WHITE PAPER

OREGON STATE UNIVERSITY

EDWARD J. RAY HALL

TALLWOOD
DESIGN INSTITUTE

Contents

PROJECT SUMMARY

PURPOSE

Like a tree taking root in disturbed soils, the Oregon State University-Cascades Campus' newest building, Edward J. Ray Hall is now a reality. Open in fall of 2021, the 50,000 square-foot building provides learning spaces for science, technology, engineering, arts, and math and creates a student hub with active interior and exterior event and activity spaces.

The project, the first building to engage the 46-acre reclaimed pumice mine, is perched atop the mine's steep eastern rim with panoramic views across the future campus west to the mountains beyond. The project is designed to exemplify the University's commitment to sustainability with a Net-Zero Energy target and a structure of regionally-sourced mass timber. These lofty goals inspired the joint design and construction team of SRG Partnership, Inc. and Swinerton to push the envelope in three areas: incorporate locally sourced, sustainably harvested timber products, use systems and design elements to support the Net-Zero Energy goal, and create a prototype that is flexible and adaptable for the future.

PROJECT DESCRIPTION

A design-assist project, the Oregon State University-Cascades Edward J. Ray Hall is a four-story, 50,000-square-foot structure. Utilizing mass timber construction, the building features glulam beams and columns with cross-laminated-timber (CLT) floor panels. The building incorporates a wide variety of Oregon-manufactured wood products which supported the local economy and stimulated job opportunities. The building has been designed with the capability to house a photovoltaic area that is large enough so that when the array is installed, the energy the building uses on an annual basis is less than or equal to the onsite exported energy.

Located in Bend, Oregon, the academic building creates state-of-the-art spaces for an additional 500 students. It provides momentous support for the University's growing four-year programs focused on science, technology, engineering, art, and mathematics (STEAM). This includes expanded engineering and computer science offerings, along with digital arts, media and technology studies. It also provides spaces for health-related programs, teaching and research laboratory space for the kinesiology program and other newly designed programs such as an undergraduate degree in outdoor products. The exterior features a new outdoor amphitheater, along with flexible event space that also functions as an outdoor study and gathering space.

Edward J. Ray Hall acts as a gateway to the center of the campus, creating a lasting first impression of the University's aesthetic and sustainability goals. Surrounded by natural beauty, it offers occupants exceptional views of the campus topography and skyline. Work also included extensive site infrastructure to support the growth of the campus, including a Geo Exchange system and a Campus Energy Transfer Station (CETS).

