Mass Timber Buildings in the Southern US:

A Clemson University Case Study

Presented by Brian Campa

COOPER CARRY

Architect – **Cooper Carry**
Structural – **Britt Peters**
Civil – **Seaman Whiteside**
Landscape – **Koons Environmental Design**
MEP – **RMF**
CM – **Sherman Construction**
Special Collaborator – **Clemson Wood Utilization Institute**

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

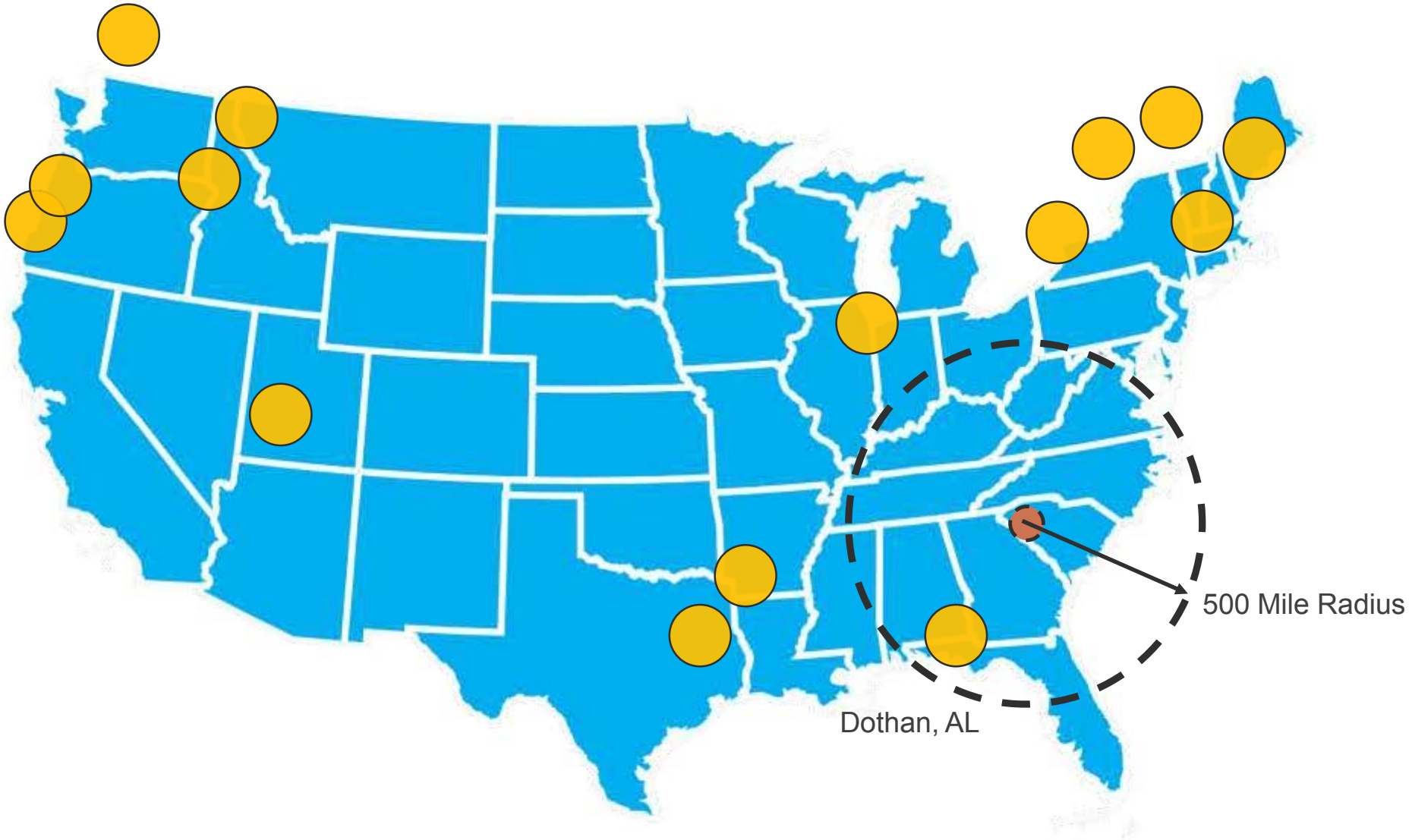
The **Snow Family Outdoor Fitness and Wellness Center** at Clemson University was a project that uniquely tested the viability of mass timber construction in the southern US. Among the design nuances, it is the fi rst building east of the Mississippi to use CLT made from Southern Yellow Pine. The location of a fitness and wellness center on a lakeside site also required a clear expression of the natural materials that comprise the structure, including CLT structural slabs and walls, glulam columns and beams, cypress screens, and thermo-set wood-based fi ber panels. Aimed at helping others understand the benefi ts and challenges of mass timber systems, this case study presentation by the project architect will provide insights into the process and design, with an emphasis on material cost analysis, thermal performance, durability, sustainability, and biophilia.

Learning Objectives

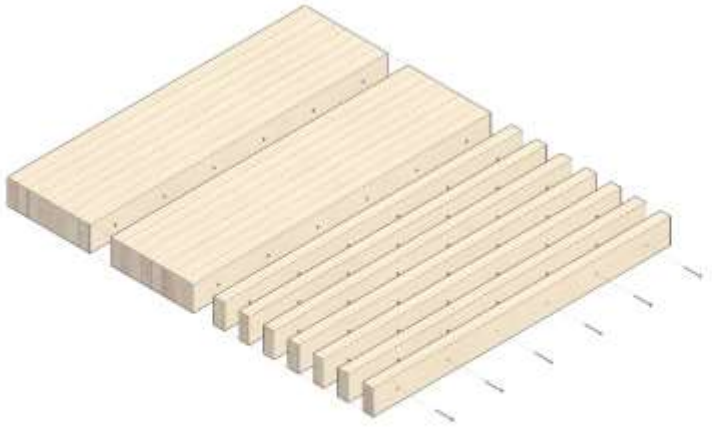
1. Highlight the use of mass timber on projects in the southern United States.
2. Discuss design considerations unique to mass timber.
3. Review the aesthetic and performance attributes of mass timber construction.
4. Identify unique construction factors related to a lakeside University project, and evaluate its ultimate success.

Mass Timber Applications In The South.

