

CLACKAMAS COUNTY BOARD OF COUNTY COMMISSIONERS

Policy Session Worksheet

Presentation Date: 2/4/2020 **Approx. Start Time:** 11:00 am **Approx. Length:** 30 min

Presentation Title: USDA Wood Innovations Grant – County Courthouse Mass Timber Design Studio Project

Departments: County Administration
 Business and Community Services (BCS)

Presenters: Rick Gruen, BCS Parks Manager
 Judith Sheine, University of Oregon School of Architecture
 Gary Barth, County Courthouse Project Manager

Other Invitees: Laura Zentner, BCS Director
 Sarah Eckman, BCS Deputy Director

WHAT ACTION ARE YOU REQUESTING FROM THE BOARD?

No action is being requested from the Board. This Policy Session is an informational update on the WIG Phase 1 – County Courthouse Mass Timber Design Project - Fall Design Studio with the University of Oregon School of Architecture.

EXECUTIVE SUMMARY:

The WIG Phase 1 – County Courthouse Mass Timber Design Project – Fall Design Studio project supports Clackamas County’s Cross Laminated Timber (CLT) initiative and further advances the Board’s desire to consider mass timber construction as part of the proposed new County Courthouse.

Funding for the project was secured by BCS on behalf of the County from a USDA – Wood Innovations Grant. The grant covers the cost for the University of Oregon School of Architecture to conduct an architecture design studio that focused on student teams developing courthouse designs utilizing mass timber for the main structural system. The design studio was held during the 2019 fall term and engaged 24 upper level and graduate students grouped in six teams. Architects and engineers with expertise in courthouse design and function, energy and daylight performance, building codes and mass timber engineering worked with the students.

Judith Sheine, University of Oregon School of Architecture Professor and project lead, will be presenting the six (6) unique courthouse designs developed by the student teams.

One of the designs will be selected to undergo a Life Cycle Analysis that will analyze and compare the economic and environmental co-benefits of a mass timber constructed courthouse with a more conventional steel and concrete courthouse. This will constitute Phase 2 of the WIG project.

FINANCIAL IMPLICATIONS (current year and ongoing):

The project is grant funded and supported by staff from both BCS and County Administration. There are no ongoing implications.

Is this item in your current budget? YES NO

What is the cost? \$100,000 What is the funding source? USDA Wood Innovations Grant

STRATEGIC PLAN ALIGNMENT:

- **How does this item align with your Department's Strategic Business Plan goals?**

The Mass Timber Design Project supports Business & Community Services Assets line of business goal related to carbon sequestration.

- **How does this item align with the County's Performance Clackamas goals?**

The Mass Timber Design Project supports the Board's key initiative of growing the mass timber industry in Clackamas County which creates family wage jobs.

LEGAL/POLICY REQUIREMENTS: N/A

PUBLIC/GOVERNMENTAL PARTICIPATION:

CLT Courthouse Subcommittee; Public Outreach

OPTIONS:

N/A – Informational update on the Wood Innovations Grant.

RECOMMENDATION:

N/A – Informational update only.

ATTACHMENTS:

Power Point Presentation

SUBMITTED BY:

Division Director/Head Approval

Department Director/Head Approval

County Administrator Approval



For information on this issue or copies of attachments, please contact [Rick Gruen@ x4345](mailto:Rick.Gruen@x4345)

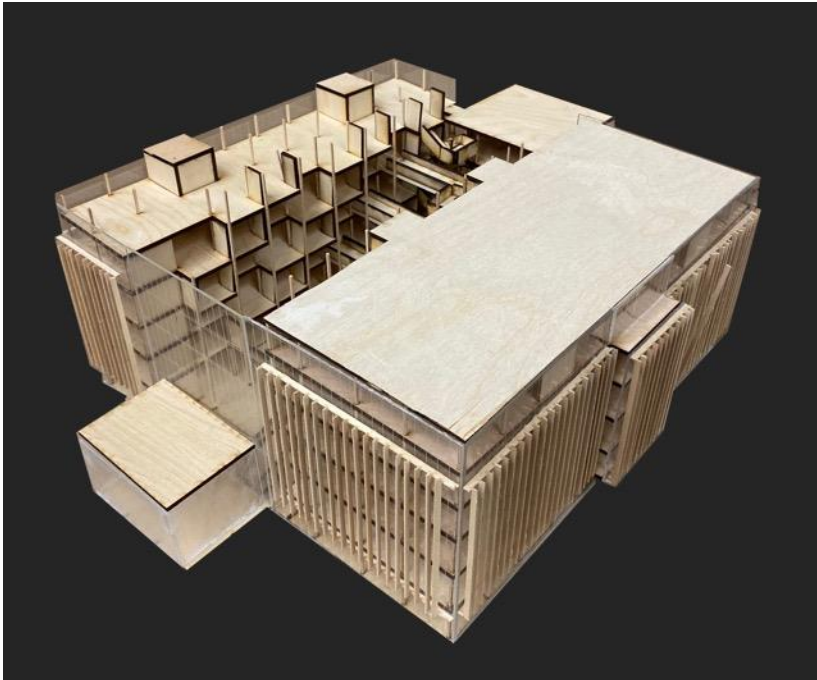
CLACKAMAS COUNTY MASS TIMBER COURTHOUSE



Judith Sheine, Kevin Van Den
Wymelenberg
Department of Architecture
University of Oregon

Mikhail Gershfeld
Department of Civil Engineering
California State Polytechnic
University, Pomona

Justin Stenkamp
PAE Consulting Engineers, Inc.



Clackamas County Courthouse
Mass Teamers

Gemma Fucigna, Jessi Gahl, Aaryn Gray, Lorine Moellentine



Clackamas County Courthouse
Mass Teamers

Gemma Fucigna, Jessi Gahl, Aaryn Gray, Lorine Moellentine



ATRIUM VIEW FACING MT.HOOD

Clackamas County Courthouse
Mass Teamers

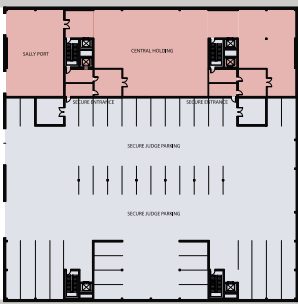
Gemma Fucigna, Jessi Gahl, Aaryn Gray, Lorine Moellentine



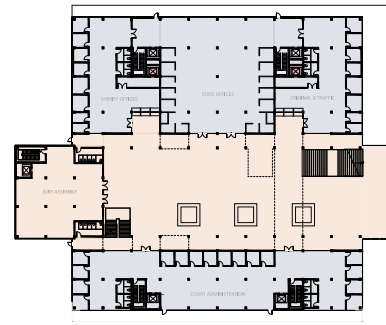
Clackamas County Courthouse
Mass Teambers

Gemma Fucigna, Jessi Gahl, Aaryn Gray, Lorine Moellentine

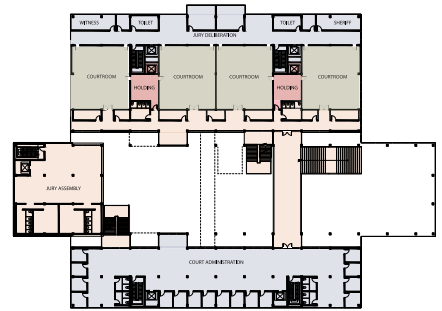
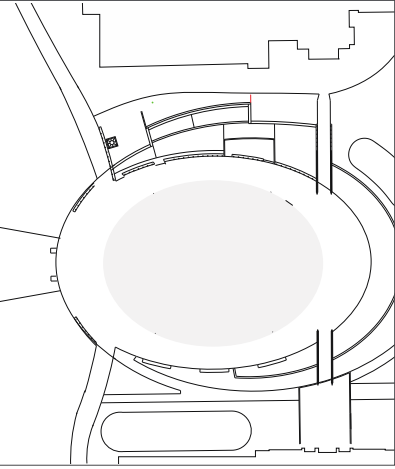
IN CUSTODY PUBLIC STAFF/JURY COURT-ROOMS



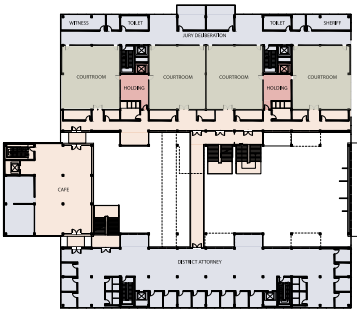
-1 BASEMENT FLOOR PLAN
SCALE: 1/16" = 1'-0"



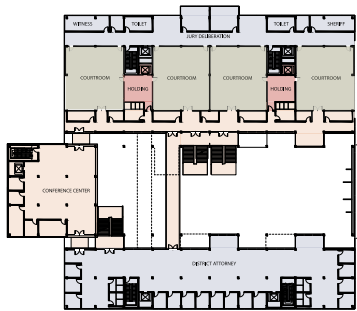
1 FIRST FLOOR PLAN
SCALE: 1/16" = 1'-0"



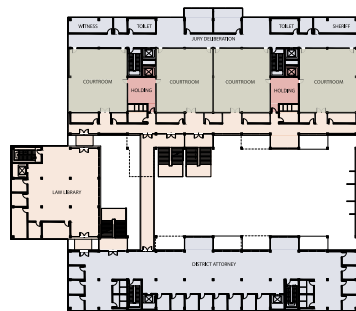
2 SECOND FLOOR PLAN
SCALE: 1/16" = 1'-0"



3 THIRD FLOOR PLAN
SCALE: 1/16" = 1'-0"



4 FOURTH FLOOR PLAN
SCALE: 1/16" = 1'-0"



5 FIFTH FLOOR PLAN
SCALE: 1/16" = 1'-0"

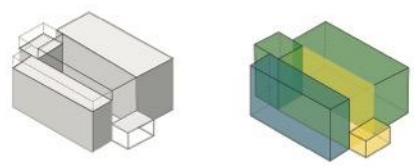
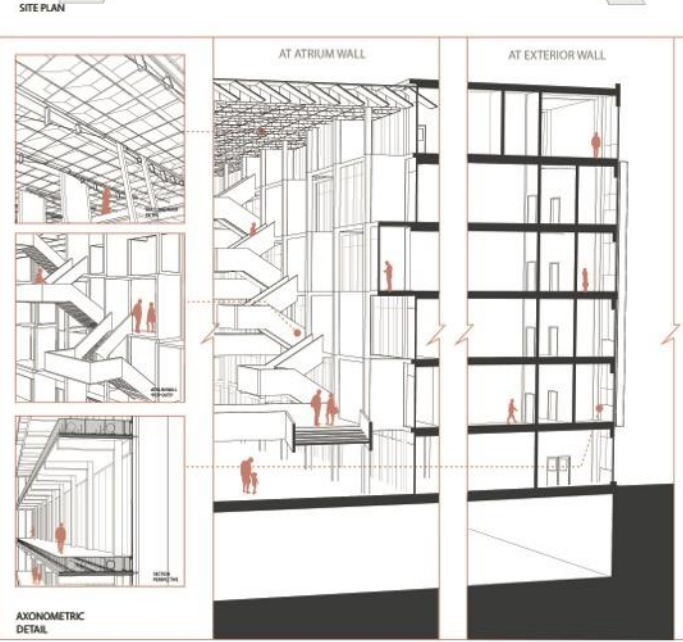