RENDERING OF NORTH FACADE

PROJECT OVERVIEW

CAMPUS INFORMATION

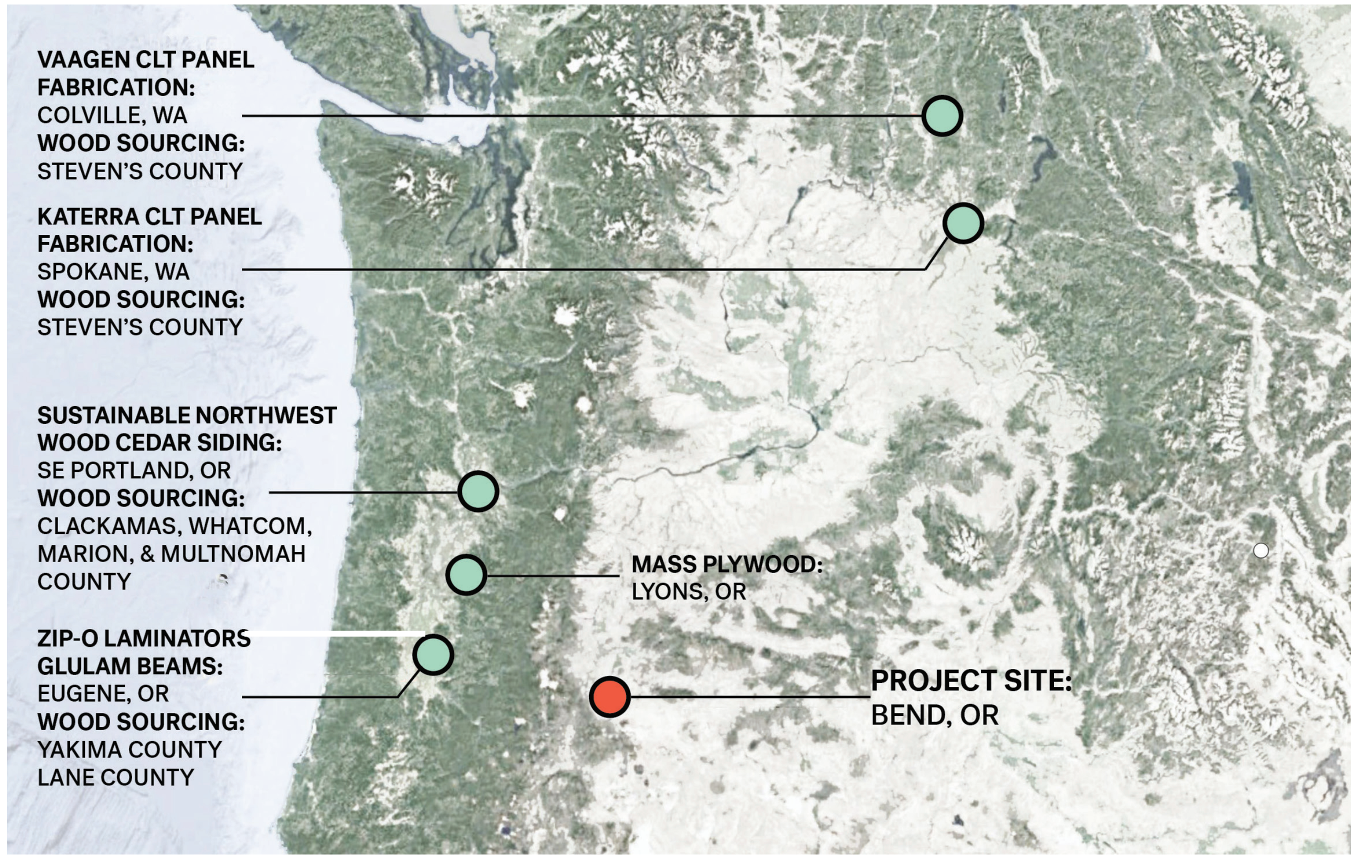
Oregon State University-Cascades provides access for central Oregonians to OSU's excellence in both academics and innovative research. It is the only baccalaureate and graduate degree-granting institution based in Central Oregon. OSU-Cascades was born out of a 30-year grassroots effort put forth by central Oregonians to bring a university to the region. OSU-C's history as an institution dates to September 2001 when the University was located in a small building on the north side of Bend. From there the campus moved to the Central Oregon Community College campus. It then expanded to a four-year university when it welcomed its first freshman class in Fall 2015.

A 2016 study by the American Council on Education described Central Oregon as an "education desert." The nearest university is Oregon State University's main campus in Corvallis, almost three hours away.

The region thus lags behind the rest of Oregon in higher-education attainment, and the gap in rural Crook and Jefferson counties is significant. As such, OSU-Cascades is critical for serving Central Oregon's rural families.

OSU-Cascades is Oregon's fastest-growing public university campus and has been since 2011. Following the campus' current growth trajectory, the current academic facilities on the 10-acre campus would have been at full capacity starting in 2021. Without additional space, the University would have been unable to adequately serve its students, with most students unlikely to move to attend another university much further away from home. Thanks to a $49-million investment, which included $29 million in state bonds, $10 million in private donations and $10 million in matching bonds, OSU-Cascades can now meet the educational needs of this rapidly-expanding, yet under-served region with it's newly open facility.

TIMBER SOURCING MAP



MASS TIMBER INSTALLATION

MASS TIMBER
BENEFITS:

- Supports Regional Economy
- Speed of Construction
- Carbon Sequestration
- Improved Daylighting
- Renewable Resource
- Biophilic Response

BACKGROUND INFORMATION

In 2016, the Higher Education Coordinating Commission (HECC) approved a list of University capital construction projects for the 2017-19 biennium. These projects were evaluated and prioritized based on a rubric developed by the commission. Three projects were chosen, including the Oregon State University-Cascades, Edward J. Ray Hall.

As well as experiencing rapid growth, Central Oregon's economy is diversifying. For quite some time, employers have looked to OSU-Cascades to provide skilled workers in growth industries such as high-tech, biosciences, healthcare, and outdoor products. When the Edward J. Ray Hall project was announced, it was immediately seen as a much-needed investment to meet the increasing needs of growing communities outside of the Portland metropolitan area.