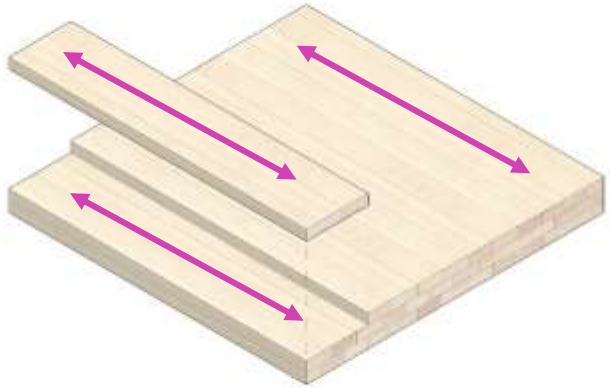
Mass Timber Manufacturing



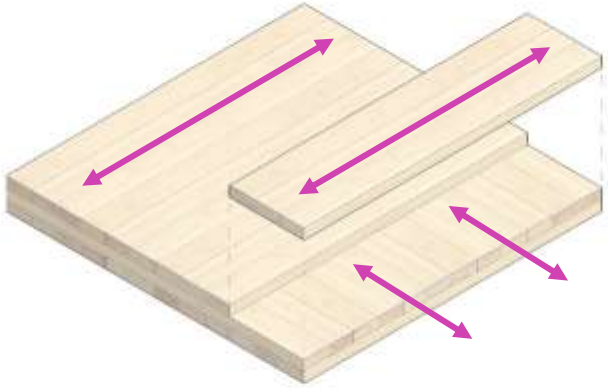
Evaluated Mass Timber Systems



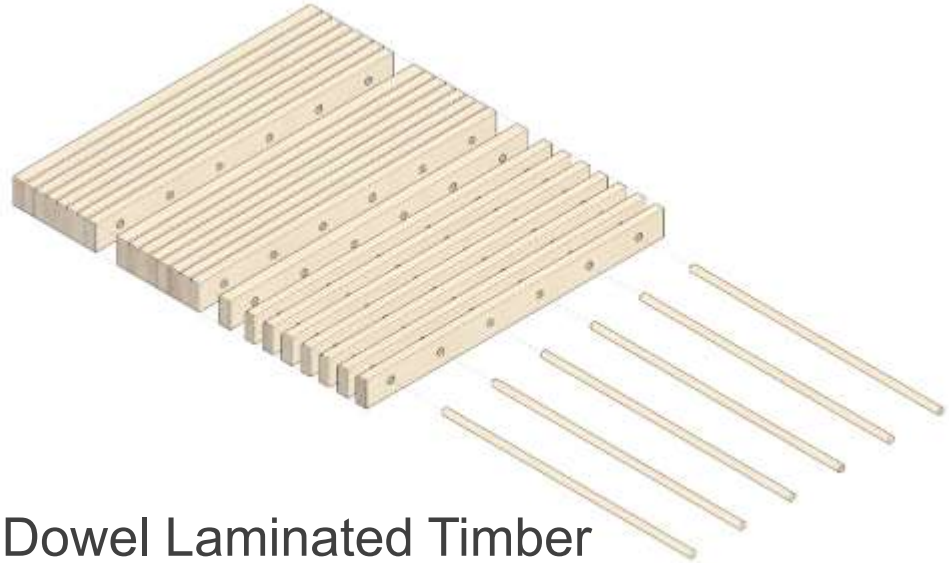
Nail Laminated Timber



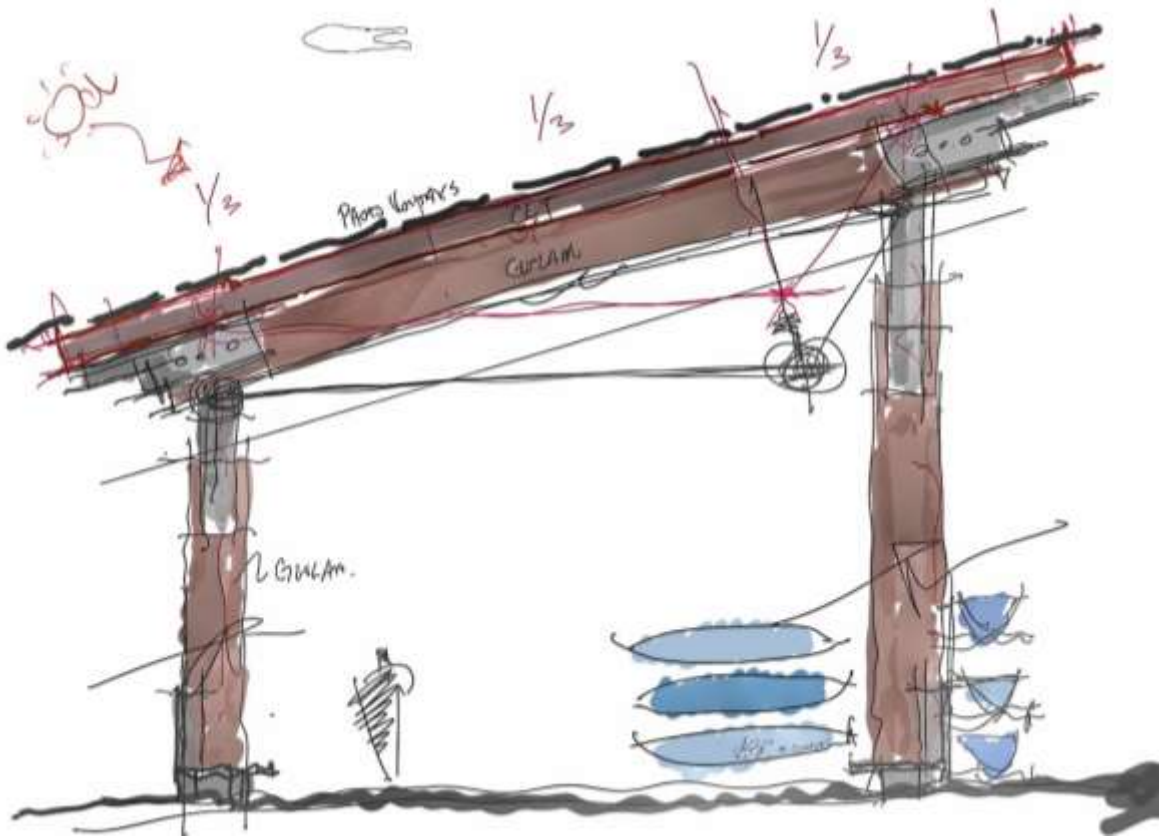
Glue Laminated Timber

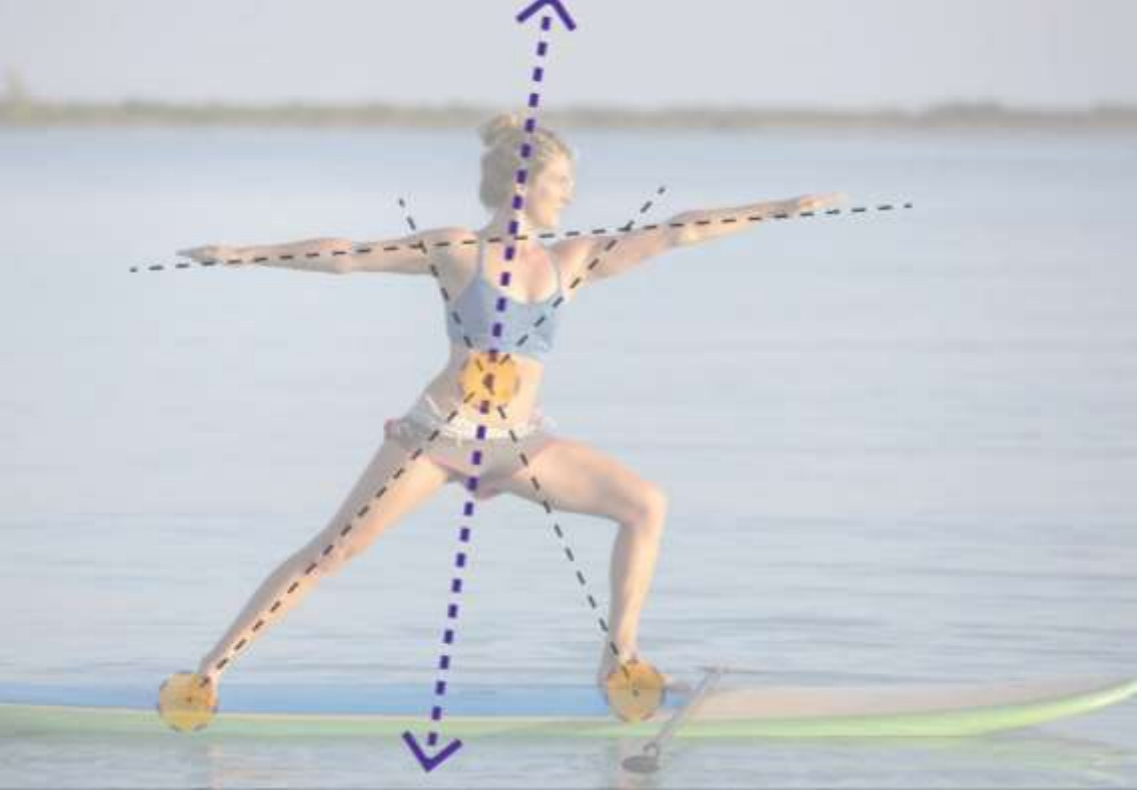


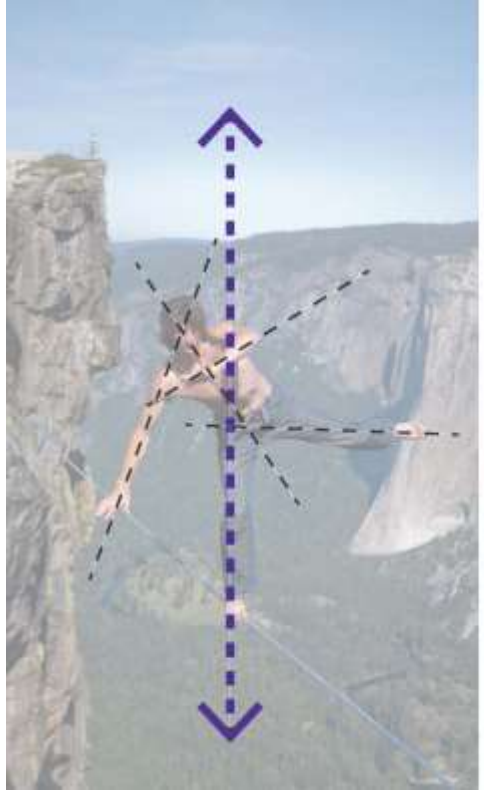
Cross Laminated Timber

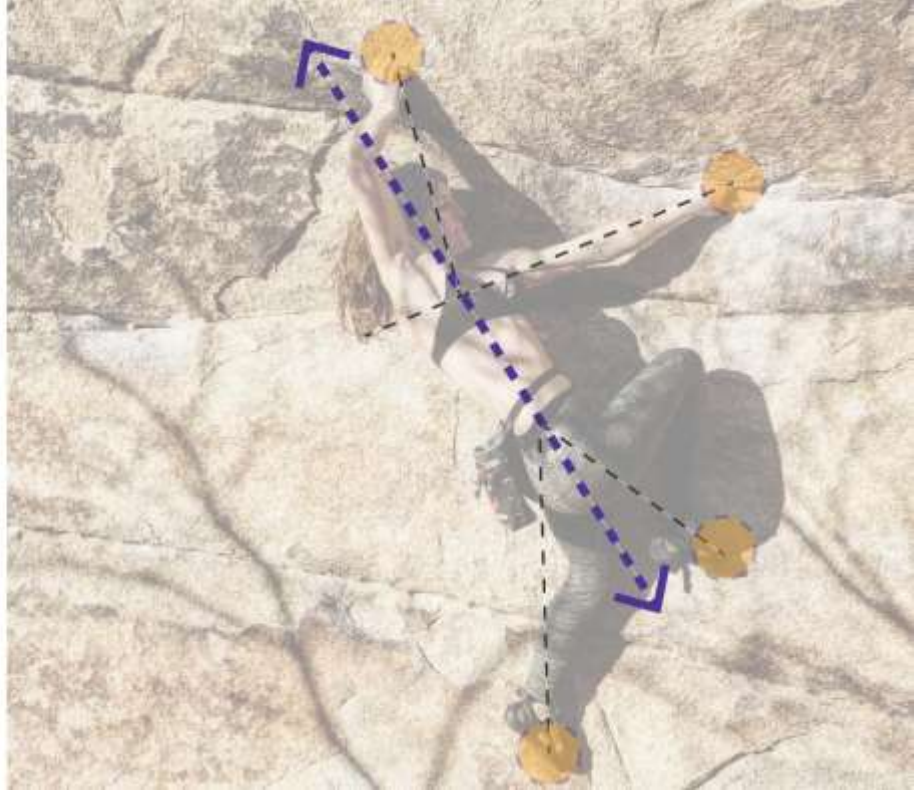


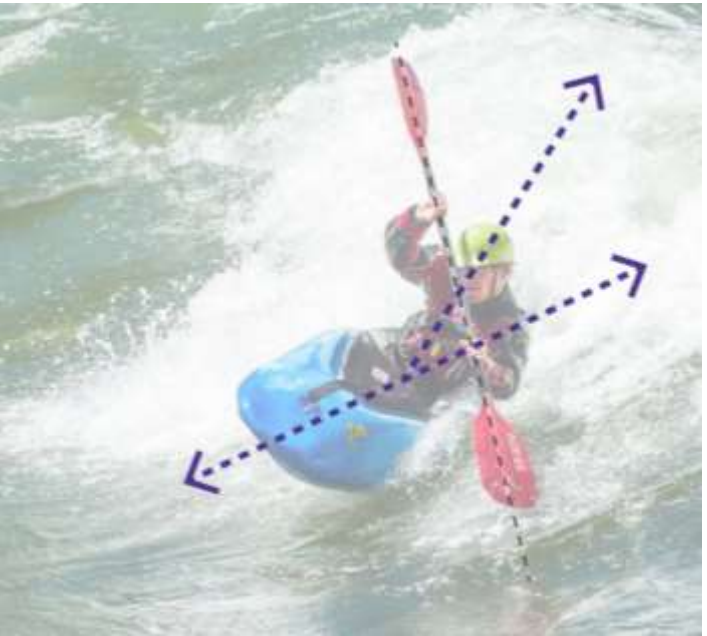
Dowel Laminated Timber


1/3
1/3
1/3







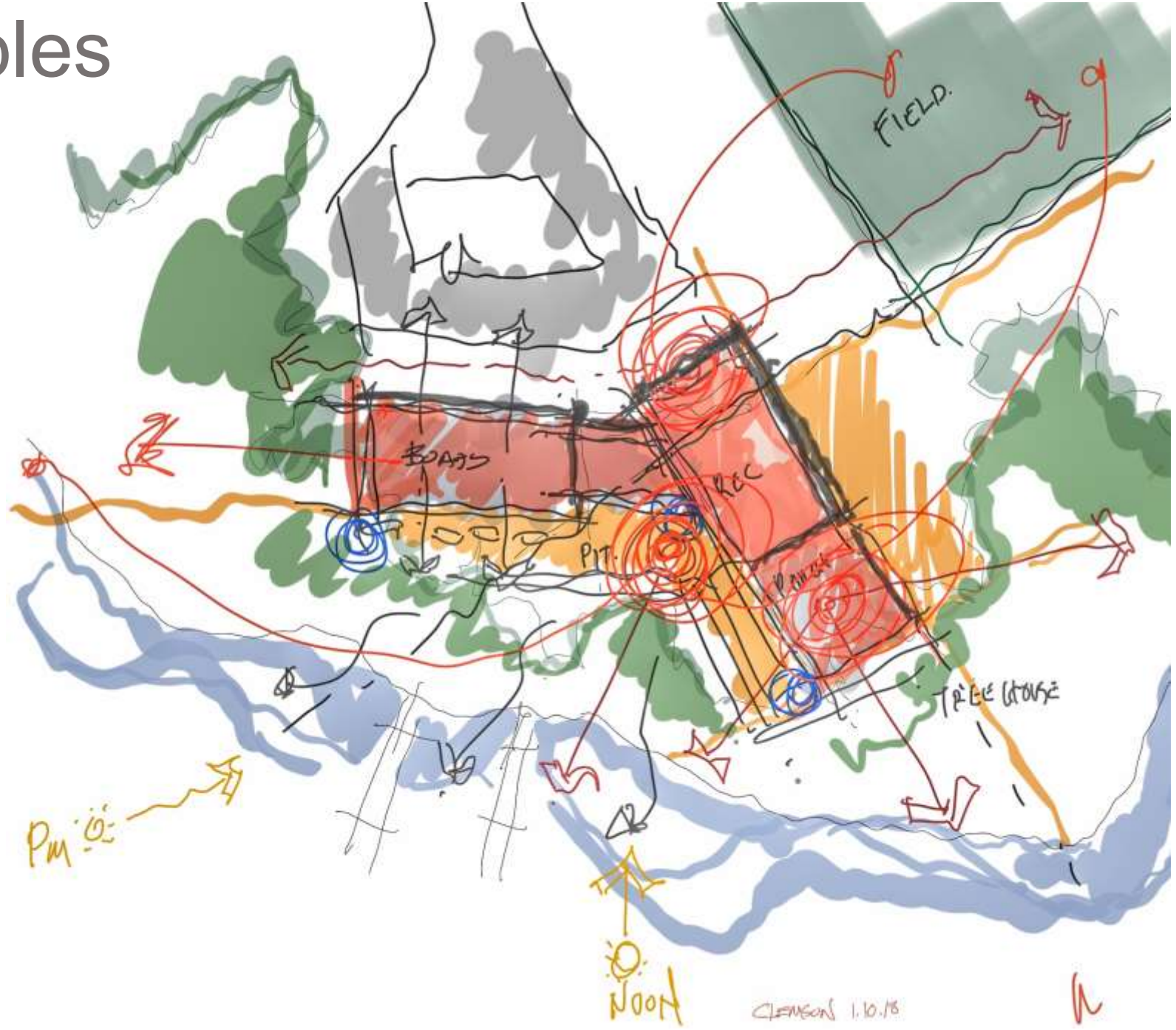


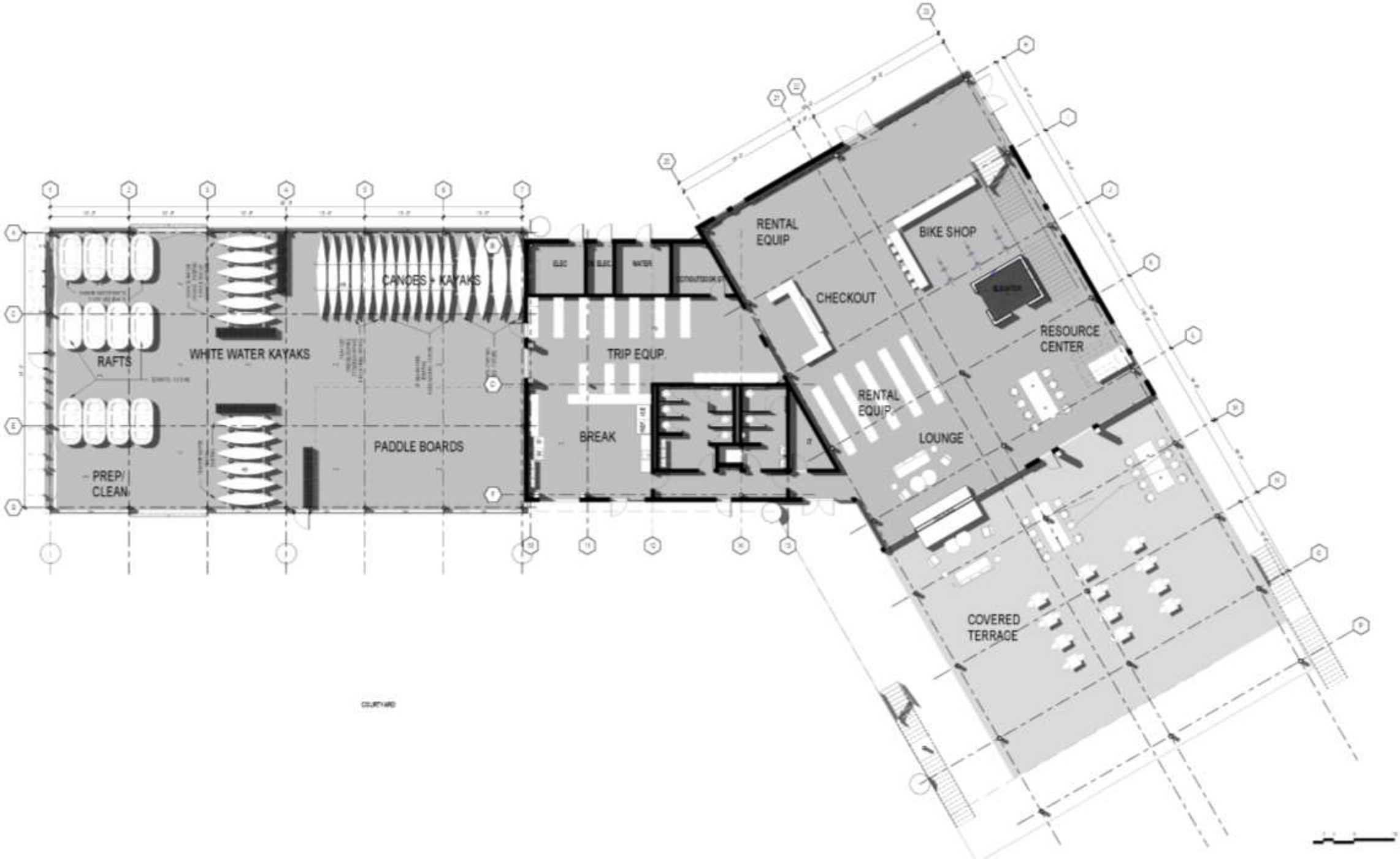