6 SIXTH FLOOR PLAN
SCALE: 1/16" = 1'-0"

Clackamas County Courthouse
Mass Teamers

Gemma Fucigna, Jessi Gahl, Aaryn Gray, Lorine Moellentine

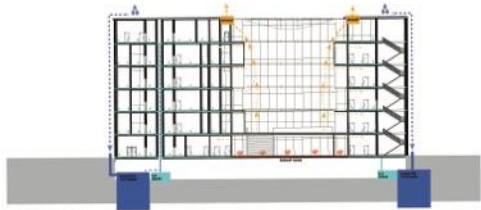




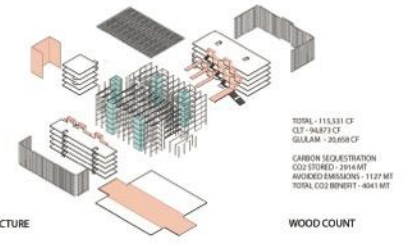
PARTI PUBLIC - PRIVATE



FURNISHED COURTROOM



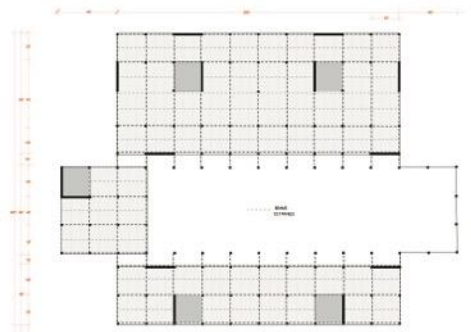
HVAC SECTION SCALE: 1/8" = 1'-0"



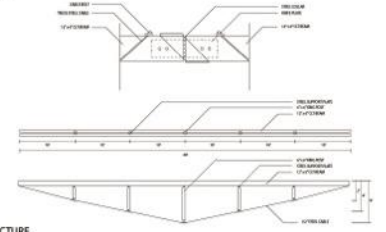
3D STRUCTURE

WOOD COUNT

TOTAL - 115,531 CF
 CLT - 94,873 CF
 GDL/SLB - 20,658 CF
 CARBON SEQUESTRATION
 CO2 STORED - 2914 MET
 AVOIDED EMISSIONS - 1127 MET
 TOTAL CO2 BENEFIT - 4041 MET



2D STRUCTURE SCALE: 1/8" = 1'-0"



TRUSS STRUCTURE

Clackamas County Courthouse
 Mass Teamers

Gemma Fucigna, Jessi Gahl, Aaryn Gray, Lorine Moellentine





Clackamas County Courthouse
Mass Teamers

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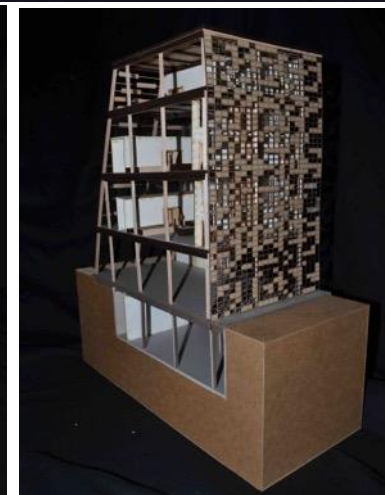
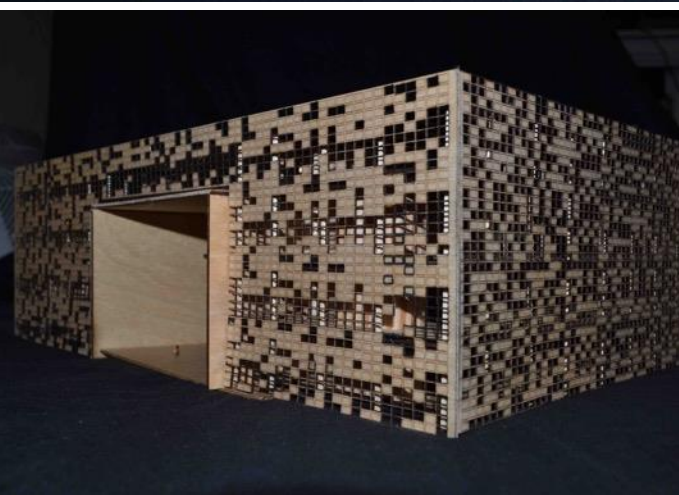
Clackamas County Courthouse
Lumber Liquidators

Austin Gutierrez, Aizeder Iriondo, Alex McCord, Molly Winter



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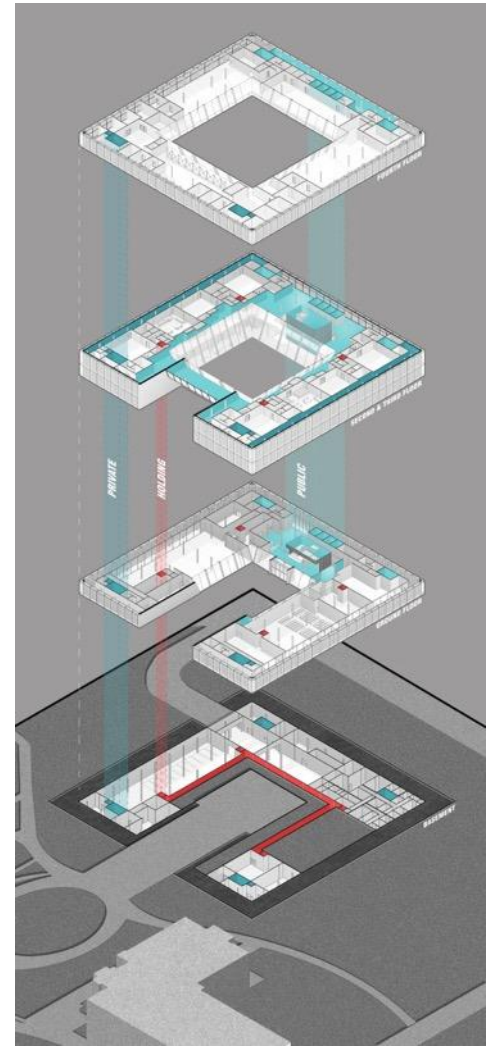


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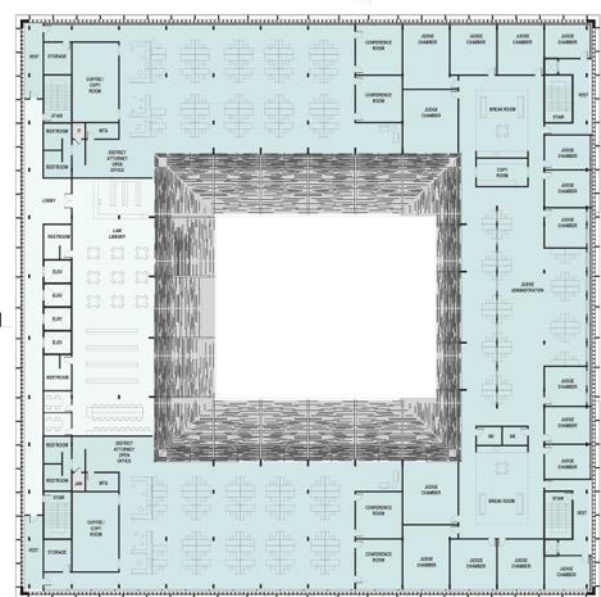
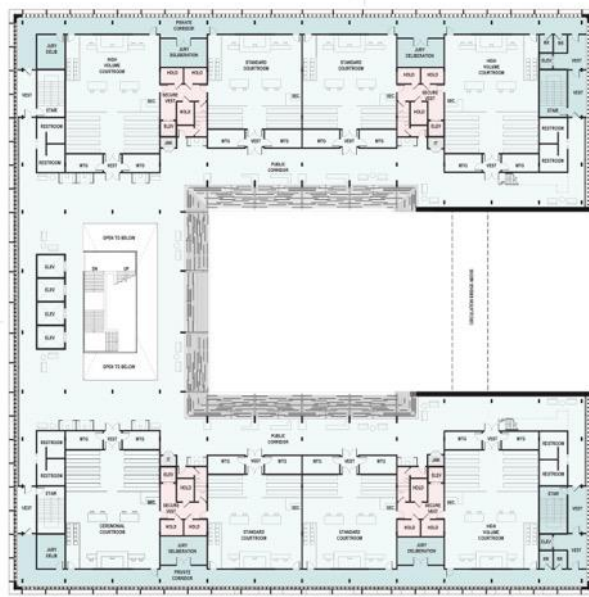
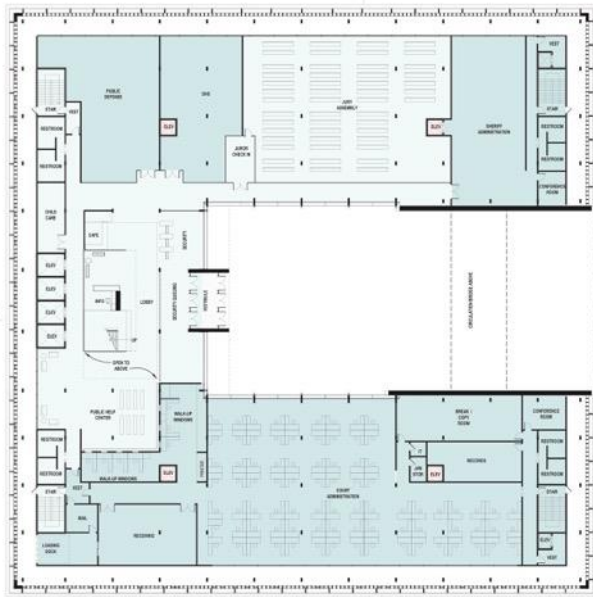
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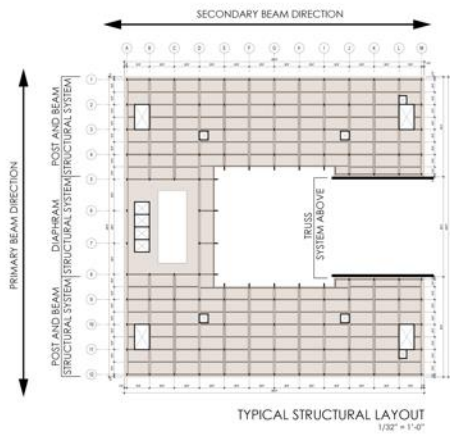
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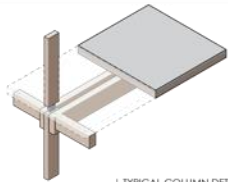
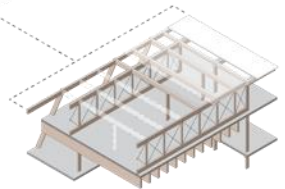
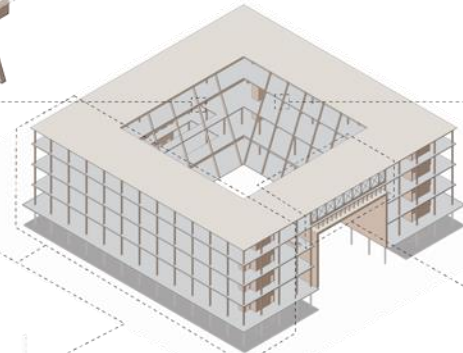
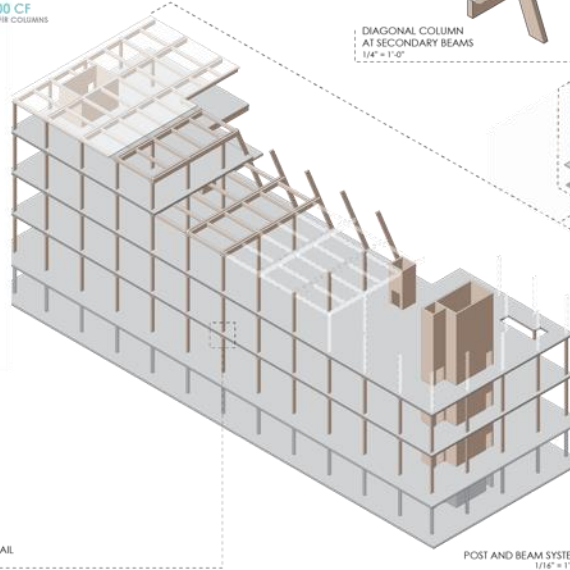
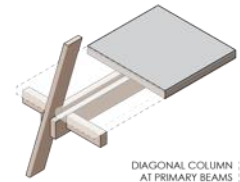
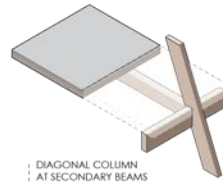
3,800
METRIC TONS
CO₂ SEQUESTERED IN THE
STRUCTURAL ELEMENTS

