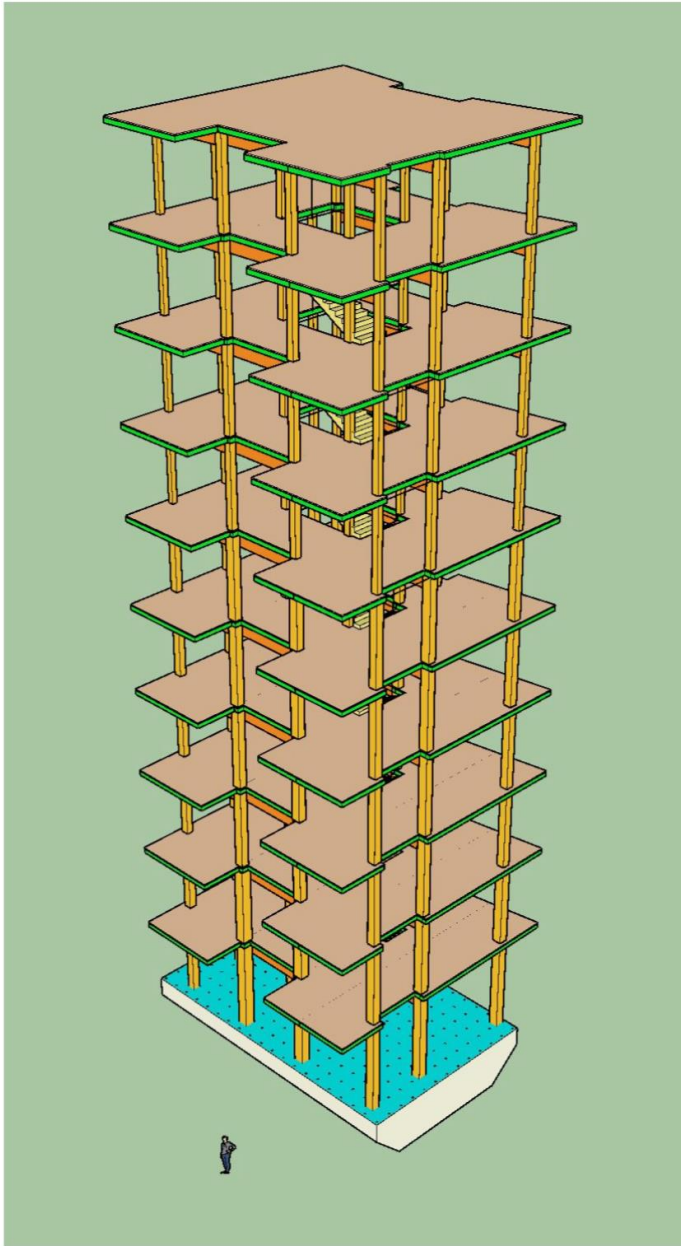
Construction <https://www.youtube.com/watch?v=5Gbyf3pRPFk>

Testing [https://www.youtube.com/watch?v=Y8e-FCGk\\_AM](https://www.youtube.com/watch?v=Y8e-FCGk_AM)

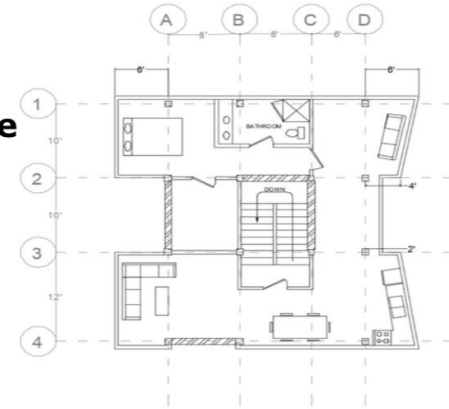
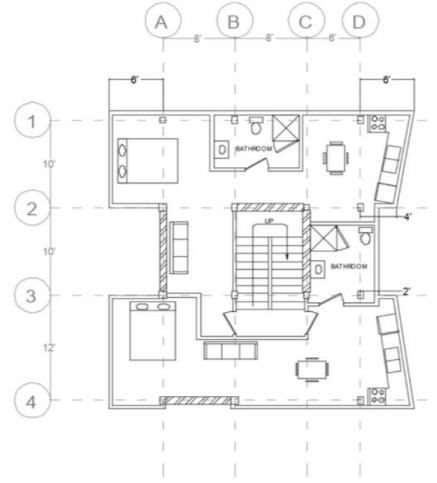
The building system performed extremely well against earthquakes. Very limited structural damage even at MCE level events.