Project Principles

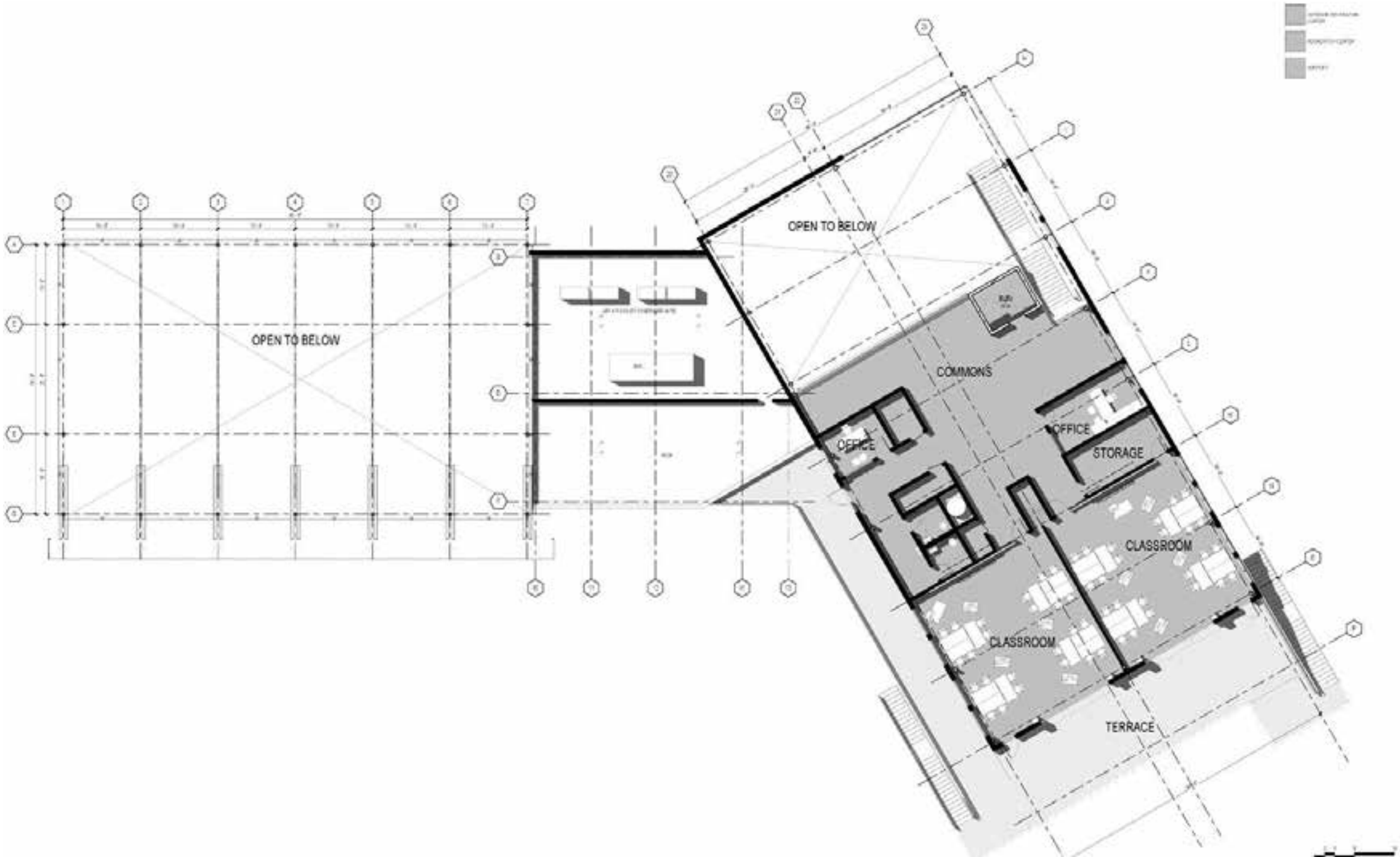
1. Create a facility that connects students with nature.

2. Explore the benefits and challenges of advanced wood building materials and systems.

3. Support the well-being and health of the Clemson Community.




RENTAL EQUIP
BIKE SHOP
CHECKOUT
RESOURCE CENTER
RENTAL EQUIP
LOUNGE
COVERED TERRACE
CANOES + KAYAKS
TRIP EQUIP
RAFTS
WHITE WATER KAYAKS
PADDLE BOARDS
BREAK
PREP/ CLEAN


OPEN TO BELOW
OPEN TO BELOW
COMMONS
OFFICE
OFFICE
STORAGE
CLASSROOM
CLASSROOM
TERRACE

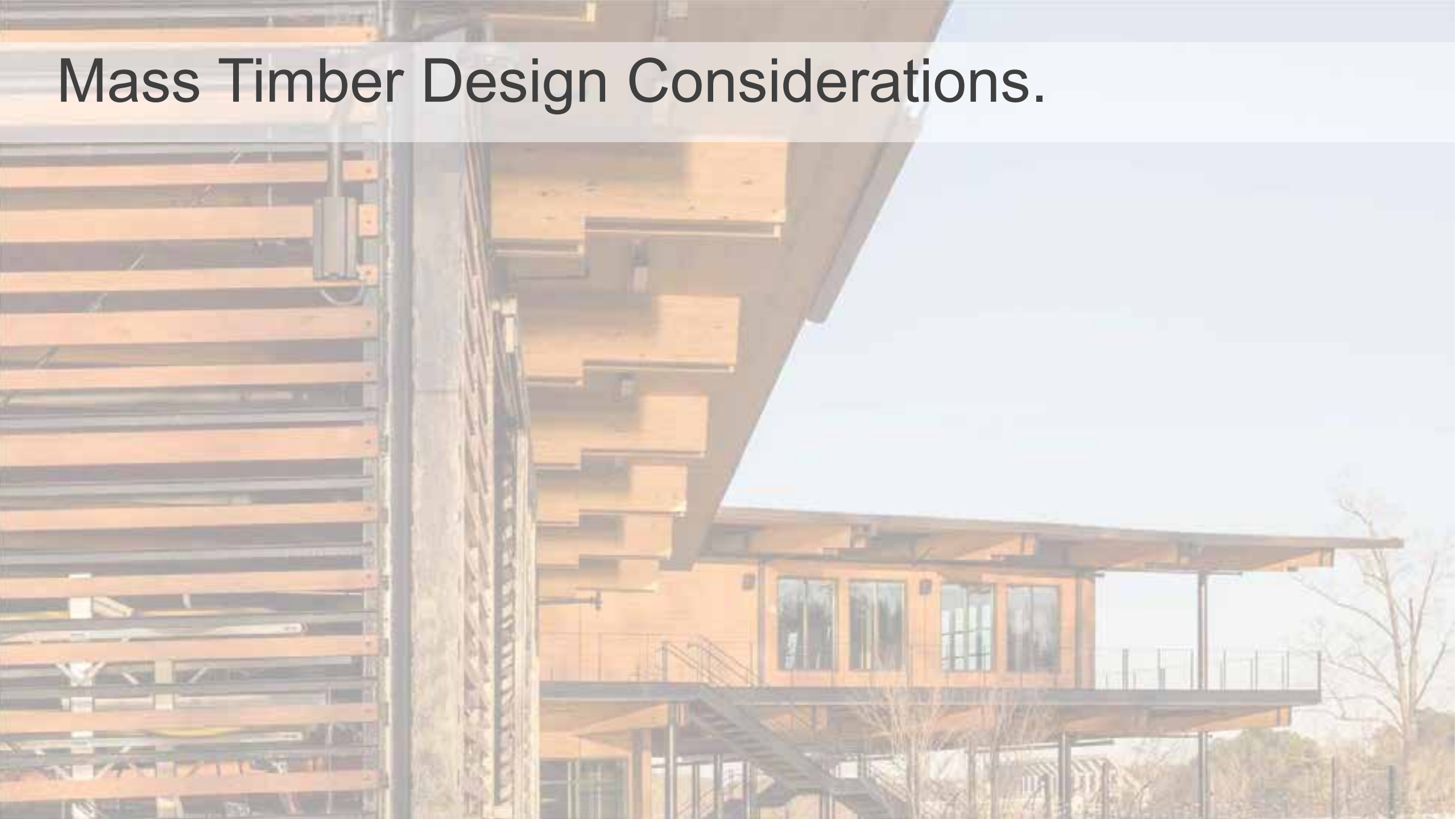
Connect students with nature.