5,270
METRIC TONS
POTENTIAL CARBON
BENEFIT

100,000 CF
DOUGLAS FIR CLT

42,750 CF
DOUGLAS FIR BEAMS

6,500 CF
DOUGLAS FIR COLUMNS



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Carbon Summary



Results



Volume of wood products used:
4,226 cubic meters (149,250 cubic feet)



U.S. and Canadian forests grow this much wood in:
12 minutes



Carbon stored in the wood:
3800 metric tons of carbon dioxide



Avoided greenhouse gas emissions:
1470 metric tons of carbon dioxide



Total potential carbon benefit:
5270 metric tons of carbon dioxide

Project Name: Project Name (optional)
Date: December 5, 2019

Results from this tool are based on wood volumes only and are estimates of carbon stored within wood products and avoided emissions resulting from the substitution of wood products for non-wood products. The results do not indicate a carbon footprint or global warming potential and are not intended to replace a detailed life cycle assessment (LCA) study. Please refer to the References and Notes' for assumptions and other information related to the calculations.

Equivalent to:



1114 cars off the road for a year



Energy to operate 557 homes for a year

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ENERGY PRODUCTION

Solar PV panels system on the roof of the courthouse and proposed parking garage will provide **765 kW** solar array, about **50%** of the buildings' energy use.



NATIVE FOREST PLANTING

Lodge pole pines provide year-round shading for rooms facing the courtyard as well as a cooler microclimate during the summer. The courtyard facade is constructed from local materials with a gradient pattern to provide shading for upper floors the pine trees can't reach.



ACOUSTICS

The CLT floors are constructed to adjust for acoustical needs with a rigid insulation layer underneath the concrete top layer. In addition, it allows the CLT to be reused. The walls also provide acoustical separation with two layers of gypsum board of different thicknesses.



RAINWATER COLLECTION

The roof can collect **2 million gallons** of rainwater per year for treatment and reuse for toilet flushing.



PASSIVE HEATING & COOLING

Geothermal heating and cooling is integrated in the building's systems to reduce energy consumption. The building also receives natural cooling from the retention pond that flows underneath the double-layer facade.



STORMWATER TREATMENT

Stormwater is collected from the site and adjacent parking lot. It is drained to a stormwater vault for storage and heavy sediment filtration. From there, water is pumped up to the retention pond that surrounds the building for natural filtration through biofilters and phytoremediation.



STORMWATER STORAGE

Preparing for the worst, stormwater can bring **500,000 gallons** of water to the 5-acre site in **24 hours**. Our site can hold **100%** of these 10-year stormevents with permeable surfaces, swales and 12 ft deep stormwater vault underneath the parking lot.

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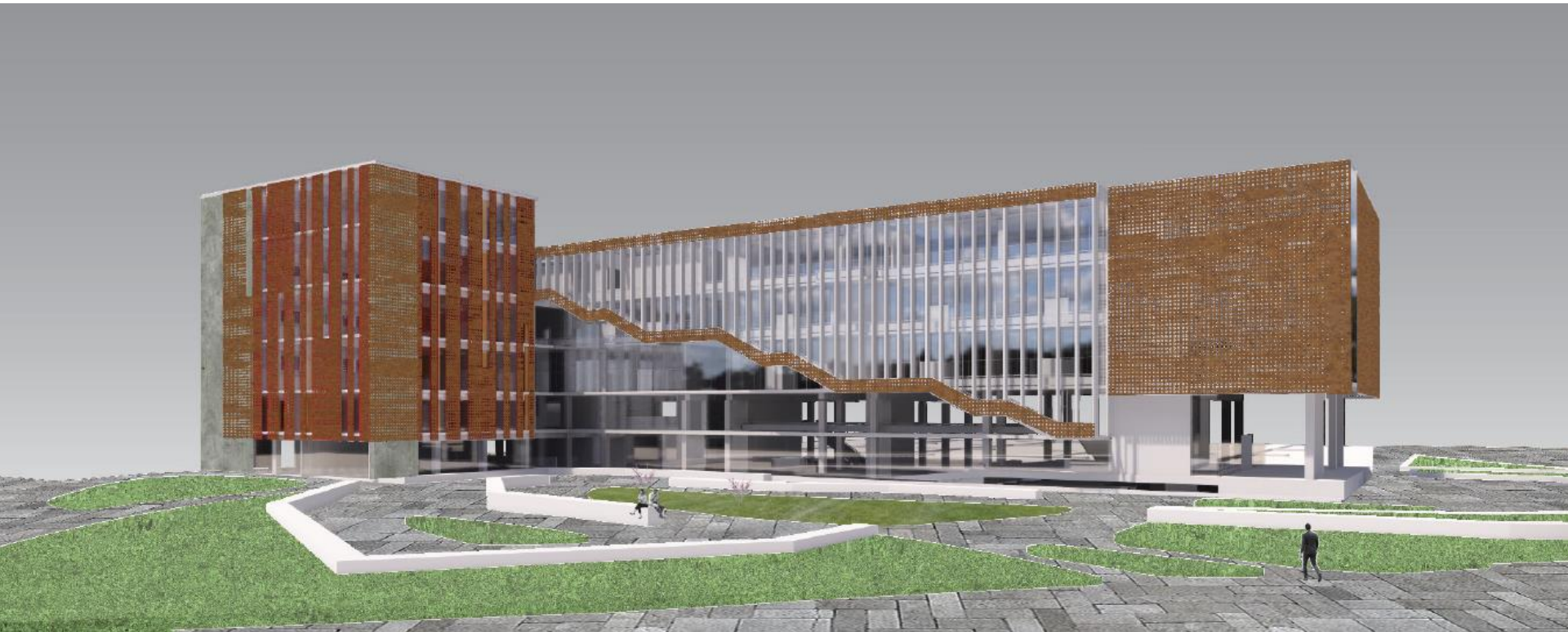
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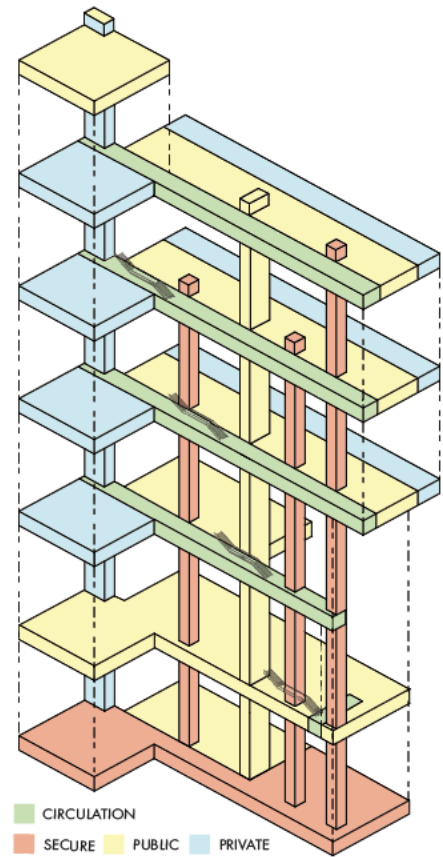
Clackamas County Courthouse
Chiles

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Chiles

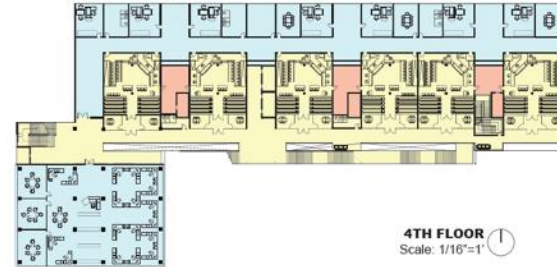
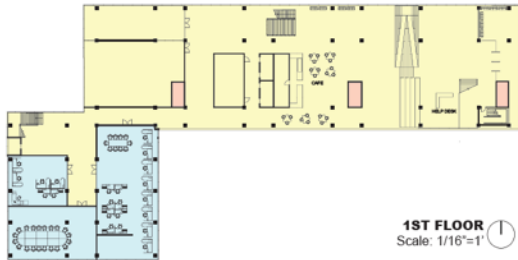
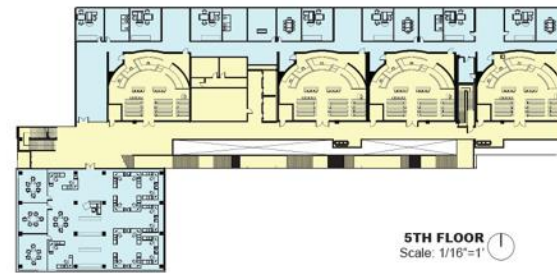
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PROGRAM