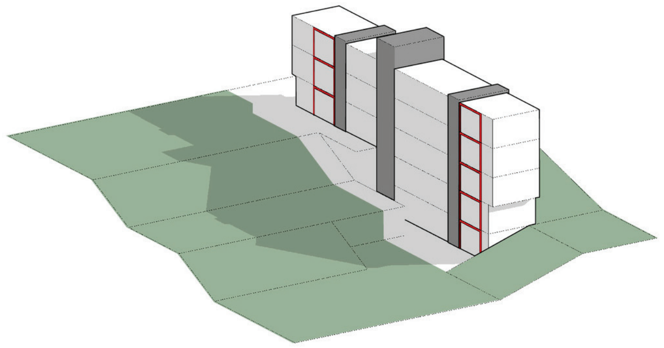
The economic impacts of an expanded OSU-Cascades campus extend to the entire state. According to a study by ECONorthwest, OSU-Cascades will contribute the following by 2025:

- 2,083 jobs
- $197 million in statewide economic impact
- $3.4 million in additional annual state income taxes

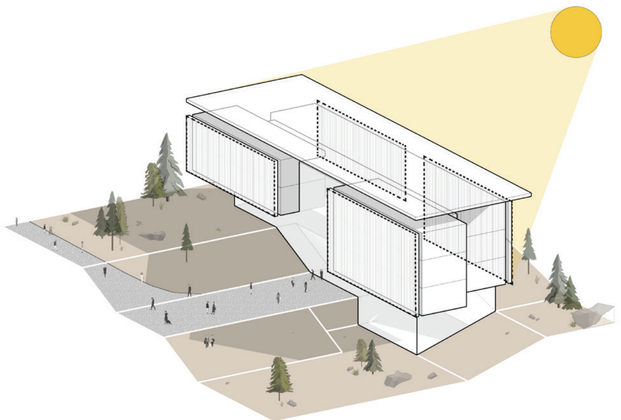
OWNER GOALS

Oregon State University-Cascades is committed to creating buildings that include technologies and materials developed and manufactured in Oregon and the Pacific Northwest. A major component of their vision is incorporating regional wood products as a part of the mass timber structural components, such as cross-laminated timber (CLT), Mass Plywood, and Glulam columns and beams. This helps support rural economic development initiatives in the region.

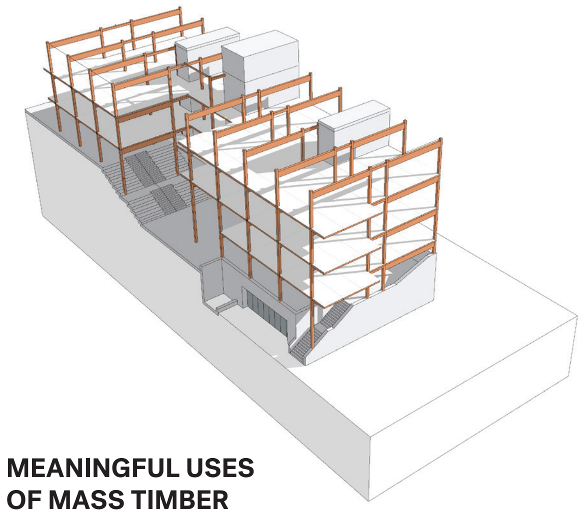
Upon receiving funding for the OSU-Cascades Edward J. Ray Hall project, the University made a commitment to use manufactured wood products—particularly cross-laminated timber in a meaningful way. With this in mind, the University had three critical goals on the project. As mentioned, they wanted a design that showed a meaningful use of mass timber. Second, they wanted the building to serve as a prototype for future buildings on campus. Lastly, an important goal for the building was to contribute to the campus goal of Net Zero energy when photovoltaics are added at some future date. Swinerton and SRG delivered all three on a very tight budget.



FLEXIBLE + ADAPTABLE
PROTOTYPE FOR THE FUTURE



NET ZERO ENERGY



MEANINGFUL USES
OF MASS TIMBER

CROSS LAMINATED TIMBER STORY

CROSS-LAMINATED TIMBER OVERVIEW

Cross-laminated timber (CLT) is an engineered wood building system designed to complement light- and heavy-timber framing options. It is made from several layers of lumber boards stacked crosswise and fused together on their wide faces. Cross lamination provides stability, strength, and rigidity, which is what makes CLT a viable alternative to concrete, masonry, and steel in many applications. It can be used for an entire building, as both the lateral and vertical load-resisting system, or for select elements such as the roof, floors, or walls.