The 10-story building will also utilize rocking walls, and will include nonstructural finishes.

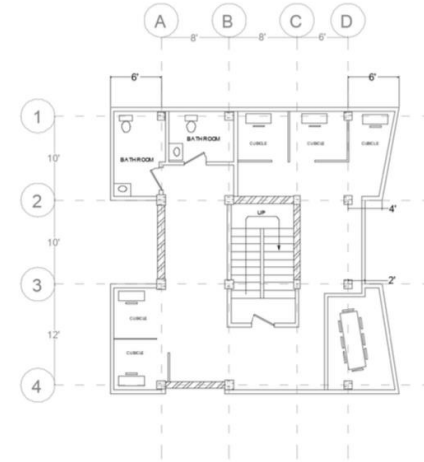
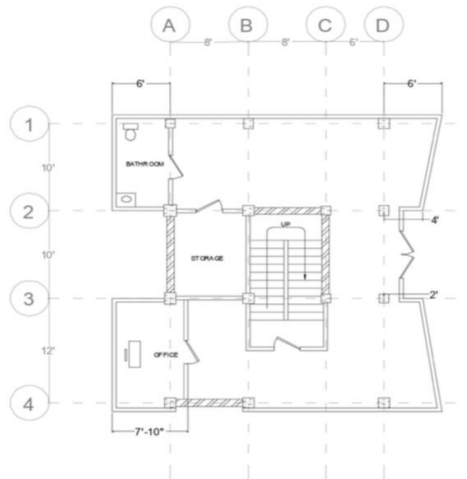


**Floor 10: Penthouse**



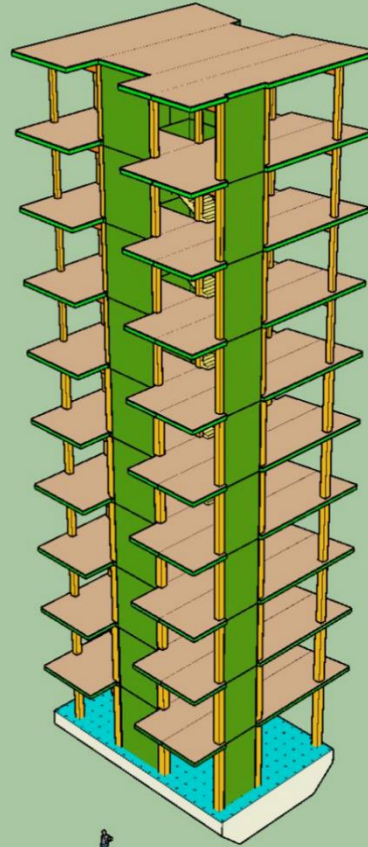
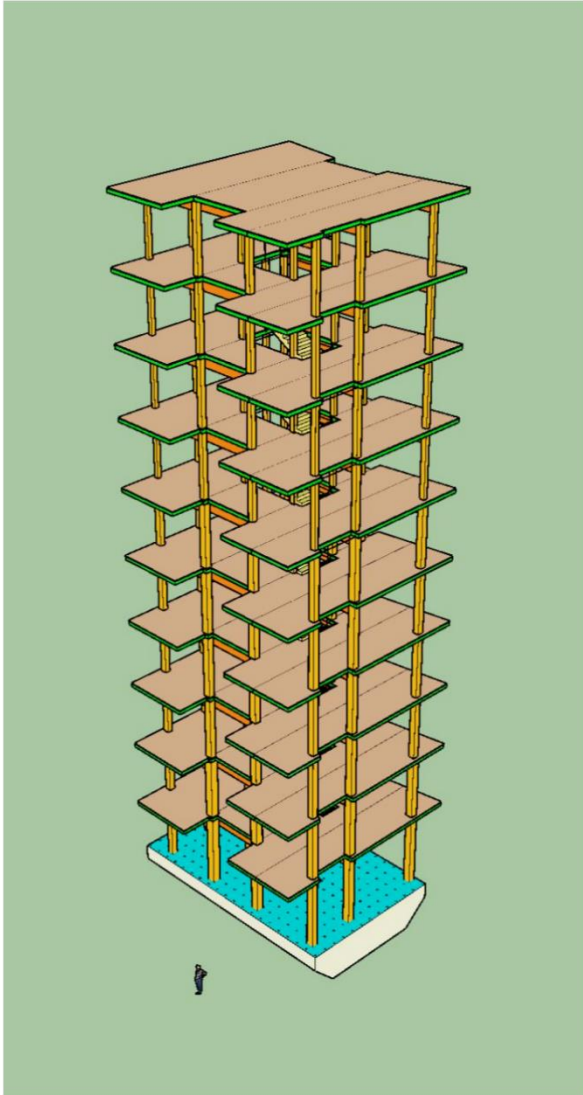
**Floor 7-9: Residential**