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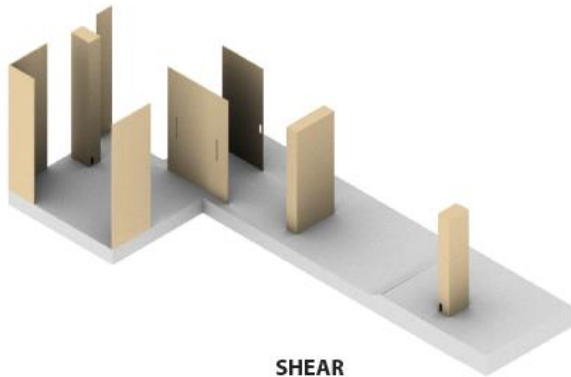
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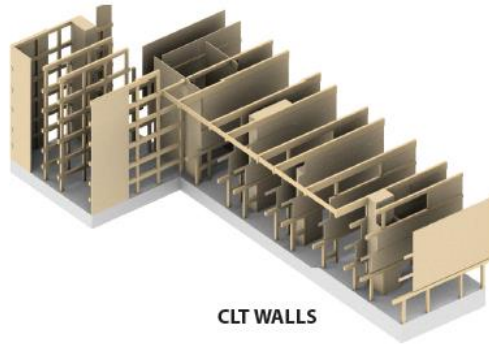


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Chiles

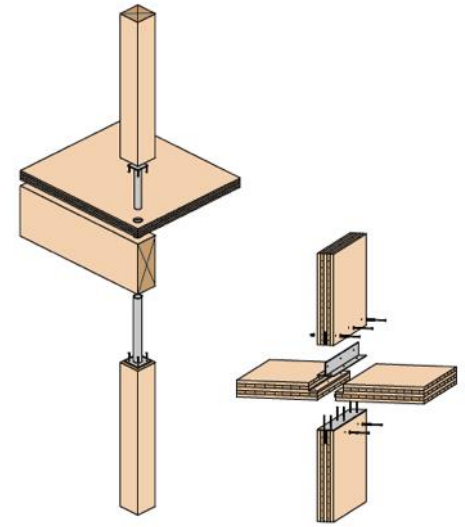
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SHEAR

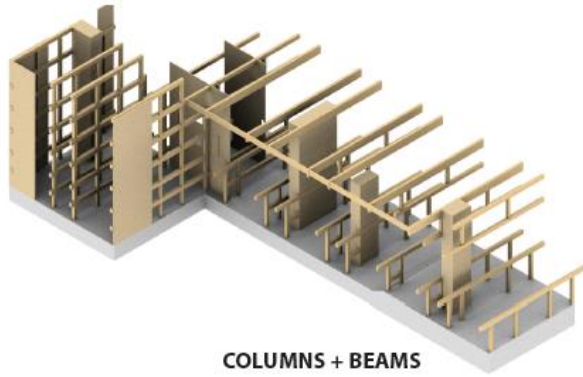


CLT WALLS



COLUMN TO FLOOR

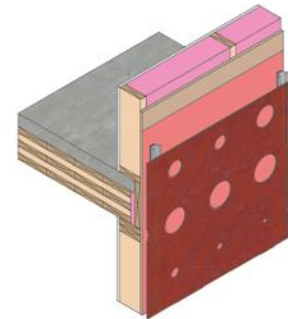
CLT TO CLT CONNECTION



COLUMNS + BEAMS



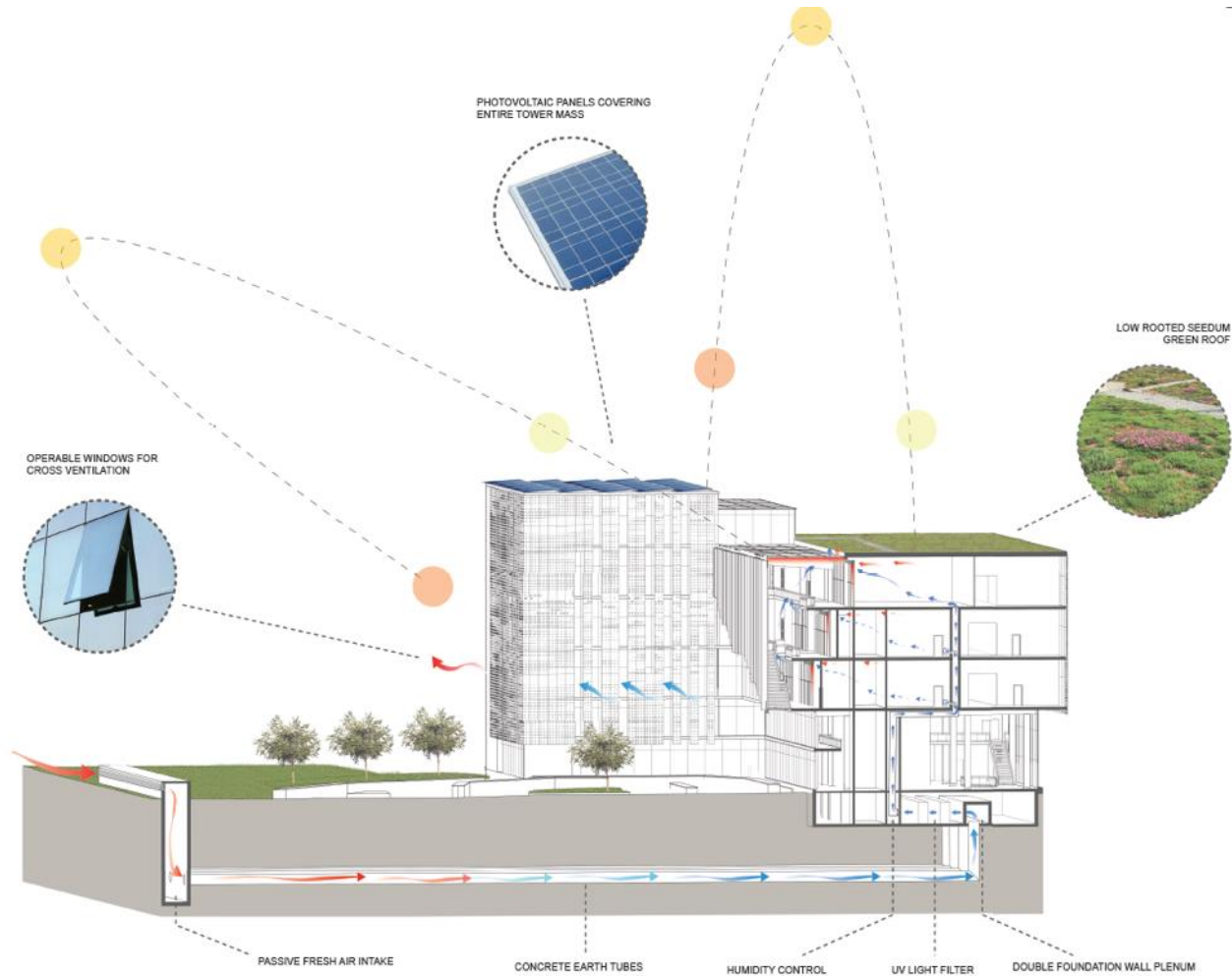
CLT FLOORS + ROOFS



FLOOR TO WALL DETAIL

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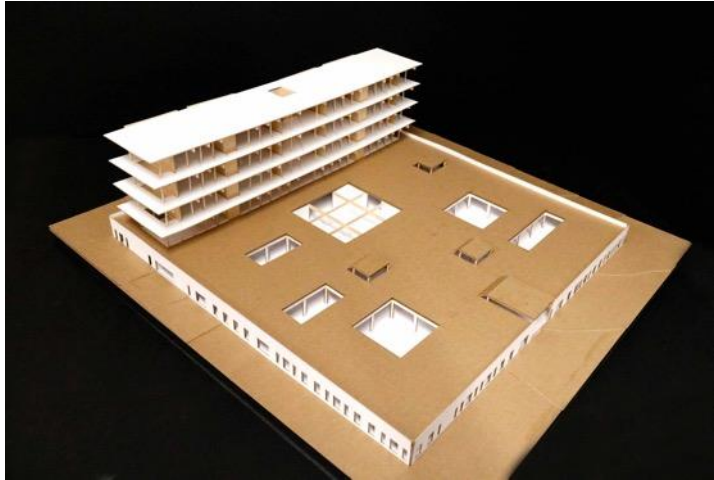
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Chiles