Establish the catalyst for future growth.

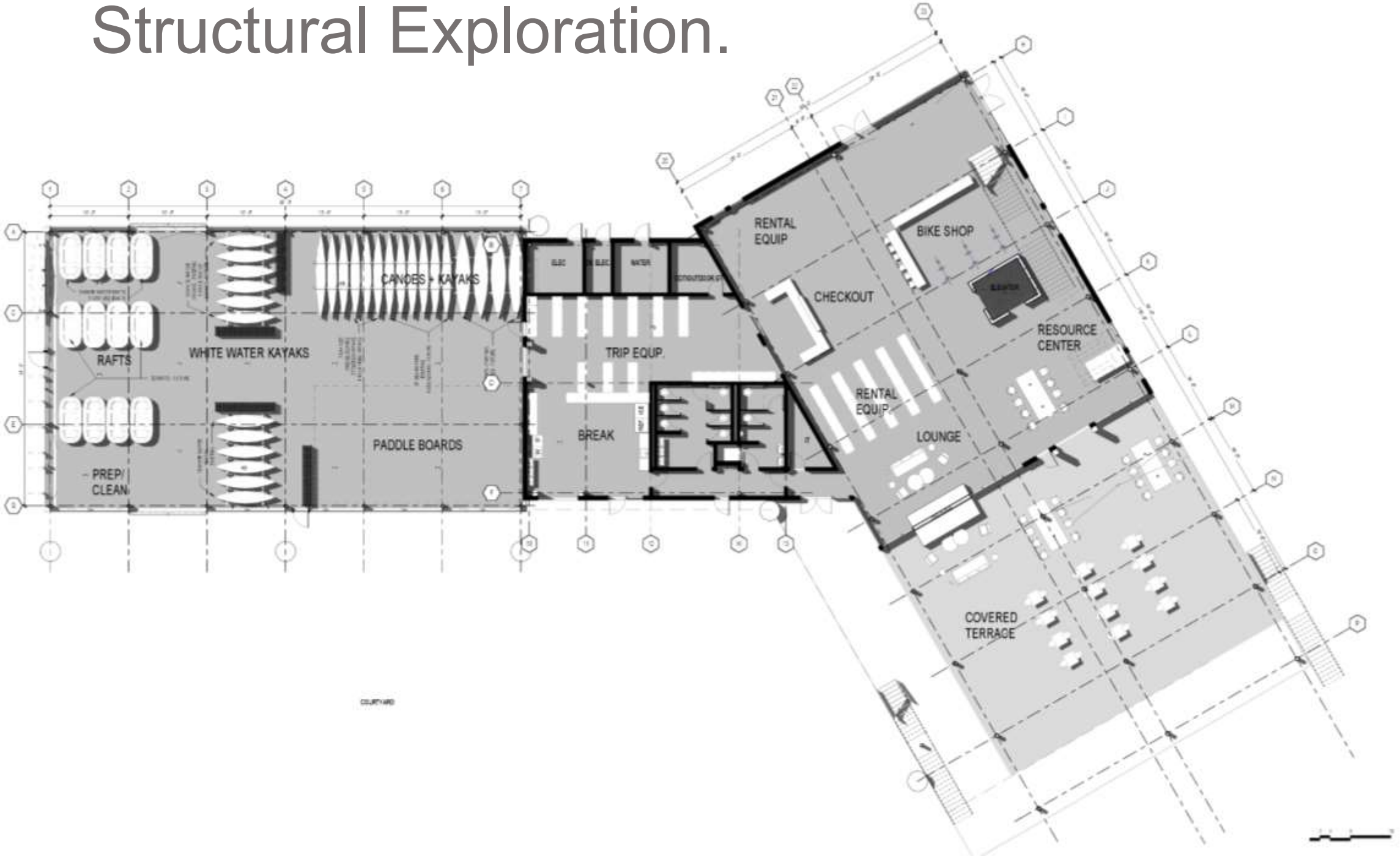
Showcase innovation with mass timber.

Create a beacon for the precinct.

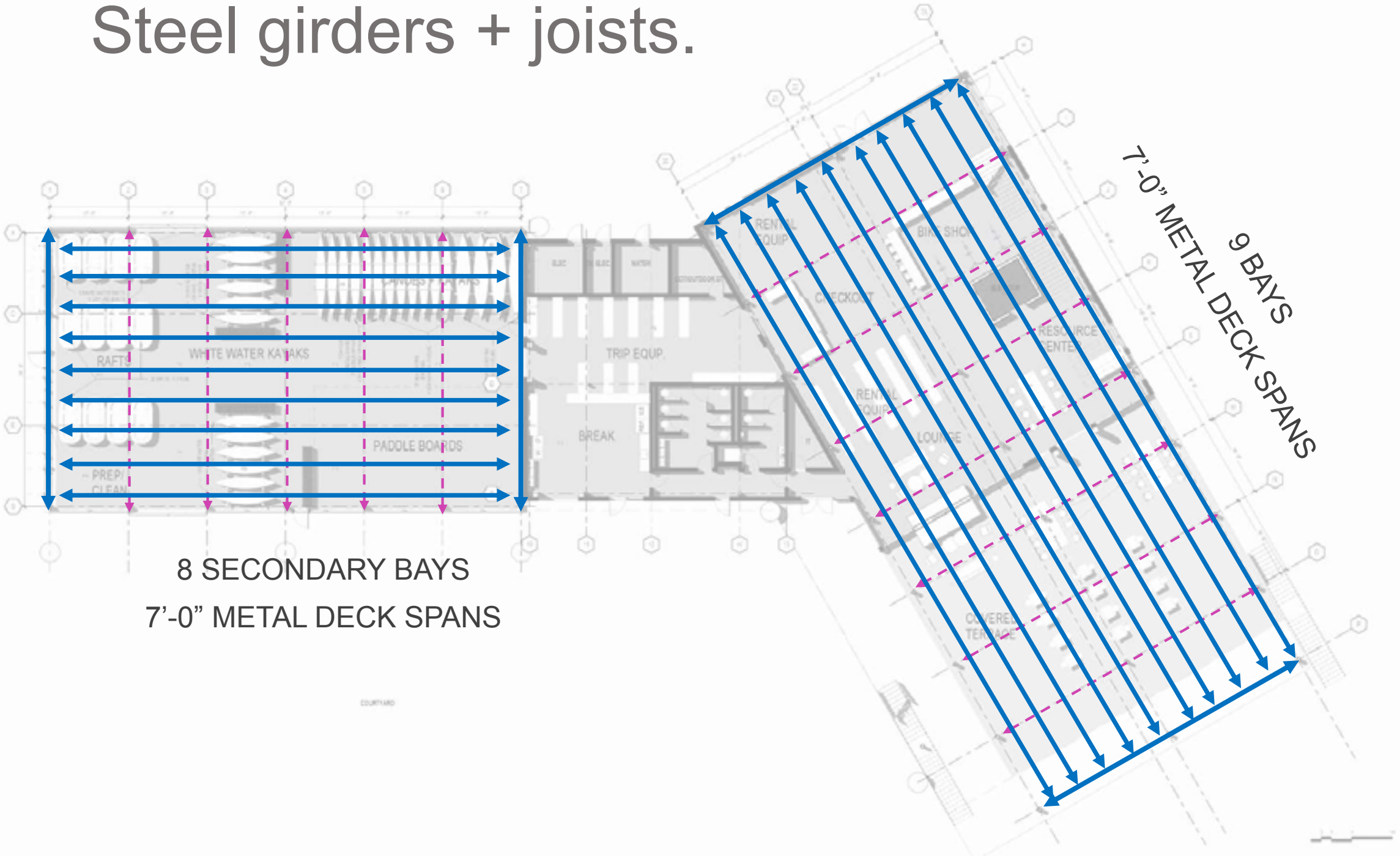
Mass Timber Design Considerations.



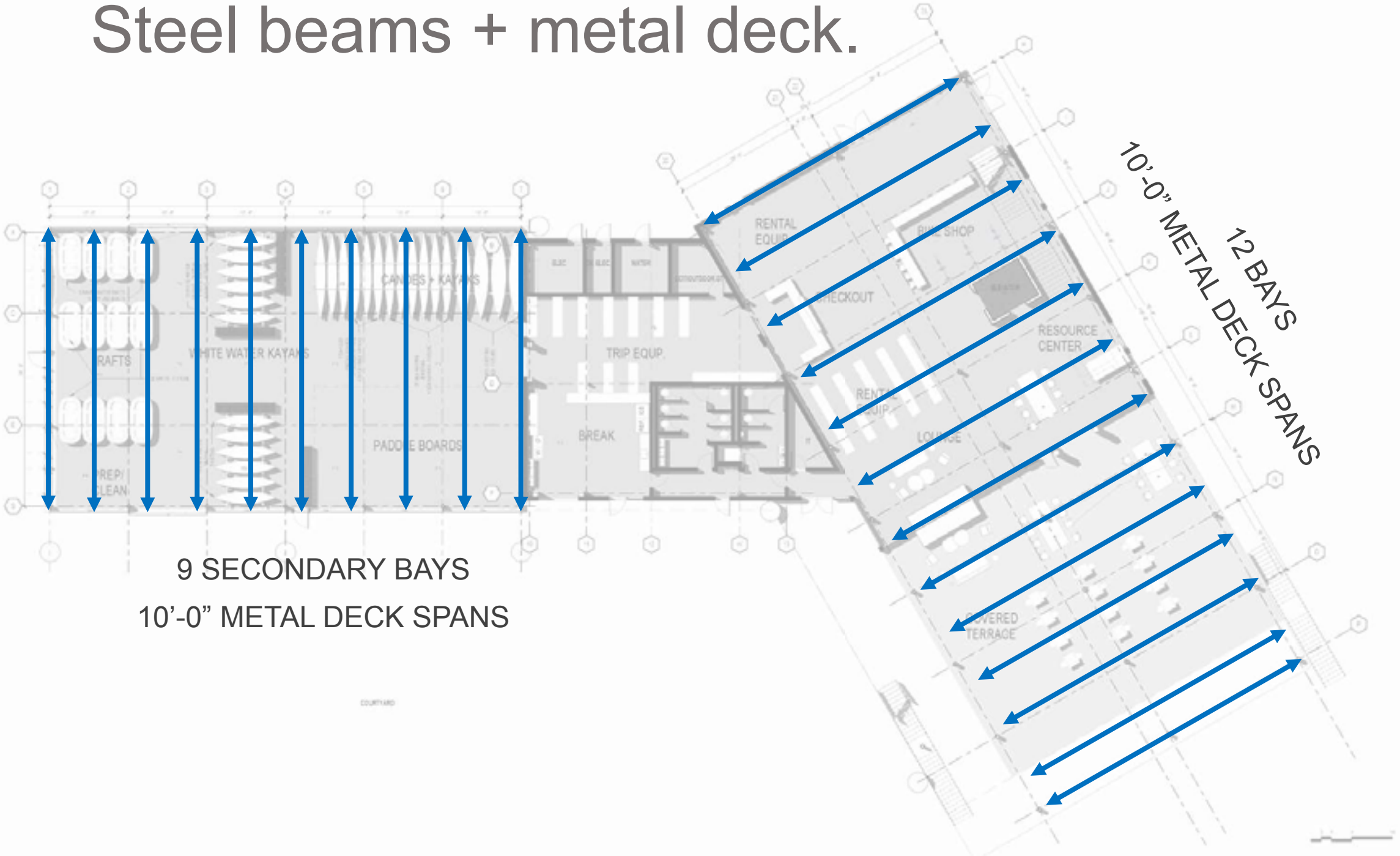
Structural Exploration.