**Floor 3-6: Office**



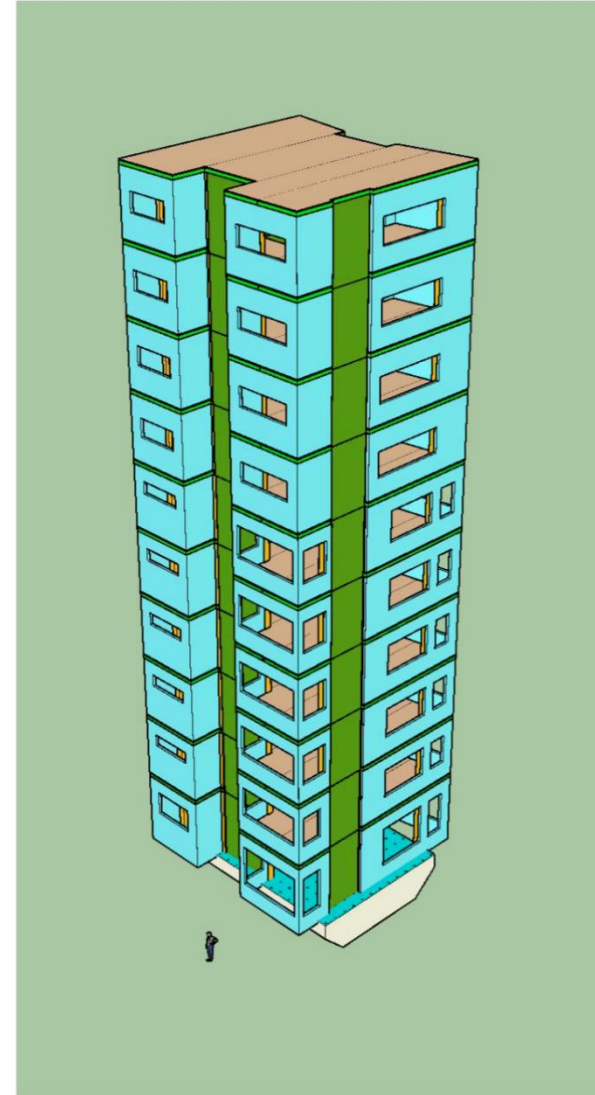
**Floors 1-2: Commercial**

**Basic Skeleton**



**Rocking Walls Added**

**Finished Building**

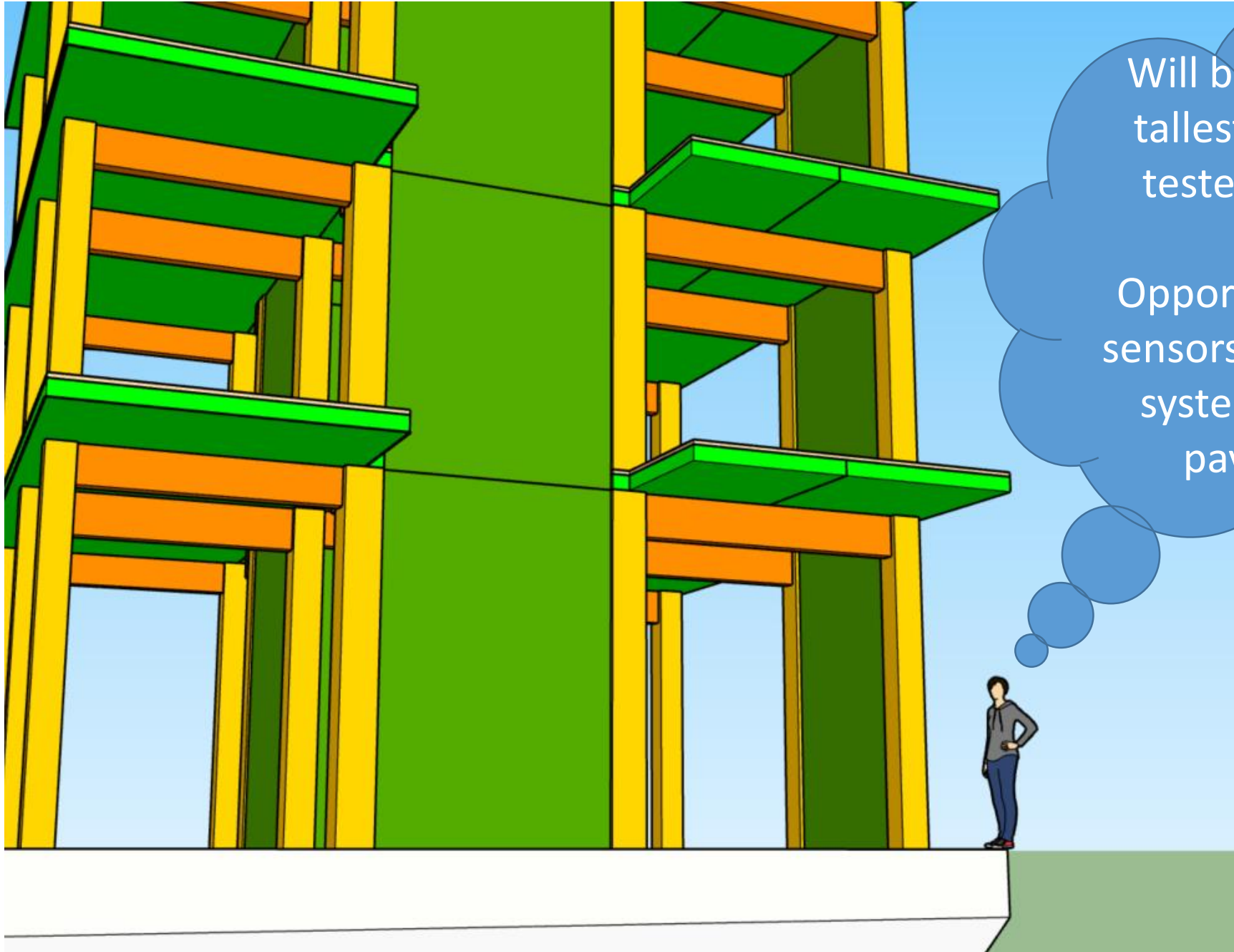




# Time Frame on 10-story test

- End of 2018: Preliminary design complete (Mainly to obtain material take-off and cost estimates). Will be able to share with interested collaborators to discuss payload opportunities.
- 2019: Engage industry collaborators. Refine seismic design to achieve resilience targets.
- 2019: Non-structural detailing
- End of 2019: Full construction plan set.
- 2020 Jan ~ May: Procurement and manufacturing, construction logistics
- 2020 June ~ August (**tentative based on shake table upgrade schedule**): Construction and Instrumentation
- 2020 September ~ October (**or as soon as shake table is ready**): Seismic Testing

Fast-Forward to end of 2020...



Will be the largest & tallest building ever tested at full scale.

Opportunity to install sensors, non-structural systems, and other payload ideas.

Even if your payload idea is not specifically for wood buildings

# Payload Contact

- Structural/Sensor related projects:

Dr. Shiling Pei [spei@mines.edu](mailto:spei@mines.edu)

- Non-structural related projects:

Dr. Keri Ryan [klryan@unr.edu](mailto:klryan@unr.edu)