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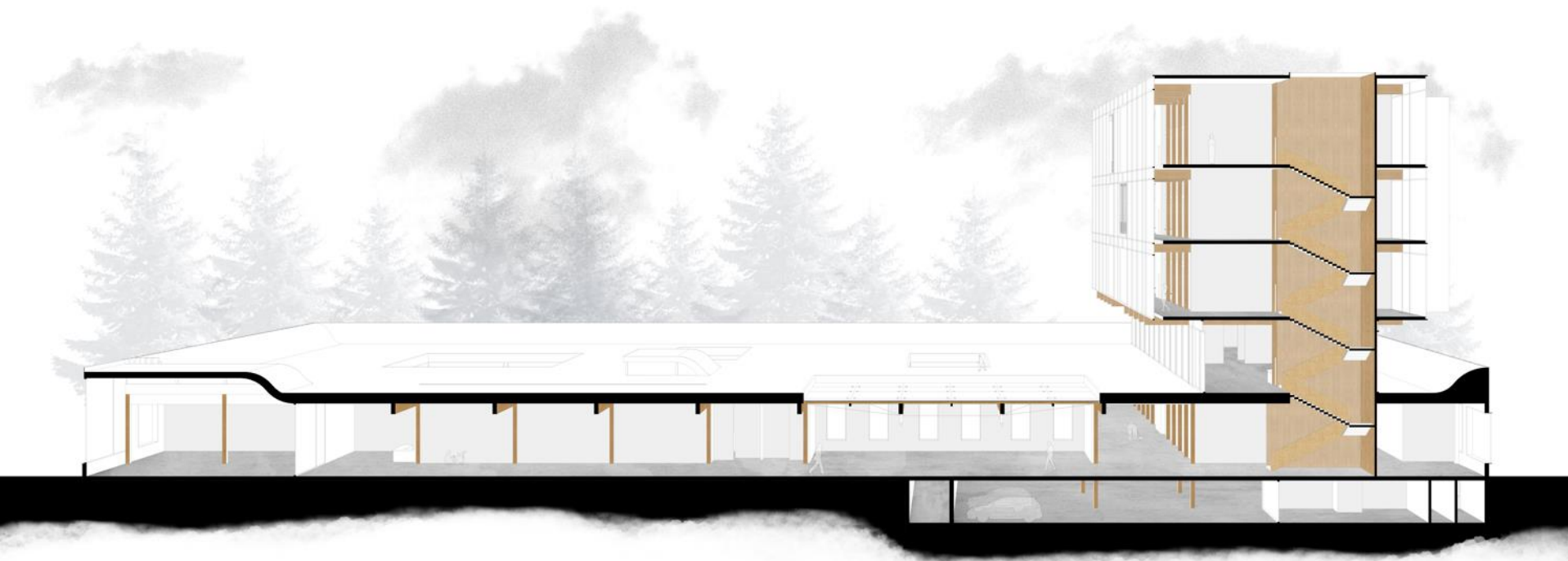
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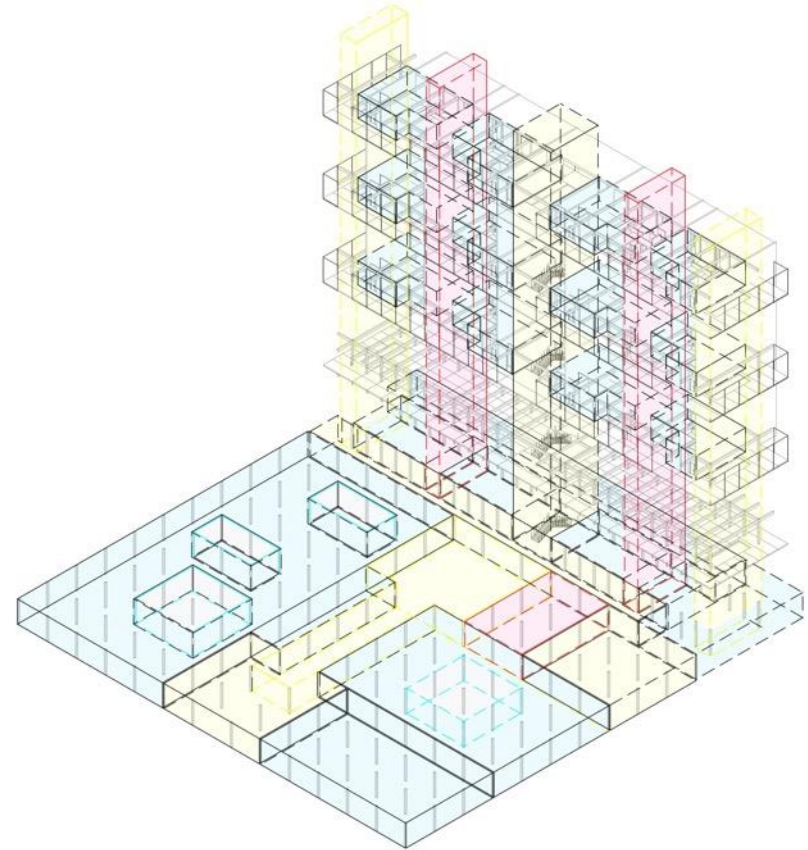
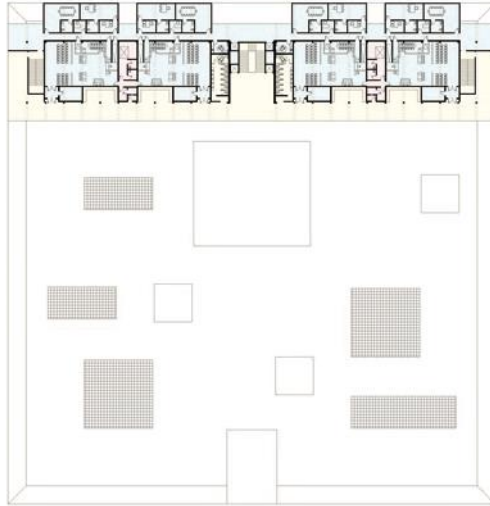
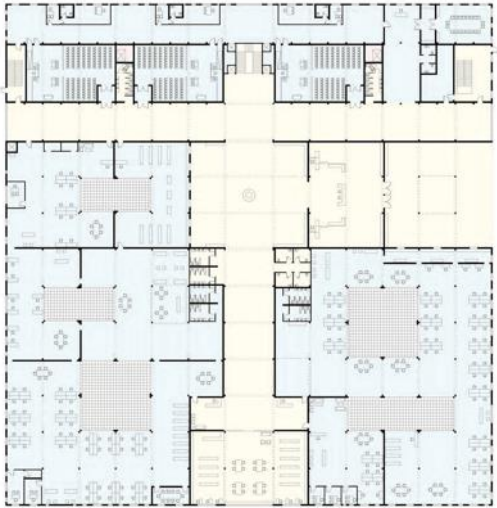
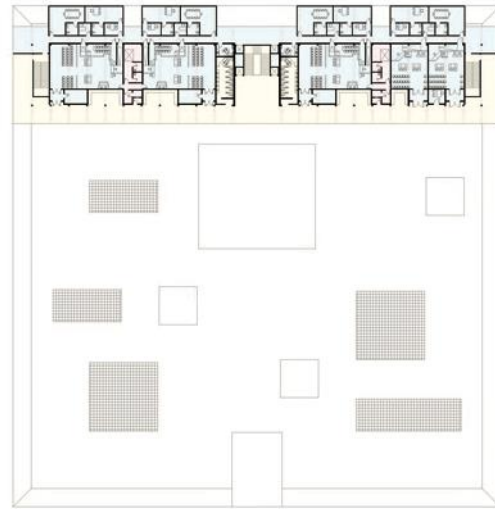
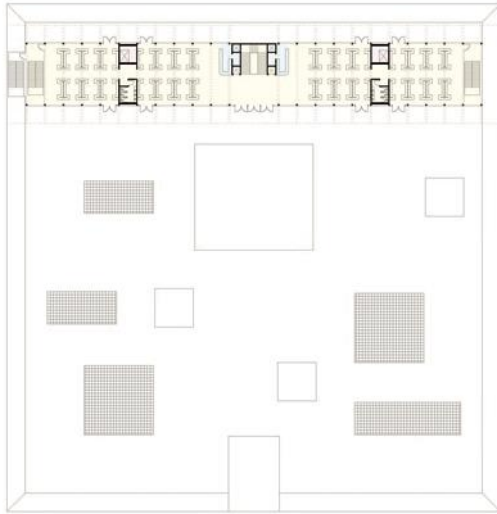
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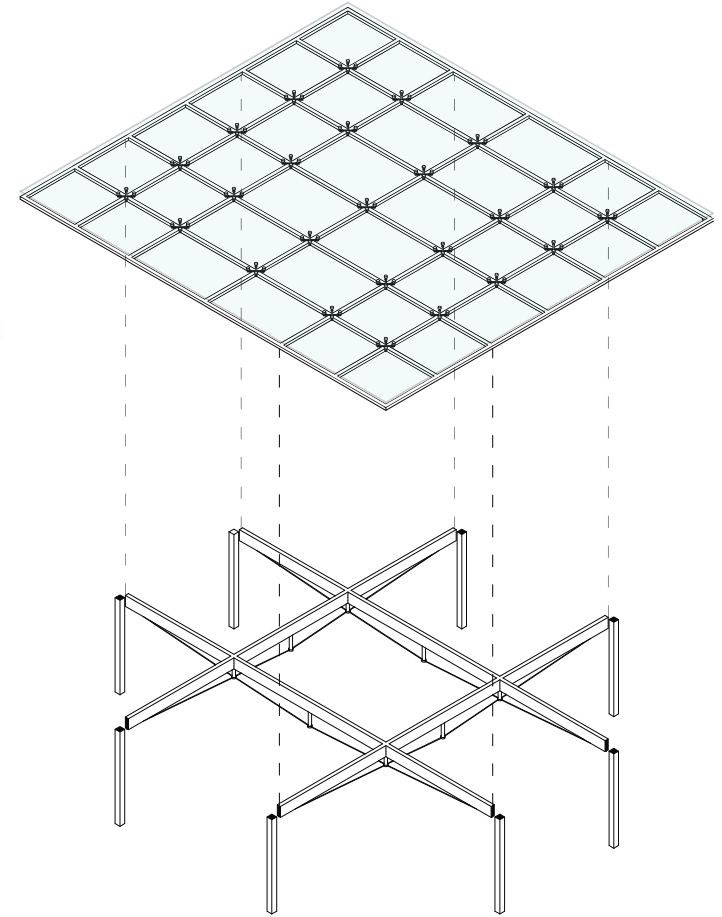
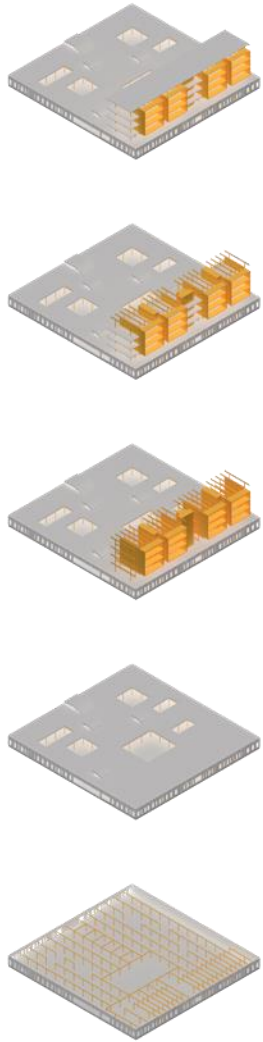
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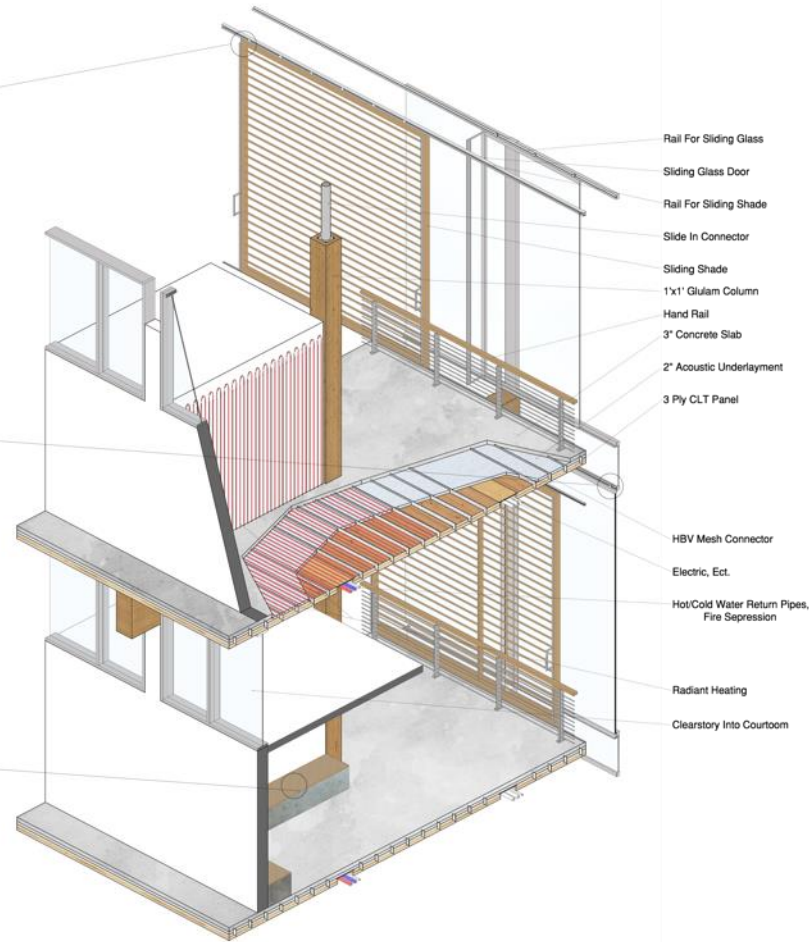
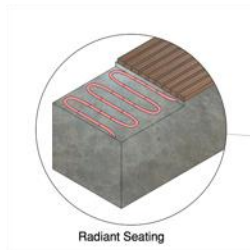
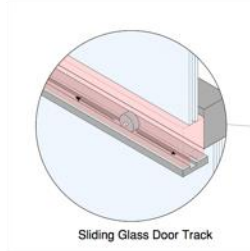
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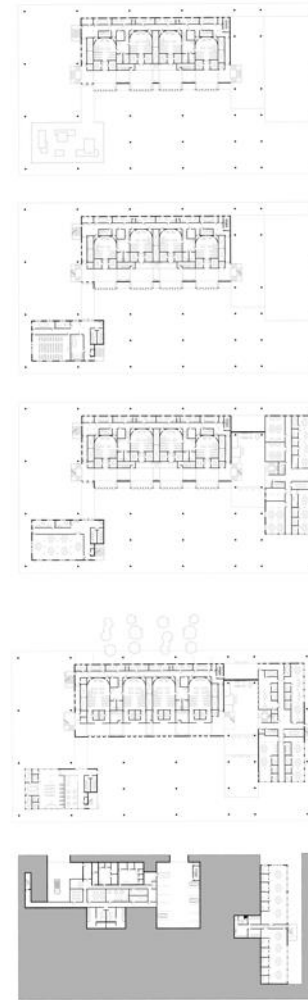
Clackamas County Courthouse
Rocket