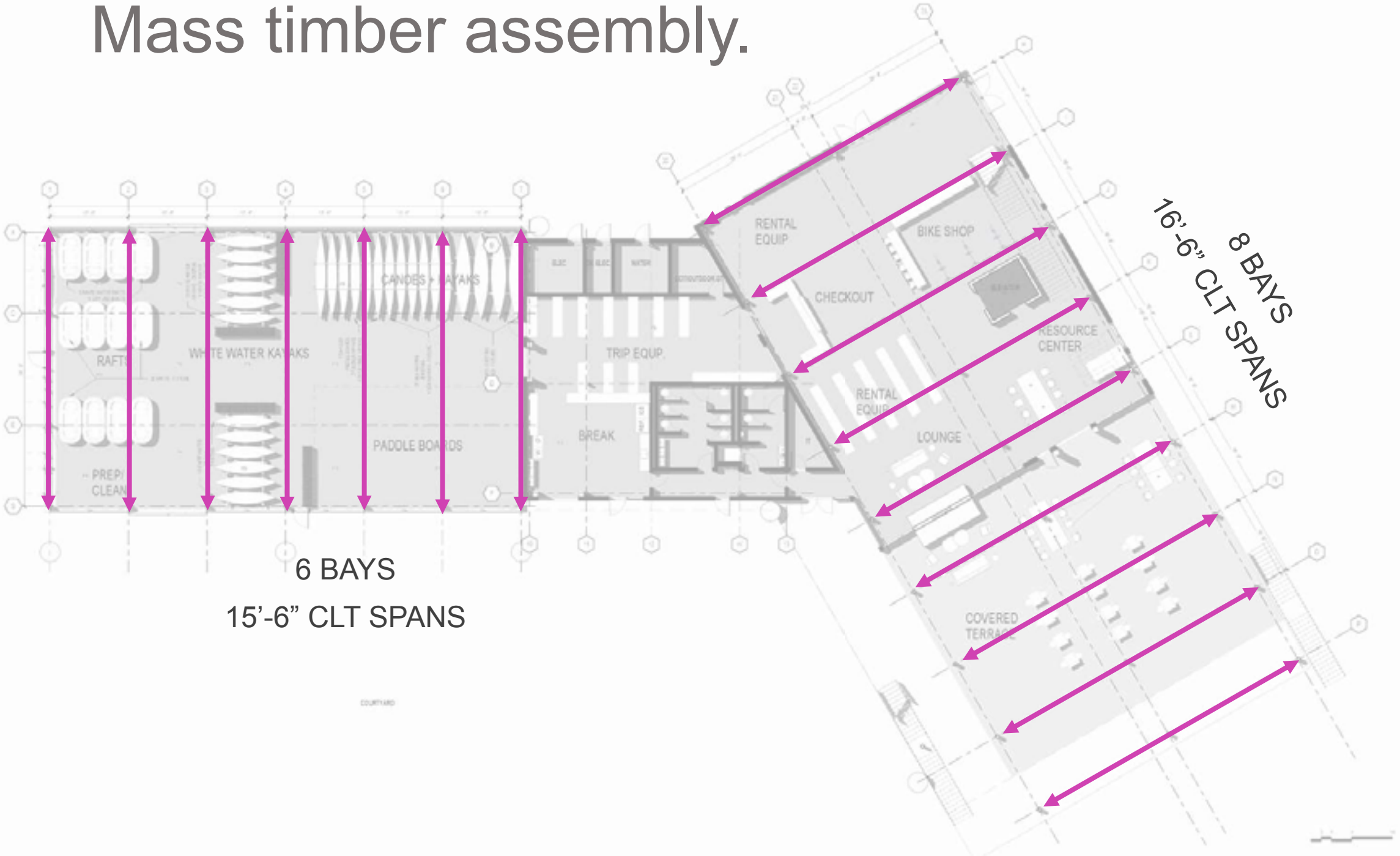
Steel girders + joists.



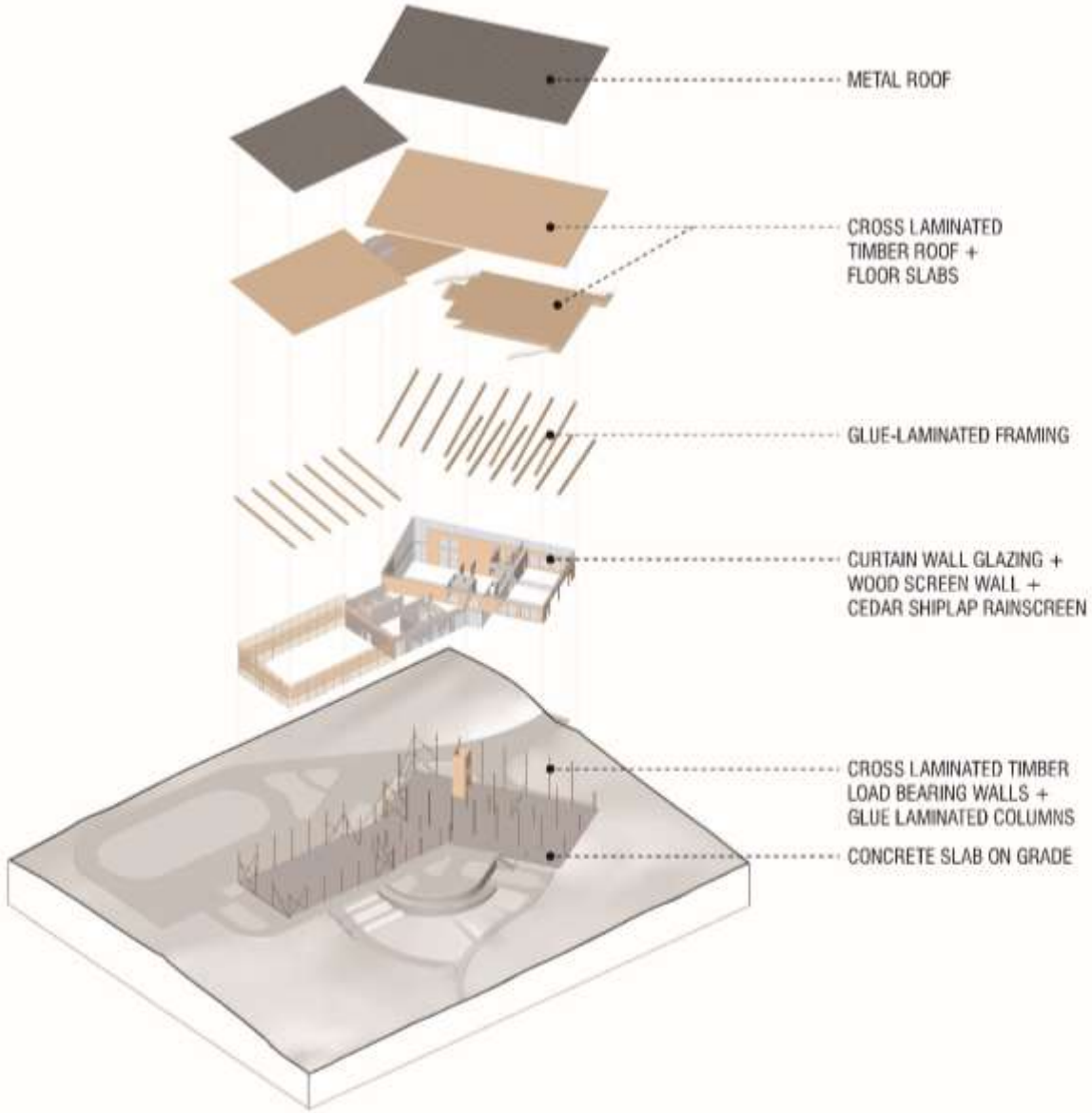
Steel beams + metal deck.



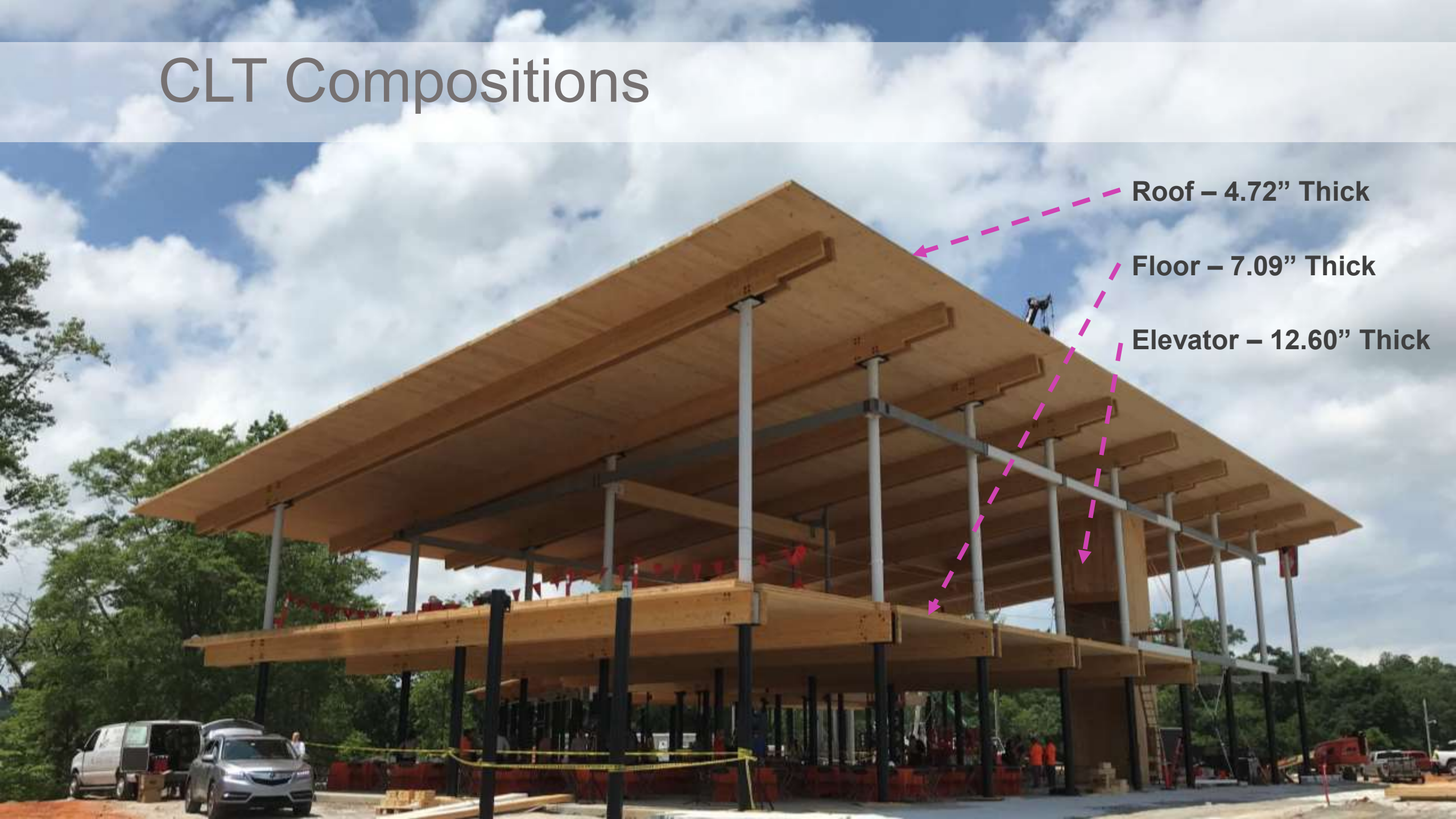
Mass timber assembly.



Composite Assembly



CLT Compositions



Aesthetics, Performance, Cost.

Cost Analysis

Opportunities for Savings

1. Elimination of ceilings
2. Efficiency of spans+ reduction of framing
3. Construction Time
4. Installation savings

Fields: $1,800,000

Building: $7,600,000

Total Cost: $9,500,000

Boat House:

CLT roof in lieu of Steel = **-$8,200**

Rec Center:

CLT elevated floor in lieu of Steel = **-$94,000**

Exposed CLT in classroom = **-$34,000**

Glulam in lieu of Steel Columns = **+$700**

Glulam in lieu of Steel Roof = **-$8,000**

Aesthetics Quality

A1 - Architectural Appearance 1

Primary highly visible panels.

#1 Southern Yellow Pine

A2 - Architectural Appearance 2

Secondary, service, and plenum panels.

#2 Southern Yellow Pine

A3 - Architectural Appearance 3

Fully enclosed, core and shell panels.