While mass timber construction is relatively new to the United States, progressive European countries have been using this method for more than two decades as a sustainable and environmentally friendly alternative to traditional construction. Internationally, it has propelled wood construction to new heights with a documented track record supporting its widespread use. It offers the structural simplicity needed for cost-effective projects, as well as benefits such as design versatility, rapid installation, reduced waste, lighter weight (compared to concrete), and energy efficiency. As recently as 2014, CLT panels had to be shipped from manufacturers in Europe and Canada, but there are now a growing number of manufacturers and distributors working in Oregon, Washington, and elsewhere in the US.

Investing in CLT and mass timber techniques further propels Oregon into the forefront of this innovative construction technology. In doing so, Oregon also sets itself apart as a state committed to green building. By utilizing mass timber construction on the OSU-Cascades Edward J. Ray Hall project, multiple benefits were realized including support of homegrown industries, investment in rural economies, and creation of jobs in the timber industry.

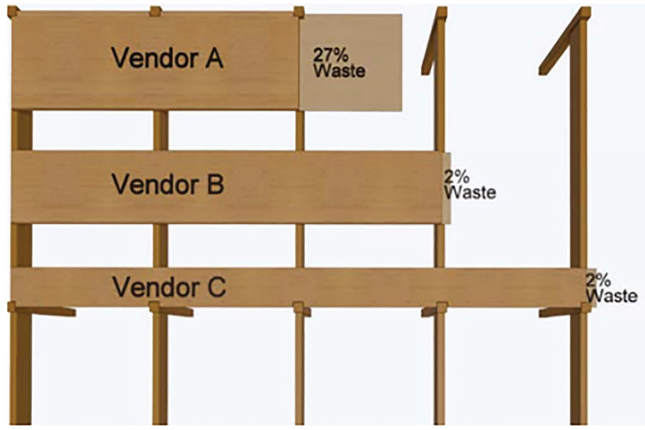
NORTH WEST FACADE DURING CONSTRUCTION

UTILIZATION OF 10'-0" BAYS

After the OSU-Cascades, Edward J. Ray Hall project was approved to move forward, OSU held an architectural design competition to source ideas on how their aforementioned goals could be met. As an early advocate of the benefits of mass timber construction, SRG eagerly submitted a proposal, and was awarded the project. Immediately after selecting the architect, OSU-C did a contractor selection process, seeking to create a project team that valued collaboration. Swinerton was selected in part because of their mastery of the use of mass timber in addition to their strong approach to collaboration.

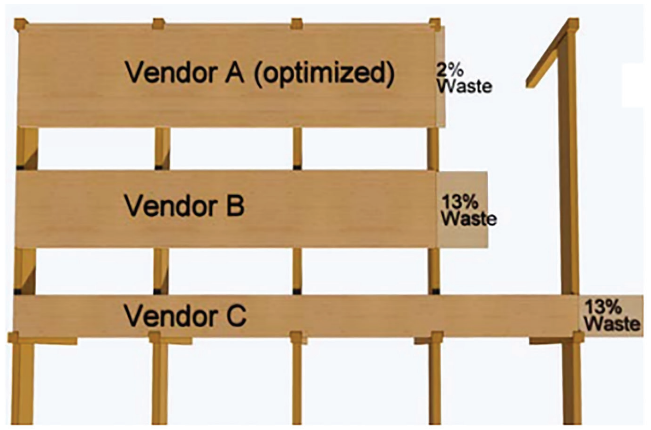
Upon award of the project, SRG and Swinerton formed a team and began exploring options to achieve the University's vision. They knew it would only be possible to achieve the University's goals if they formed a highly collaborative team with direct involvement with the University, stakeholders, faculty, and students.

The early design process included studies that reviewed possible bay sizes and how each would work with the layout of the program. This included test fitting the program and reviewing stack adjacencies for the different schemes. At the first design meetings, the team presented multiple tabletop studies that looked at various mass timber framing options. They discussed multiple iterations for the bay sizes with the University, including beams at 15'0", 13'4", 12'0", and 10'0" on center, modules that also worked with the size of classrooms and laboratories proposed for the building. They then took the bay sizes and determined the different ways each one could be framed to optimize the structural frame. In the end, a 10'0" bay size was chosen for the mass timber structure based on the efficiency of the system and the reduction in wood material the system would use. Multiple other benefits were also realized by this decision which we will discuss later in this paper.