Chandler Arnsdorf, Brooke Everard, Chiara Maggiore, Matthew Weldon



Clackamas County Courthouse
Rocket

Chandler Arnsdorf, Brooke Everard, Chiara Maggiore, Matthew Weldon

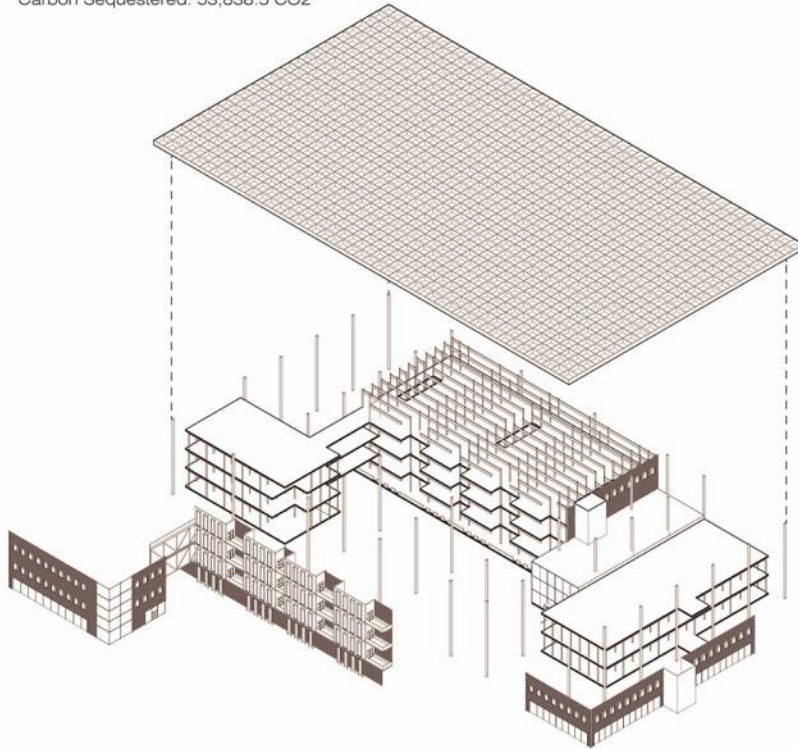


Clackamas County Courthouse
Rocket

Chandler Arnsdorf, Brooke Everard, Chiara Maggiore, Matthew Weldon

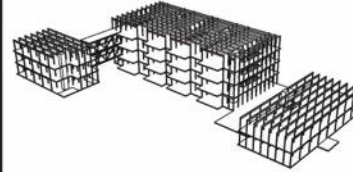
Exploded Structure

Total Board Feet of Wood: 1,292,124ft
 Total Cubic Feet of Wood: 107,677ft
 Carbon Sequestered: 53,838.5 CO2



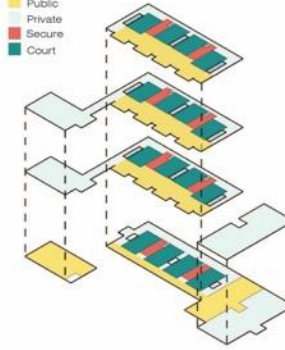
Primary Structure

The structure within the building follows an A-B-A bay sequence running from North to South and an even ten foot bay sequence running from East to West. By keeping the bays small, it allows the beams to run along the long axis of the building with a composite three ply CLT and concrete slab spanning between. A series of elevator shafts and shear walls between courtrooms brings lateral loads to the foundation. Soaring above the structure is the unifying roof.



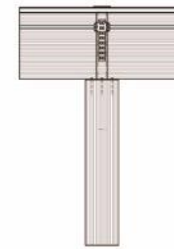
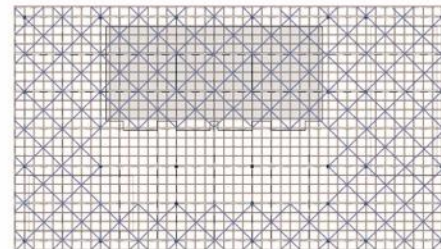
Programmatic Axon.

Public
 Private
 Secure
 Court

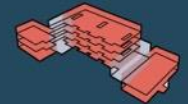


Roof Structure & Joints

Columns connect to the beams within the roof with a steel tube and plate that is inserted through a hole drilled through the overhead beams in a very similar way to the connection of columns between floors. Coffers are inserted into the larger beams via metal dovetail joints which also act as the anchors for the steel rod system. The roof is constructed with a series of post tensioned glulam beams with smaller offers filling in the space between. Steel rods have been added within the coffers to create a rigid diaphragm capable of supporting massive snow and water loads. The Field of columns under the roof serve only to support the gravity loads with the connection to the larger court block creating resistance to lateral loads.



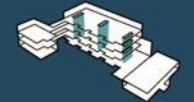
Parti



Green Architecture



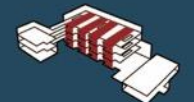
Air Stacks



Vertical Circulation



Structural Organization



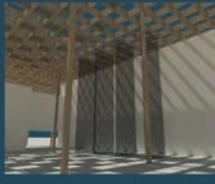
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Net Zero Strategies



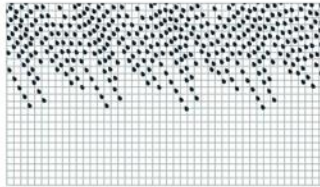
Roof creates an ample space for photovoltaic arrays to supply the building's power



Roof creates a vast surface to collect water to supply the building's water



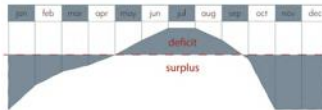
Water



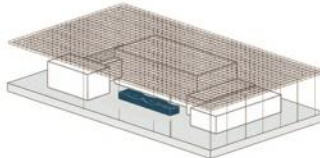
● 3.9M gallons of water collected on the roof annually



● 3.4M gallons of water used annually

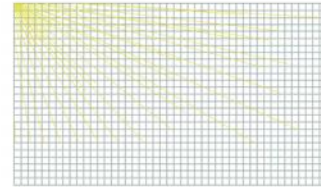


● .5M gallons of water required to supply the building during summer months

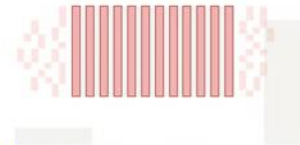


● 66,840 ft³ water tank constructed below-grade adjacent to constructed wetlands quenches building water demand

Solar



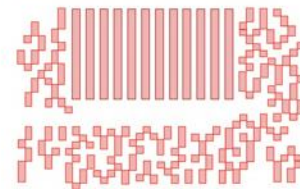
● 1.6M kWh annual energy demand (50 kWh/ft²/year assumption)



● 997,624 kWh energy produced on top of the courtrooms

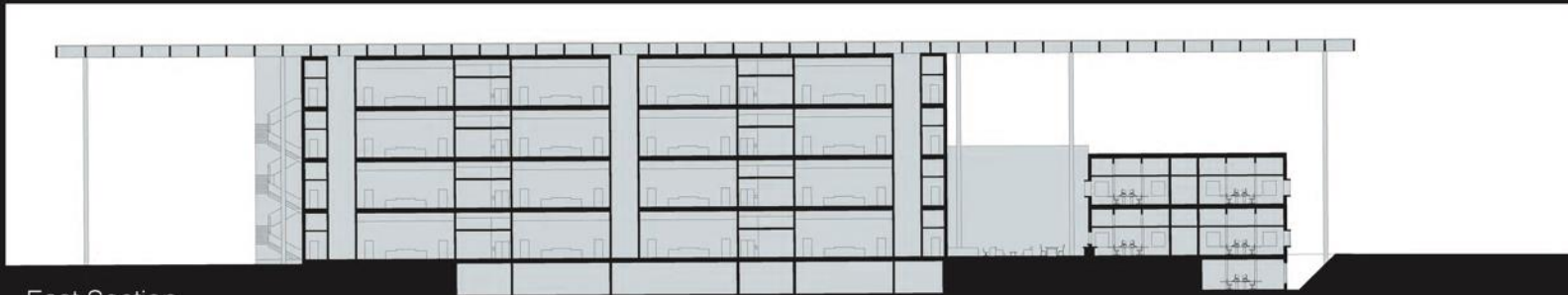


● 602,376 kWh energy demand produced above the market and lobby with the capacity to expand to include future energy demands