#2 Southern Yellow Pine

Table 1: Surface Quality Characteristics of IB X-LAM USA CLT Panels[1]

	A1	A2	IA
Grade	#1 Southern Pine	#2 Southern Pine	#2 Southern Pine
Knots - sound	permitted	permitted	permitted
Knots	max 2 1/4" Ø	max 2 7/8" Ø	permitted
Knot holes	max 1 1/4" Ø	max 1 1/2" Ø	permitted
Wane	none on face	none on face	permitted
Shake	2'-0" surface	3'-0" surface	1/3 length
Splits	equal width	1.5x width	equal 1/6 length
Decay	none	heart center streaks	heart center streaks
Blue Stain	slight discoloration	slight discoloration	permitted
Quality of Finishes	some small faults	some faults	no specifications
Surface Finish	100% sanded	100% sanded	max 10% rough sanded
Example			

[1] Grading rules follow SPIB's 2014 standard grading rules for southern pine lumber

Trends, Best Practices, + Lessons Learned.

Care of all wood materials during construction.

Material Storage

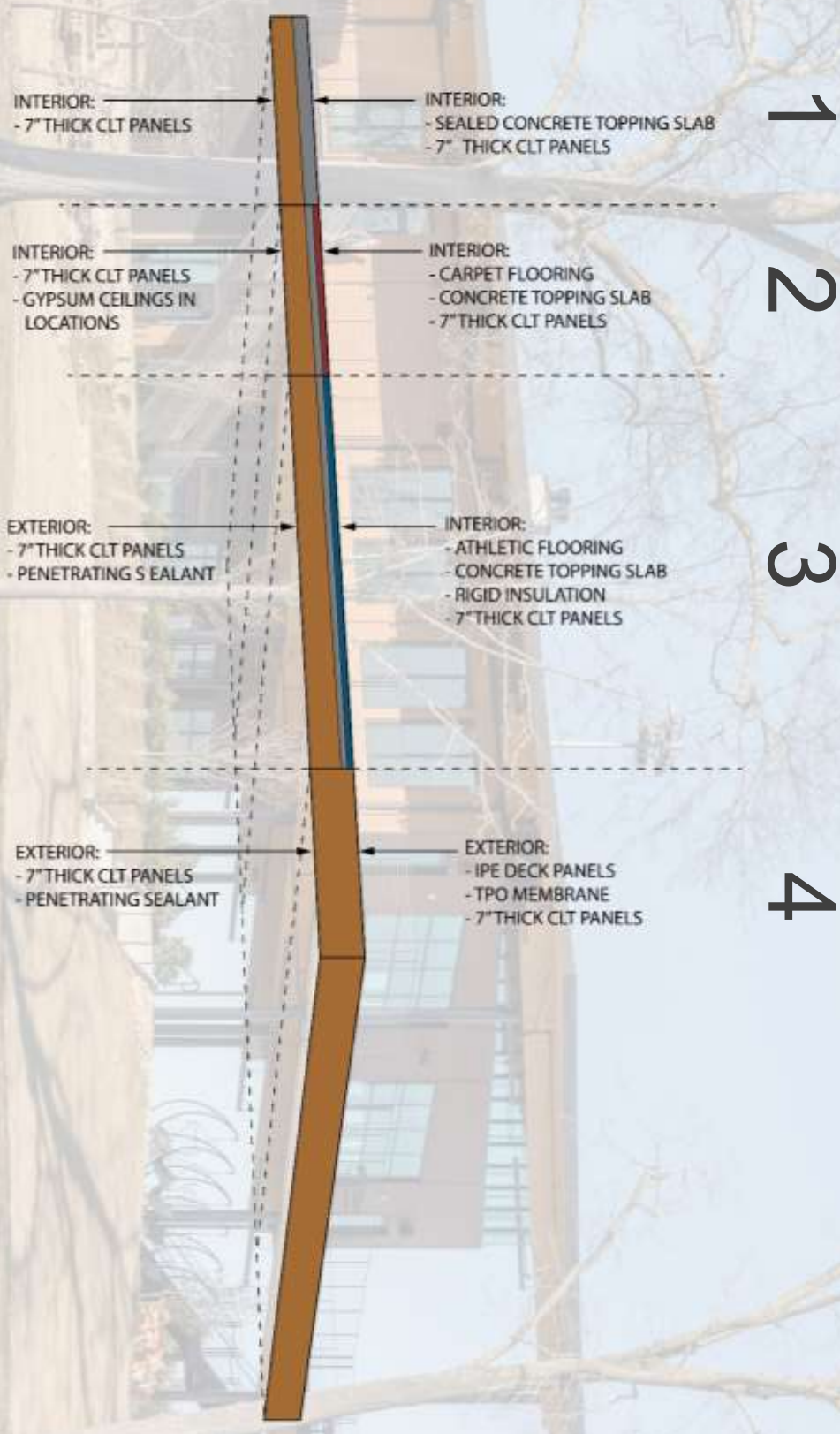
1. Store material on site based on installation sequence to reduce unnecessary moving and damage.

2. Protect material by wrapping on all six sides while sitting on site.

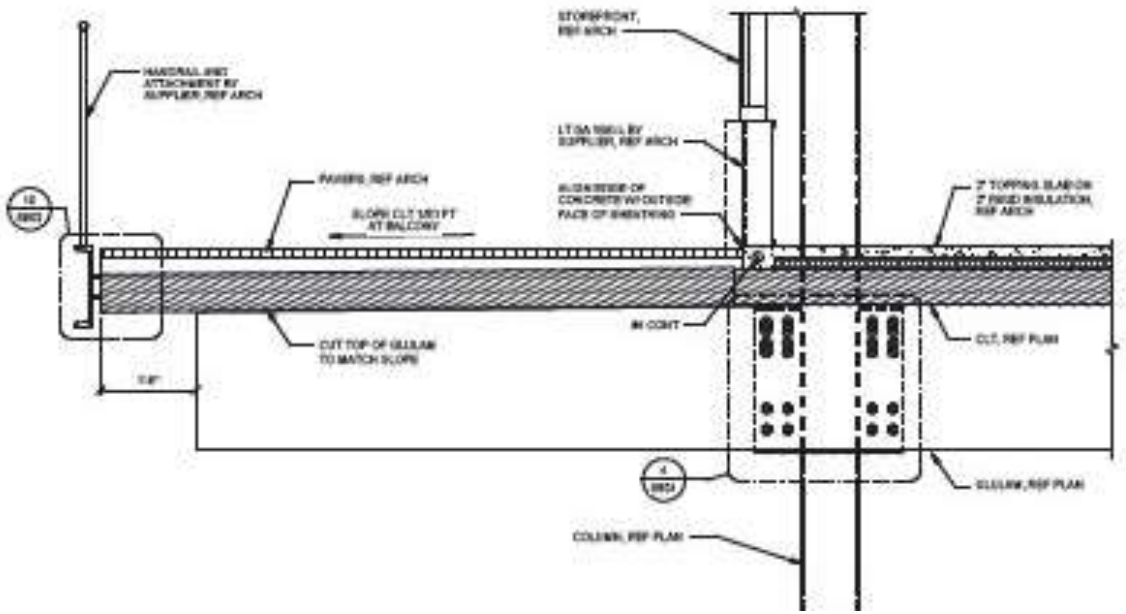
3. Store material skids to protect from standing water and moisture.

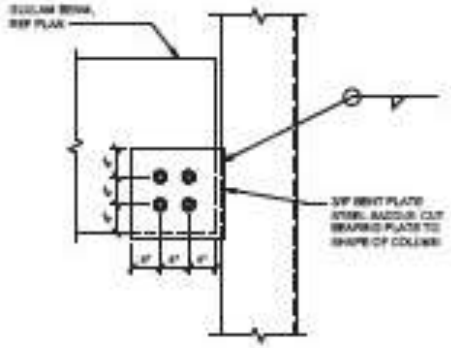
4. Over-communicate care and intention of exposed material with all subs through signage, protective material, and pre-installation meetings.

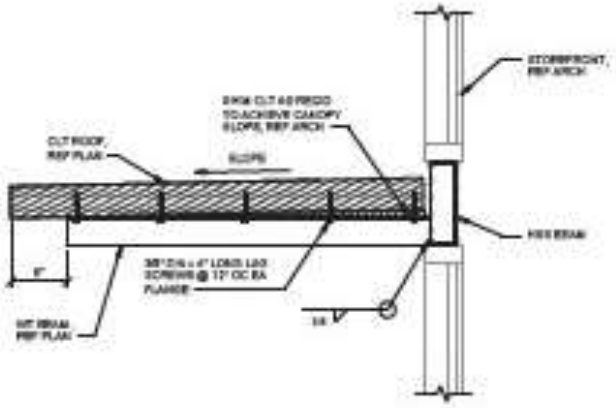
Multiple composition mass timber systems.

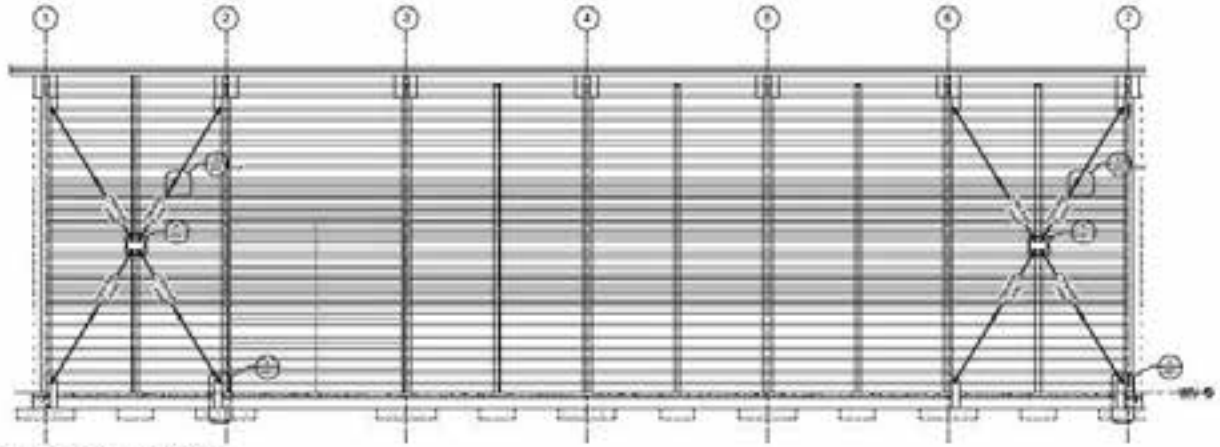

INTERIOR:
- 7"THICK CLT PANELS
INTERIOR:
- SEALED CONCRETE TOPPING SLAB
- 7" THICK CLT PANELS
1
INTERIOR:
- 7"THICK CLT PANELS
- GYPSUM CEILINGS IN LOCATIONS
INTERIOR:
- CARPET FLOORING
- CONCRETE TOPPING SLAB
- 7"THICK CLT PANELS
2
EXTERIOR:
- 7"THICK CLT PANELS
- PENETRATING S EALANT
INTERIOR:
- ATHLETIC FLOORING
- CONCRETE TOPPING SLAB
- RIGID INSULATION
- 7"THICK CLT PANELS
3
EXTERIOR:
- 7"THICK CLT PANELS
- PENETRATING SEALANT
EXTERIOR:
- IPE DECK PANELS
- TPO MEMBRANE
- 7"THICK CLT PANELS
4