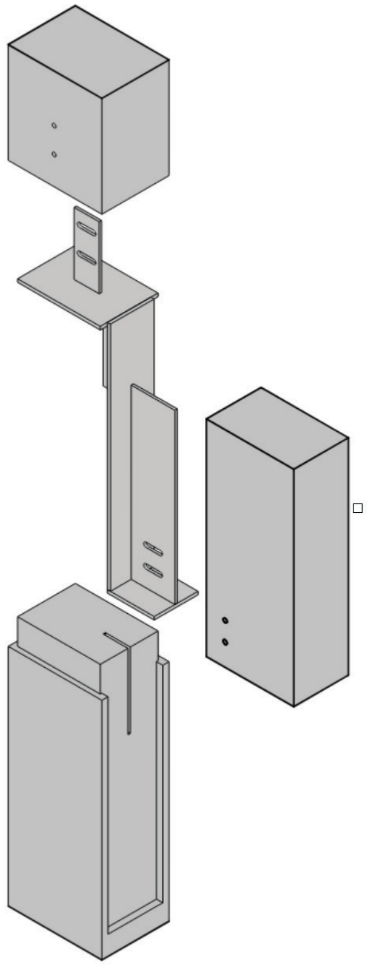
VENDOR B OPTIMIZED (15' SPAN)

- **Installation Cost/SF:**
  - Vendor A - $$
  - Vendor B - $
  - Vendor C - $$$
- **Manufacturing Cost/SF:**
  - Vendor A - $$$
  - Vendor B - $
  - Vendor C - $$

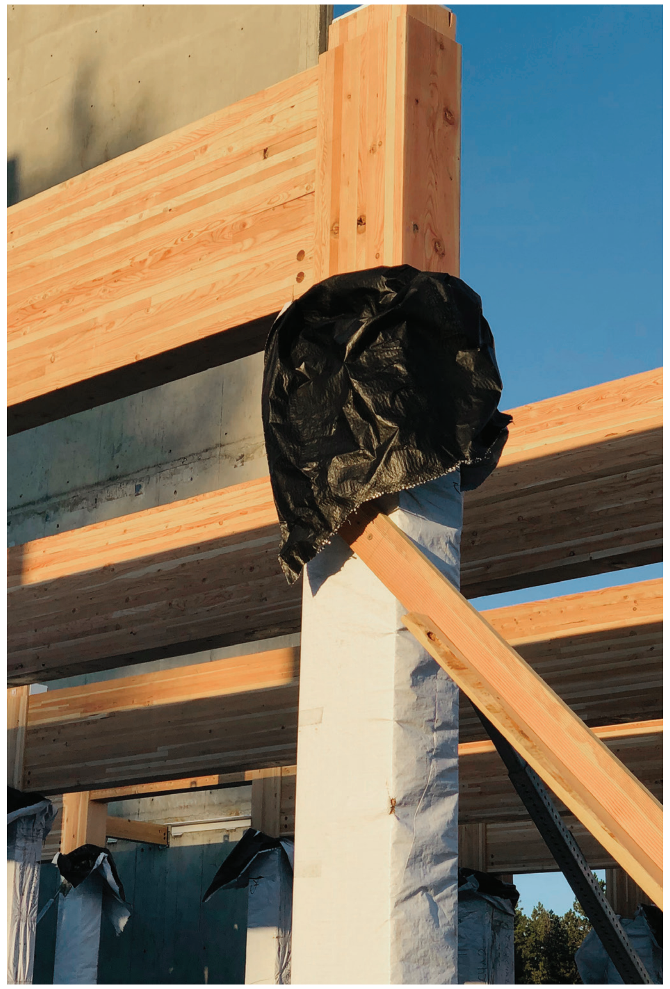


VENDOR A OPTIMIZED (13'4" SPAN)

- **Installation Cost/SF:**
  - Vendor A - $
  - Vendor B - $$
  - Vendor C - $$$
- **Manufacturing Cost/SF:**
  - Vendor A - $
  - Vendor B - $$
  - Vendor C - $$



AXON OF COLUMN TO BEAM CONNECTOR DETAIL



When it came time for procurement, Swinerton was able to consider sourcing from multiple glulam and CLT manufacturers thanks to its fabrication capabilities. Due to their extensive experience with mass timber projects, Swinerton had established working relationships with a long list of suppliers and has a detailed detailed understanding of the products and capabilities offered by each one.