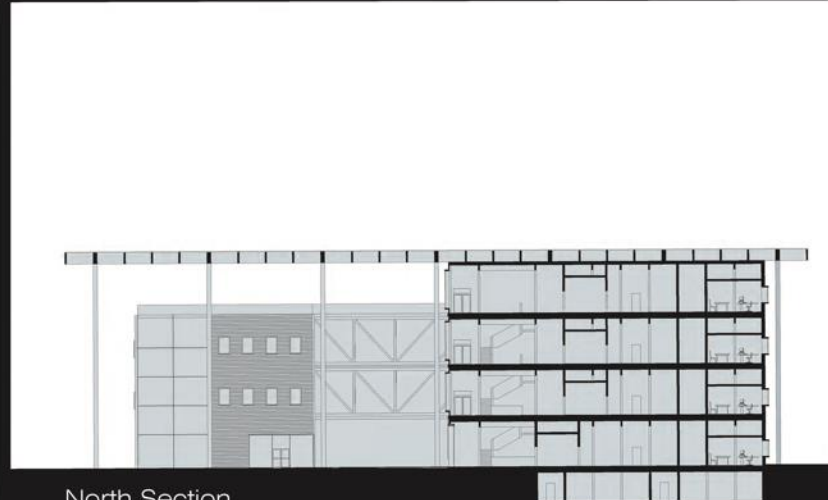
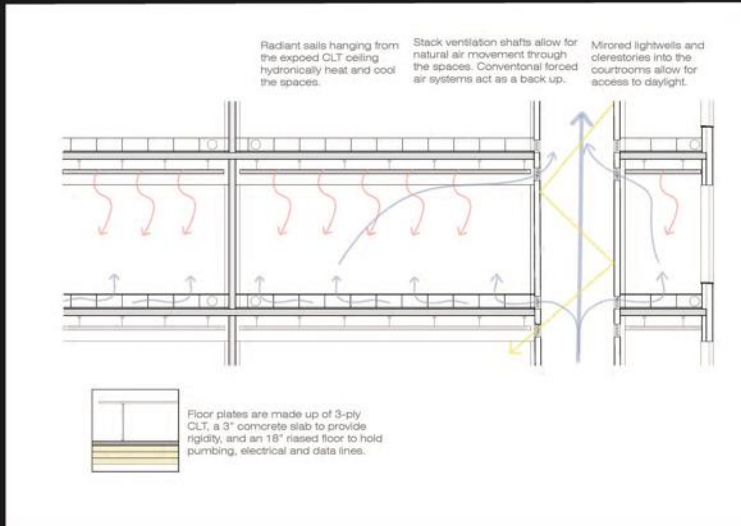
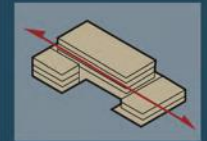
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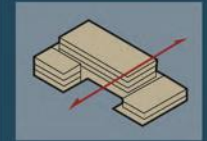
East Section

East Section



North Section

North Section



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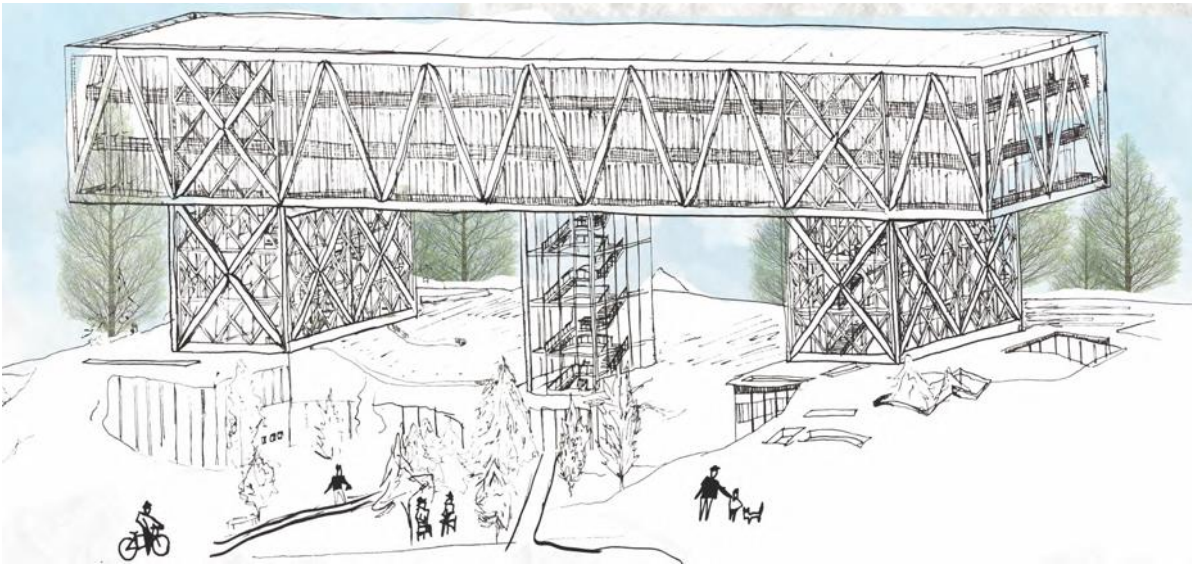
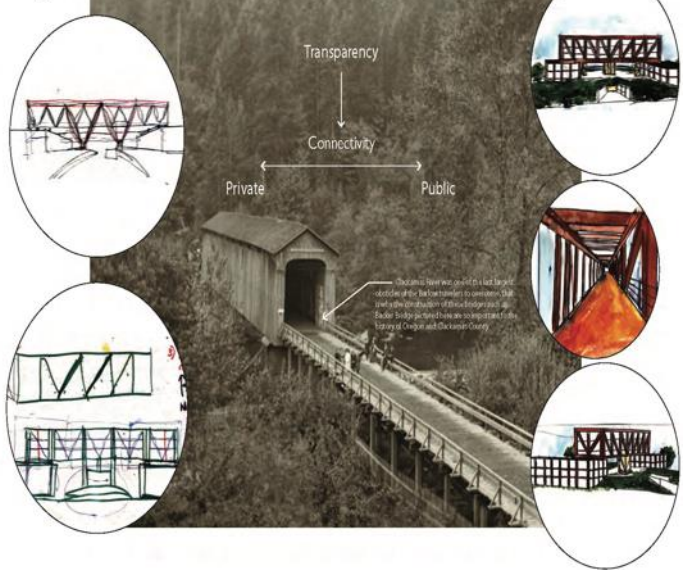
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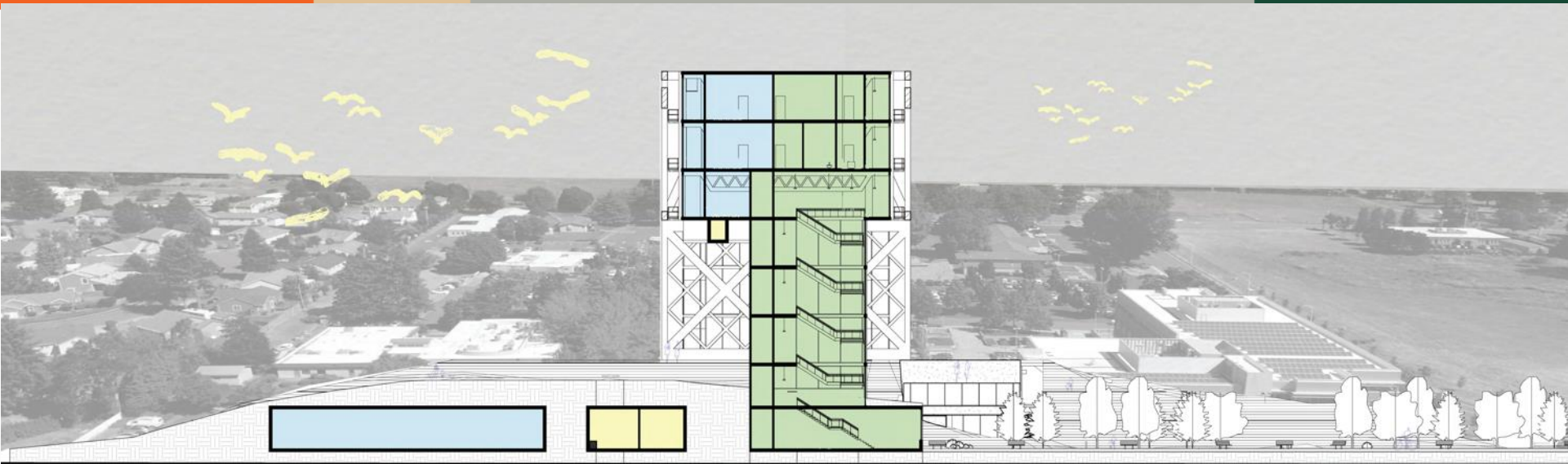
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Bridge Concept