CLT Compositions



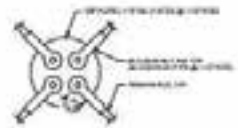




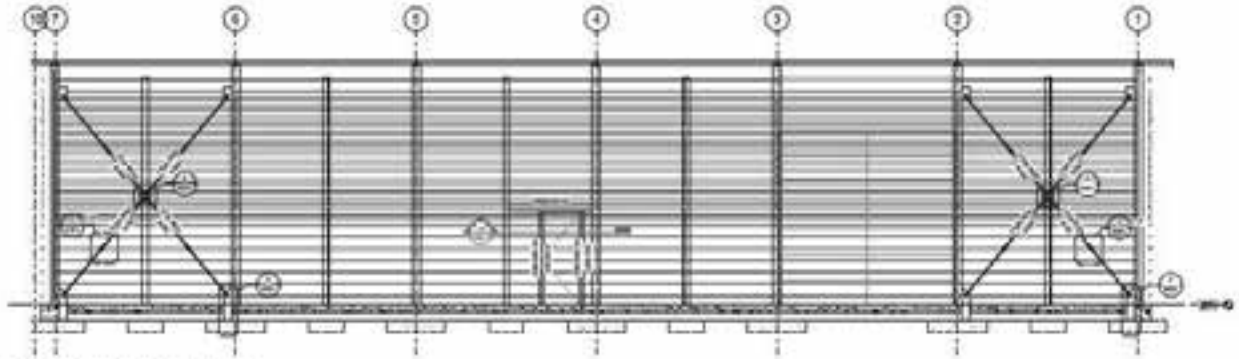


1 BRACE ELEVATION ALONG GRID A

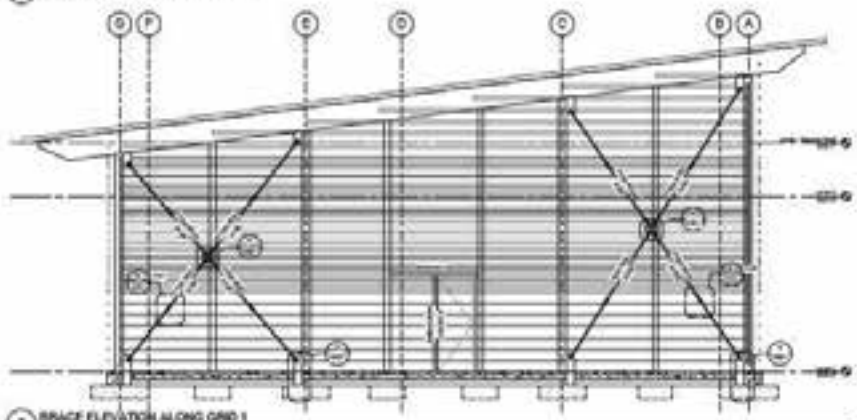
6 DETAIL



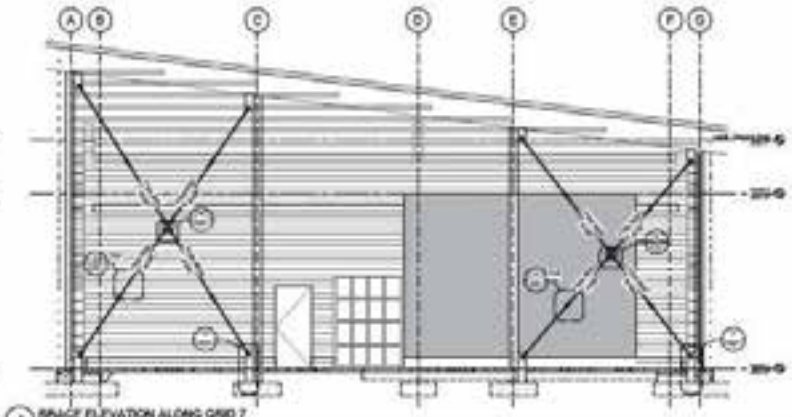
6 DETAIL



2 BRACE ELEVATION ALONG GRID G



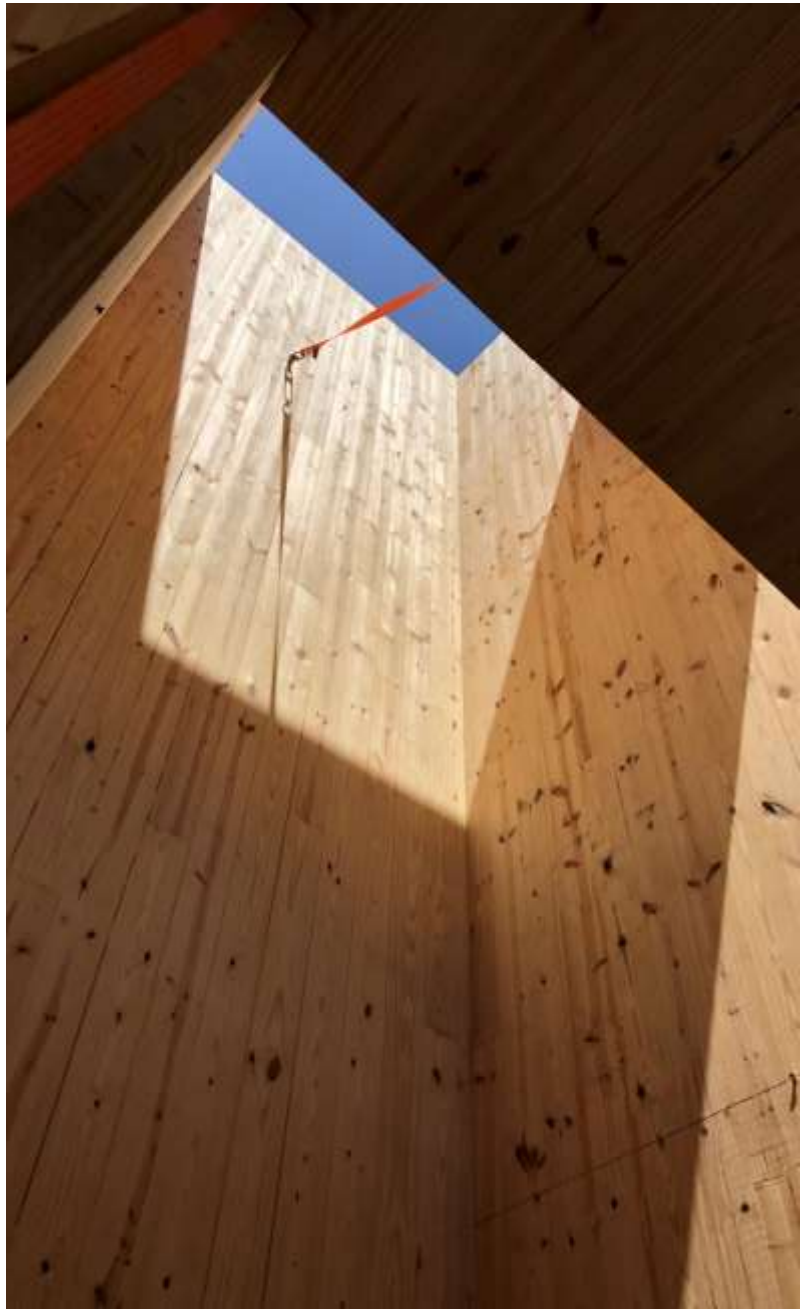
3 BRACE ELEVATION ALONG GRID 1



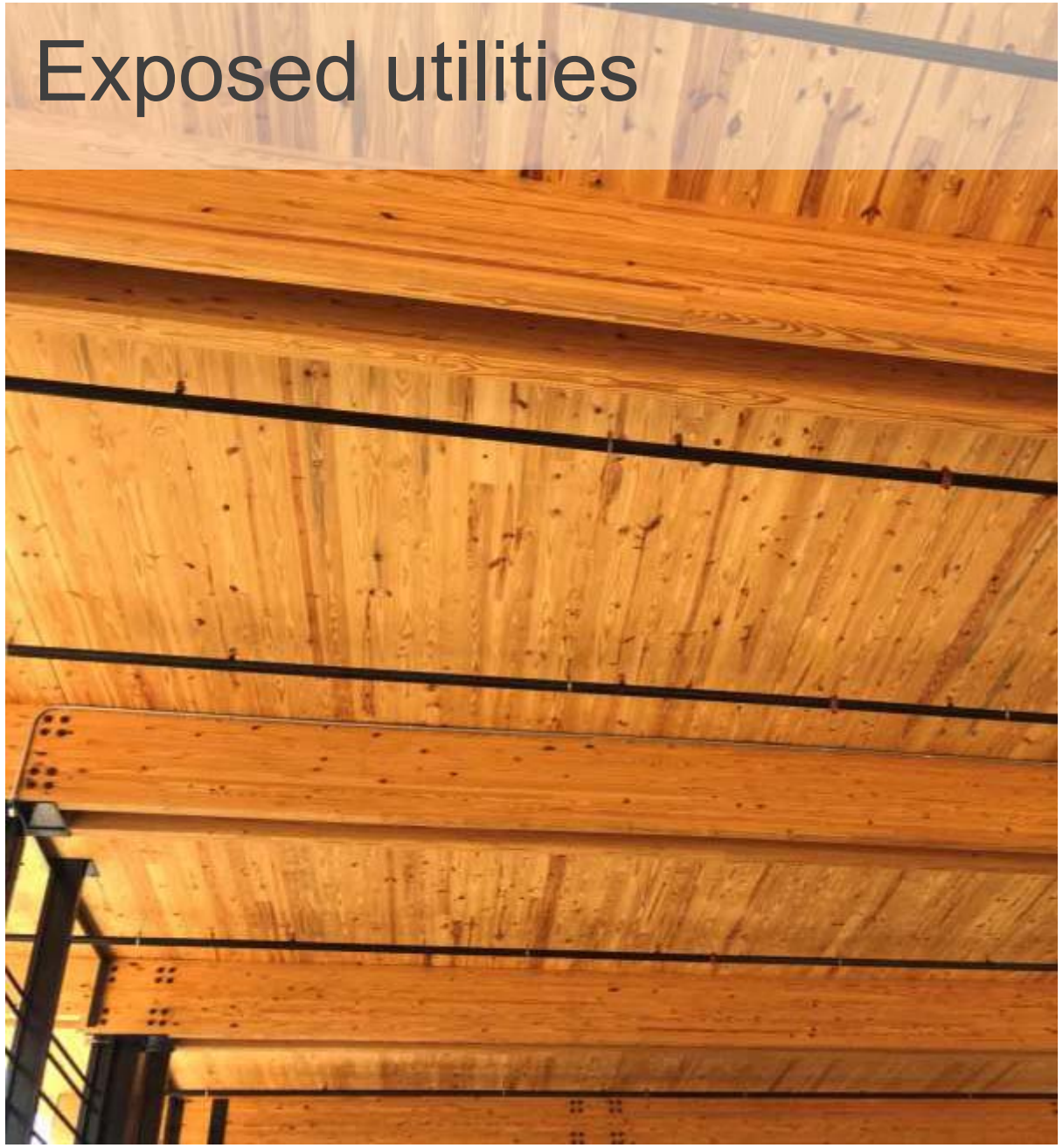
4 BRACE ELEVATION ALONG GRID 7

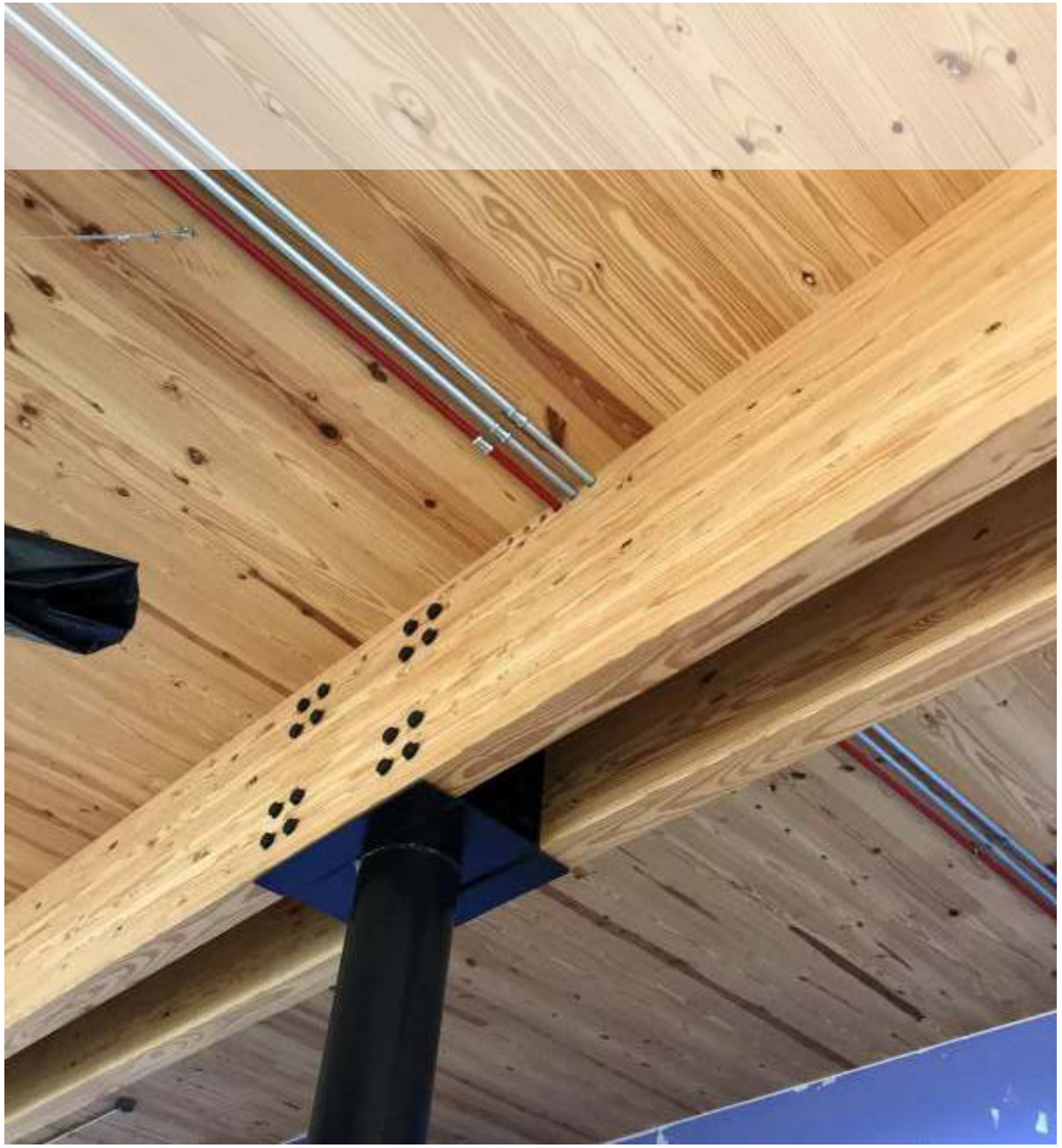

ANDY QUATTLEBAUM