The team selected Vaagen Timbers as the CLT manufacturer, and began work on what became a very successful partnership. Before Vaagen could supply their products to the project, they needed to receive stress-rated panel certification. The team immediately began providing support to Vaagen so that they could receive certification as quickly as possible. Catena Consulting Engineers was brought on board to assist in the process. Taking full advantage of everyone's expertise, the team was able to start the project with a full library of historical data and lessons learned from past projects. Swinerton, Vaagen and the structural engineer together developed different ways to achieve certification, discussed the pros and cons of each solution, and used the open dialogue to point the team in the right direction.

Several challenges were encountered in the process. When calculating factors for the beam seats, for example, the team realized the loads were too large for VAS system. They also determined the reaction forces were higher than expected. Rather than rely on existing techniques, the team came up with a custom system specified for the project's exact needs.

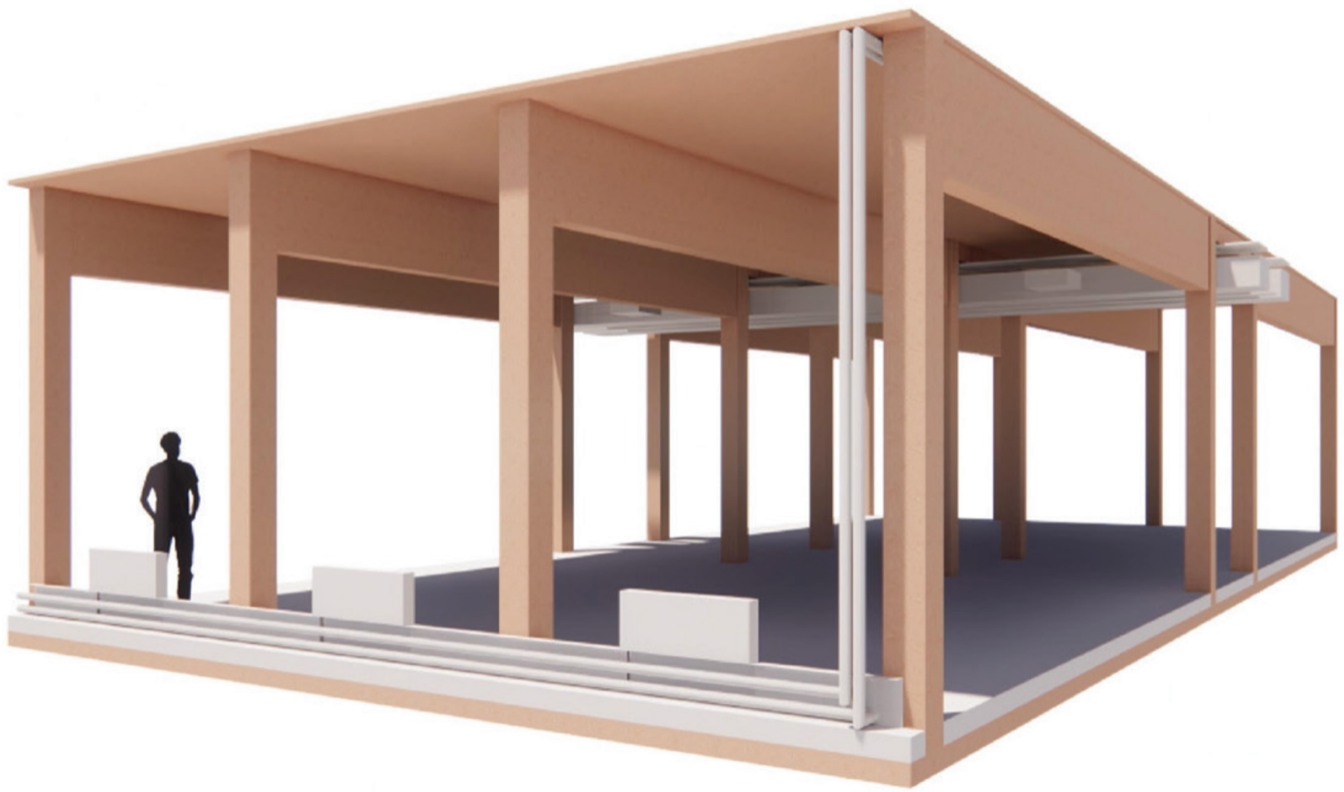
A different, but related challenge, was that the connection detail had to be optimized for installation. Rather than have two separate pieces, the solution created an individual piece that had a place to hook the column for ease of installation. The team also chose to prefabricate the connection detail rather than do it in the field. This solution allowed the site crew to take each individual piece off the truck and then quickly hook it on the column. BIM modeling was also heavily implemented to map out three-dimensional studies to optimize for prefabrication, field fabrication, and installation. Early BIM coordination saved time and money by working out these fine details in the model versus in the field.