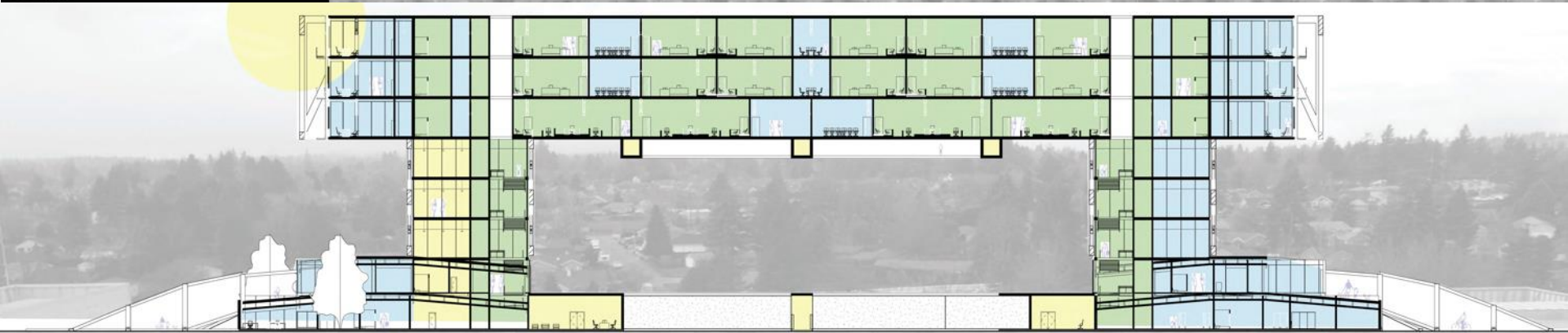


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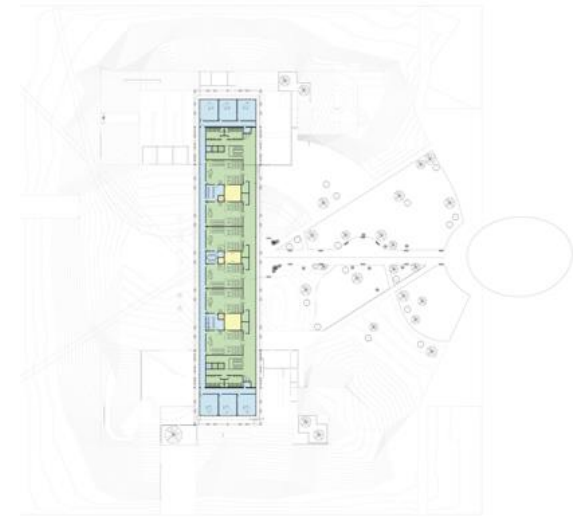
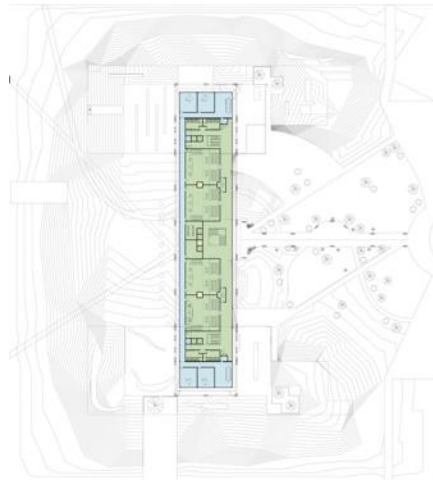
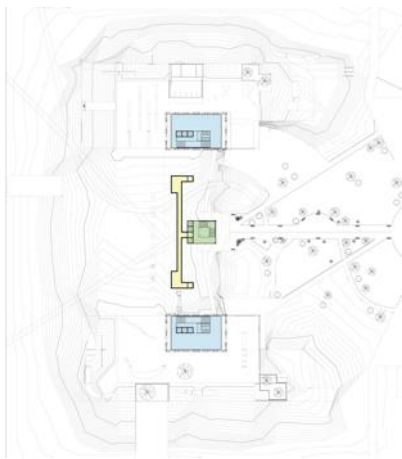
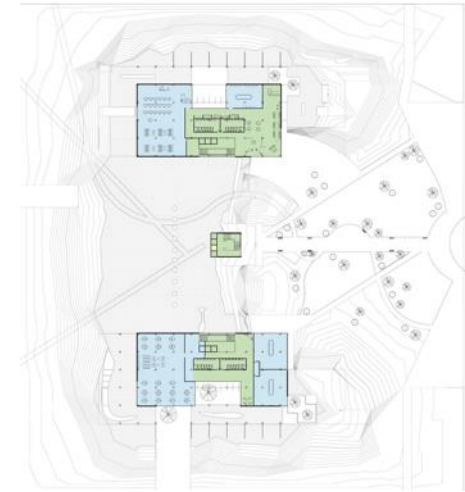
Section Facing North
1'-0"=1/16"



Section Facing West
1'-0"=1/16"

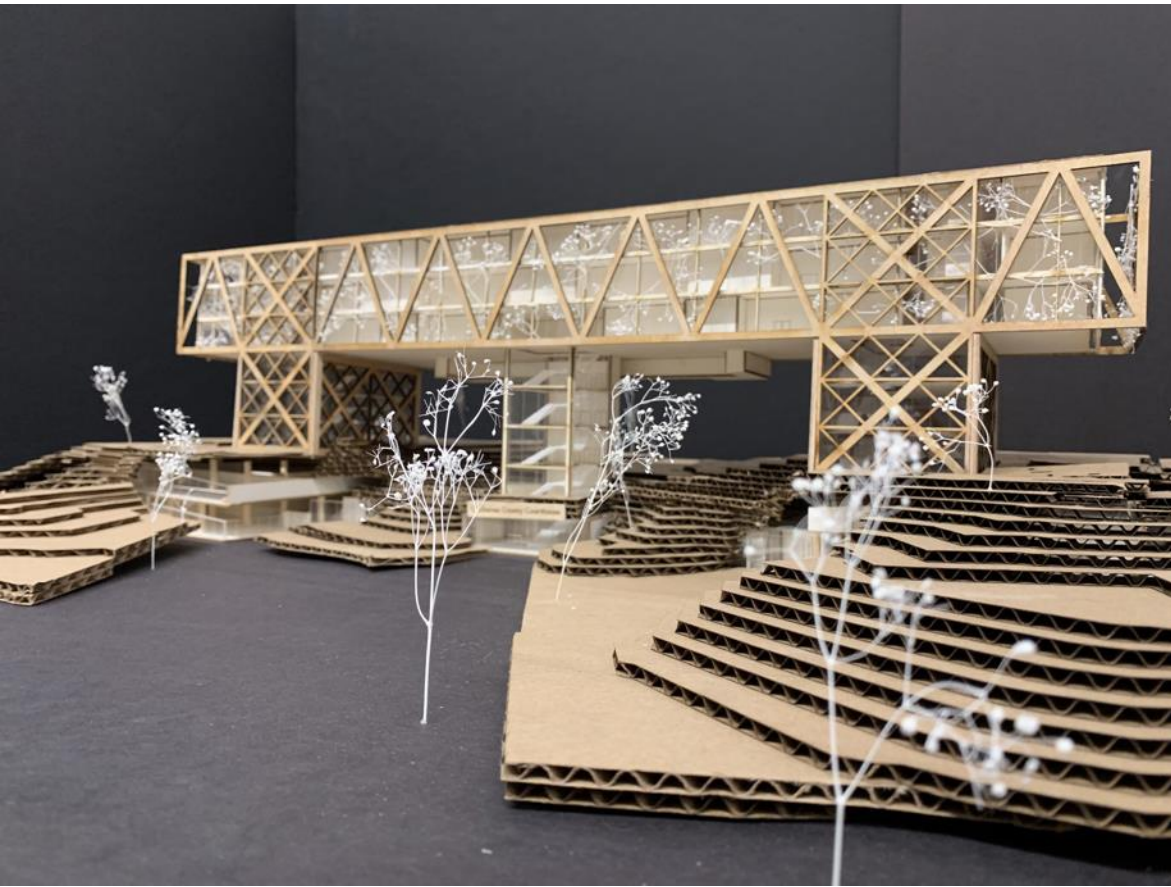
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MASS TIMBER VOLUME

Columns Material Volume	12,926.71 CF
Floor Material Volume	255,816.08 CF
Wall Material Volume	84,391.70 CF
Interior and Exterior Truss Material Volume (lvl 3-7)	87,048.99 CF
Structural Framing Material Volume (lvl 1-2)	23,854.31 CF
Total Mass Timber Volume	464,037.79 CF

BY TYPES

Glulam	123,830.01 CF
Cross Laminated Timber	340207.78 CF

CARBON SUMMARY

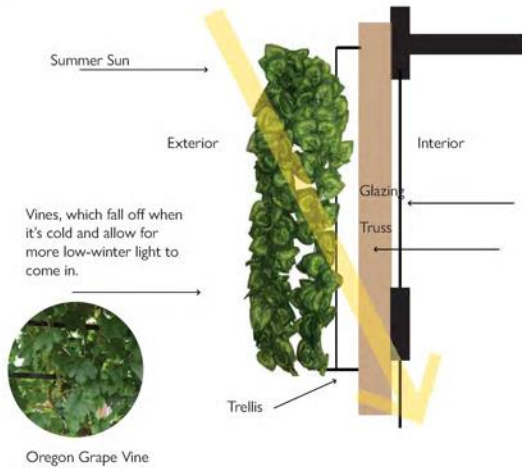
Carbon Stored in the Wood	11685 Metric Tons of CO2
Avoided Greenhouse Gas Emissions	4521 Metric Tons of CO2
Total Potential Benefit @ r b n	16206 Metric Tons of CO2

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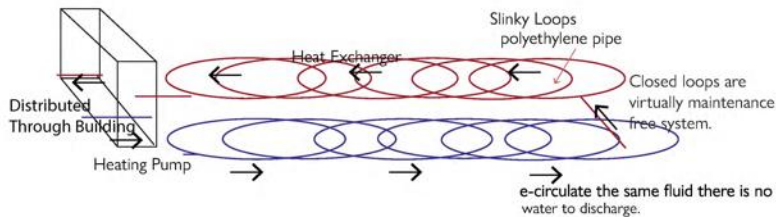
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Environmental Control Systems

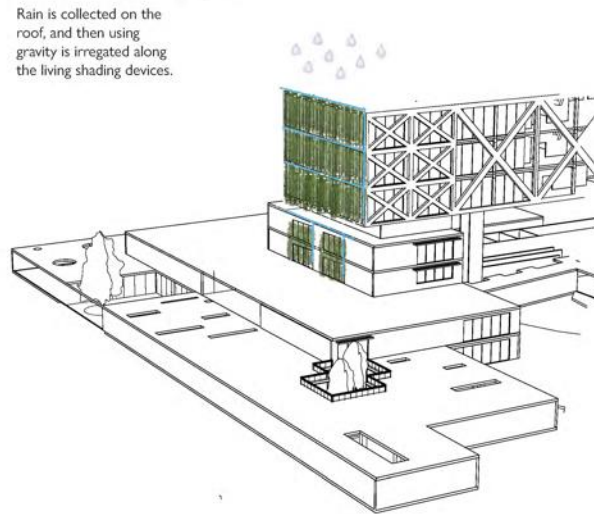
Shading Devices
Living Trellis System



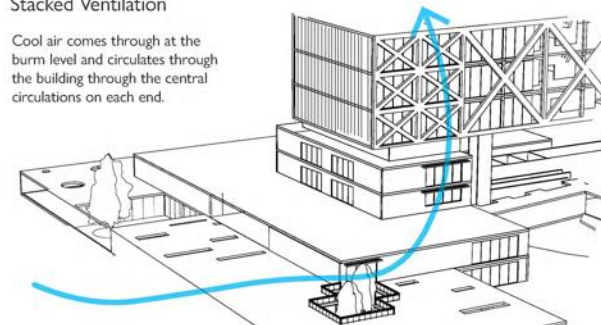
Geothermal Heating System



Rainwater Harvesting System



Stacked Ventilation



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