OUTDOOR EDUCATION CENTER

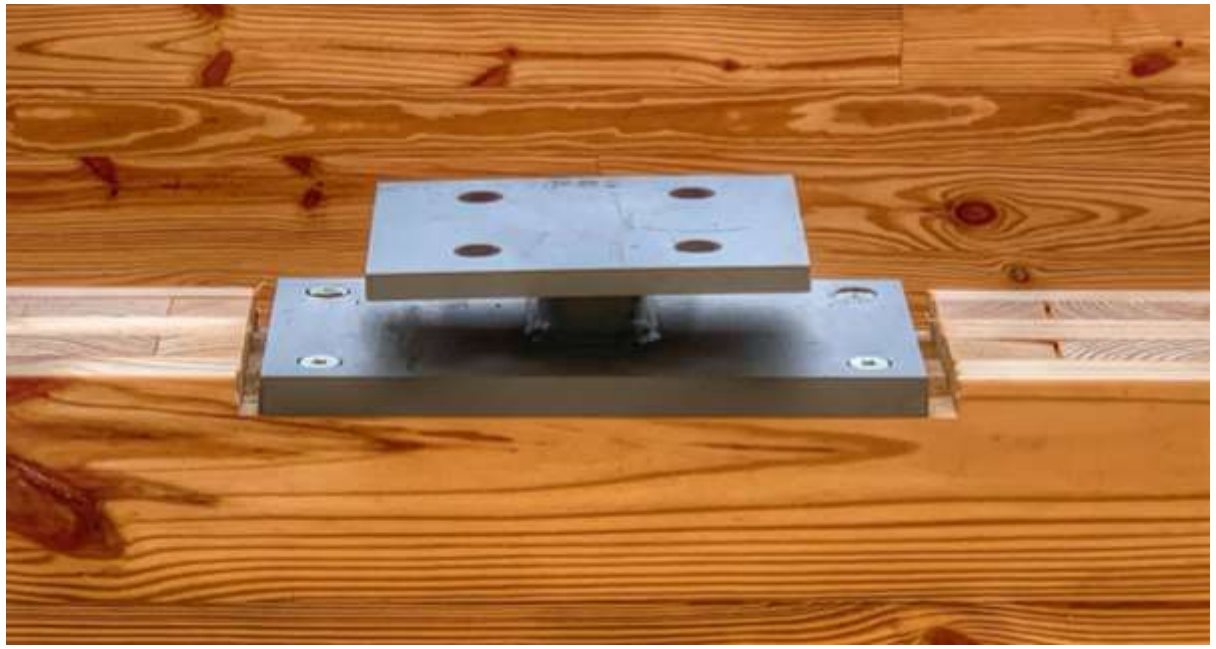
The double beam.

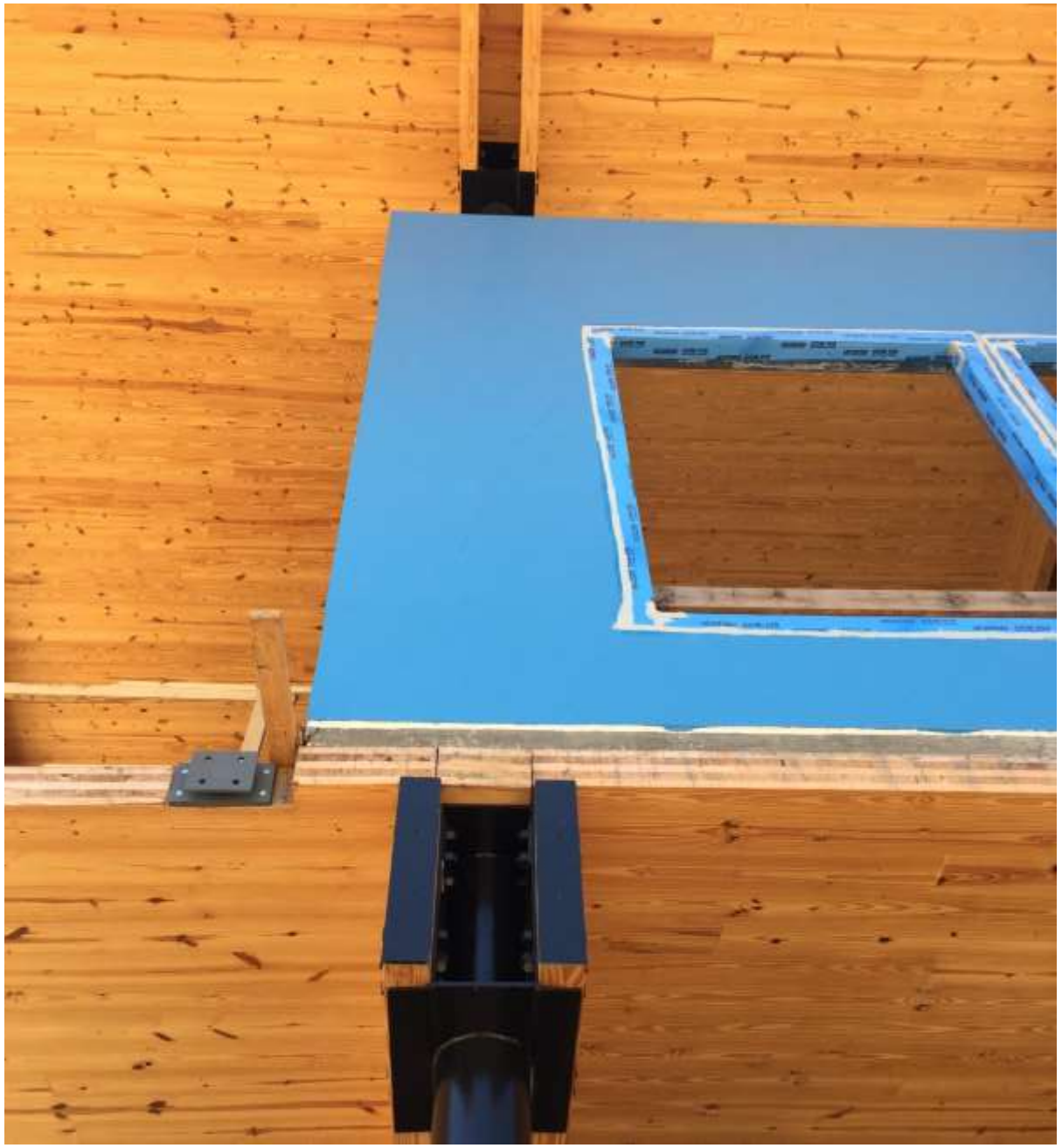


Exposed utilities

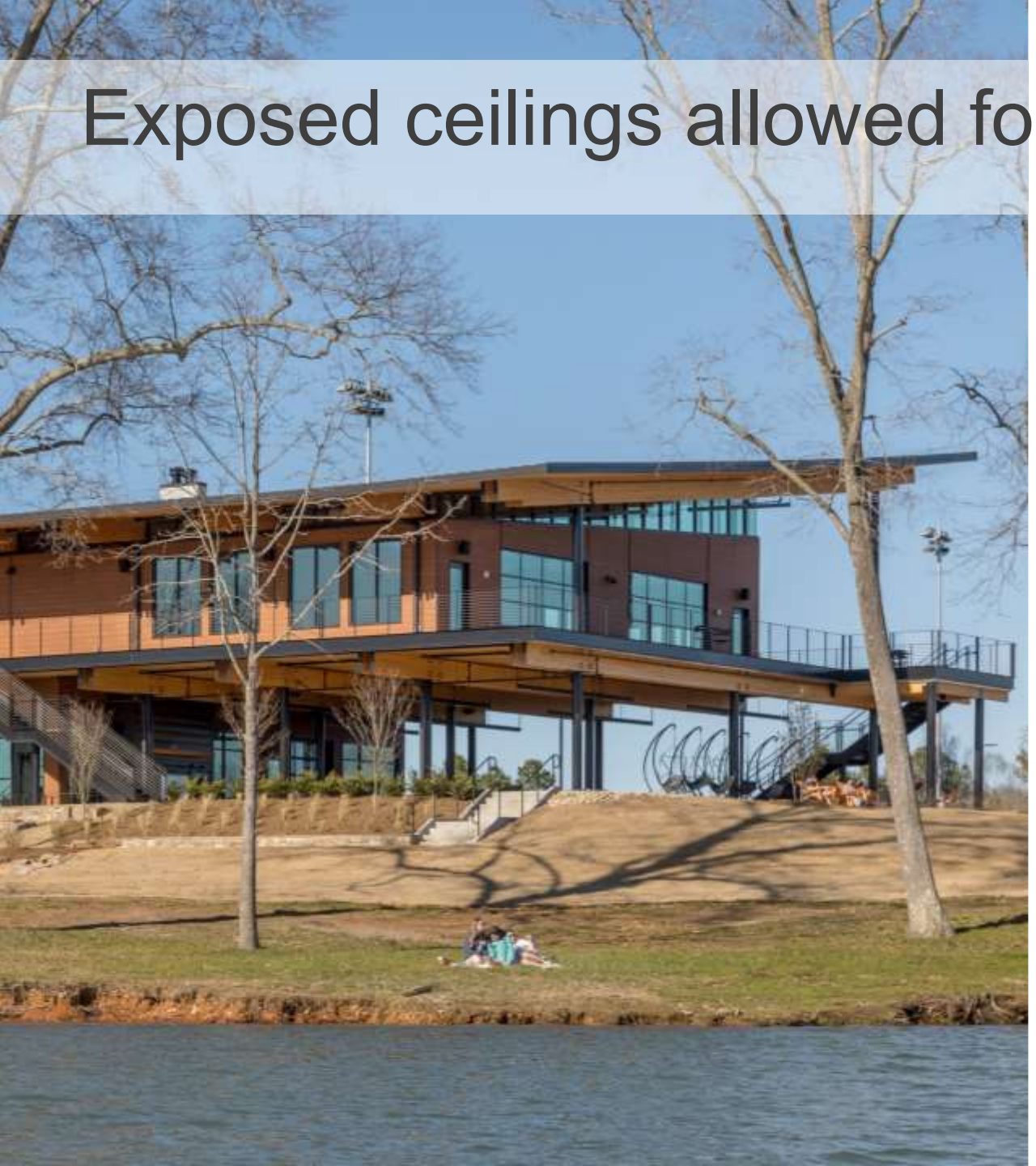








Exposed ceilings allowed for lower building heights.




45 Degree Offset
Steel Beam End Caps


ANDY QUATTLEBAUM
OUTDOOR EDUCATION CENTER
18


1


ANDY QUATTLEBAUM
OUTDOOR EDUCATION CENTER

QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

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