MECHANICAL SYSTEM

MECHANICAL SYSTEM OVERVIEW

The design decisions regarding the mechanical systems came forth from multiple discussions with Oregon State University-Cascades. With them, Swinerton and SRG went through a Choosing By Advantages (CBA) exercise. During these CBA sessions, the team looked at a series of criteria and had the University weigh each by their importance. Three aspects of their vision were rated much higher than any others.

First, OSU wanted a mechanical system that helped achieve its Net Zero and sustainability goals. Second in importance was the ease of maintenance and third, was selecting a system that would work to balance the University's goals around Net zero energy and aesthetics created by exposing wood in the space. To assist in developing a solution, the team created ISO drawings and built BIM models to view different piping distribution options in the corridor. They took their findings to the University and explained the pros and cons of each mechanical system. With OSU-C's input, the final decision was to utilize a Jaga mechanical system, which employs sensible fan-powered boxes. Budget-wise, the Jaga system is a "middle of the road" when compared to other systems. Performance-wise, it was above average, but still not the highest performing system However, its ability to maximize the University's energy saving and aesthetics goals convinced everyone to push the Jaga system to the top of the list.



AXON OF MECHANICAL SYSTEM SHOWING JAGA UNITS AND PIPING

INTEGRATION OF THE JAGA MECHANICAL SYSTEM

In simplified terms, the Jaga units act like a radiator on the perimeter of the building. They serve as a hydronic-based mechanical system rather than an air-based one. As a result, the units allowed for elimination of some of the ductwork that would have been used with a standard system.

Edward J. Ray Hall has a double-loaded corridor, with classrooms on each side. This results in a corridor with a much shallower span. The 10'0" bay allowed for the elimination of the need for a beam between the classrooms and the corridor while using a thinner CLT panel and reducing overall wood fiber in the structural frame. Eliminating the perpendicular beams also provided more space to install the mechanical systems. That allowed the team to penetrate directly into the classroom and simplify the mechanical system. This also increased performance and made it easier to install.

DRONE PHOTO OF CONCRETE CORE DURING CONSTRUCTION

SUSTAINABLE BENEFITS OF STRUCTURAL / MECHANICAL INTEGRATION

The 10'- 0" spacing had added benefits for the project, including no longer needing either perimeter beams and or a girder between the corridor and classroom bay. Eliminating the perimeter beam provided better daylighting, as the window heights could be higher, allowing natural light to penetrate deeper into the building.

By reducing the need for electric lighting, natural daylighting reflected the University's key goal of reducing energy usage. In addition, natural light improves the health and wellbeing of the building's occupants.

EXPOSED TIMBER
BENEFITS OF JAGA MECHANICAL SYSTEM

Beyond the energy-saving benefits, the use of the Jaga mechanical system made a huge impact on the building's aesthetics. Aside from its structural capabilities, the pleasing aesthetic of exposed wood is one of the greatest benefits of utilizing mass timber.

As previously mentioned, the Jaga units are located along the perimeter of the building and help eliminate some of the ductwork. Had the building utilized a standard system, its mechanical units would have covered the building's exterior and hidden large portions of the mass timber. Instead, the Jaga system allowed for a clean overall building that kept program spaces clear. It consequently allowed the wood to remain exposed to a much greater extent and maximize the building's biophilic response.

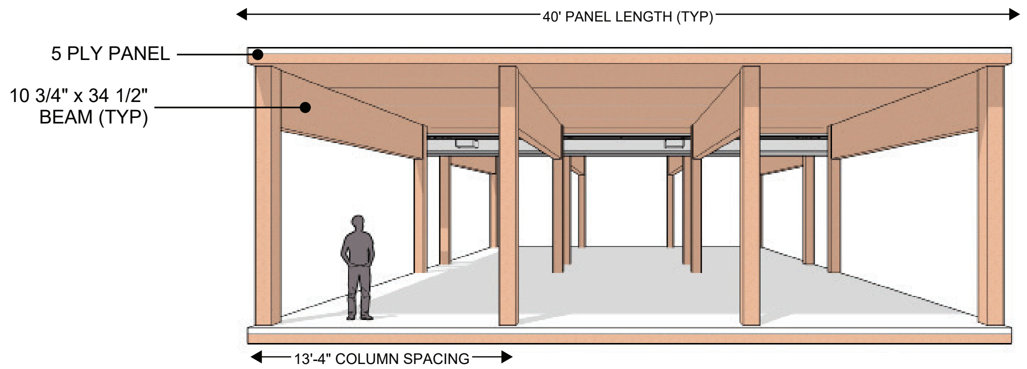
RENDERING OF CLASSROOM

SUSTAINABLE CONSTRUCTION

Not only did the 10'0" spacing simplify mechanical distribution and improve daylighting, but it also helped reduce the carbon footprint of the building. When Swinerton and SRG tested different systems, they reviewed how many cubic feet of wood would need to be used for each base size. In the end, the 10'0" spacing allowed for use of a 3-ply system. A 13'4" spacing, would have necessitated a 5-ply system.

This would have inherently increased the amount of wood and fiber needed. Using the 3-ply system we reduced the amount of structural material in the building by 25-30%. It provides a total carbon benefit of 3,590 metric tons of carbon stored and avoided. This is equivalent to removing 759 cars from the road, or the energy needed to operate 379 homes for a year. It also takes North American forests only three minutes to regrow the wood used to build the structural frame.

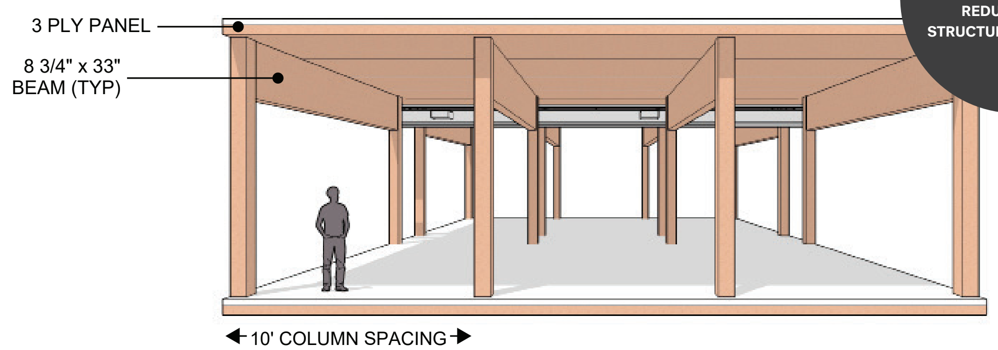
MASS TIMBER OPTIMIZATION



5 PLY PANEL WITH 13'-4" O.C. COLUMN SPACING

- CLT BY VOLUME (APPROX):
  30,070 CUBIC FT
- FRAMING BY VOLUME (APPROX):
  10,670 CUBIC FT
- TOTAL WOOD FIBER VOLUME (APPROX):
  40,740 CUBIC FT

25-30%
REDUCTION IN STRUCTURAL MATERIAL



3 PLY PANEL WITH 10'-0" O.C. COLUMN SPACING

- CLT BY VOLUME (APPROX):
  18,700 CUBIC FT
- FRAMING BY VOLUME (APPROX):
  11,750 CUBIC FT
- TOTAL WOOD FIBER VOLUME (APPROX):
  30,450 CUBIC FT

OSU Cascades / Tallwood White Paper

SUSTAINABILITY SCORECARD
OSU-Cascades, Edward J. Ray Hall

- Carbon Stored in wood:
  1,149 Metric Tons
- Avoided Greenhouse Gas:
  2,441 Metric Tons
- Total Carbon Benefit: 3,590 Metric Tons
- Equivalent to Removing 759 Cars from the Road or the Energy to Operate 379 Homes for a Year
- Time for North American Forests to Regrow the wood... **3 minutes**

The project also included extensive site infrastructure to support the growth of the campus and further Oregon State University-Cascades' Net Zero vision. This included a Geo-exchange system and a Campus Energy Transfer Station (CETS). The Geo-exchange system transfers heat, rather than creates it. The system is extremely energy efficient and produces drastically lower carbon dioxide emissions than traditional systems. The Geo-exchange system harnesses natural heat stored in the ground through a network of underground condenser pipes called a ground loop. It replaces the traditional furnace and air conditioning system. The water-based ground loop circulates through the pipes and collects the heat. The water passes through a heat exchanger or heat pump and is then distributed throughout the system.

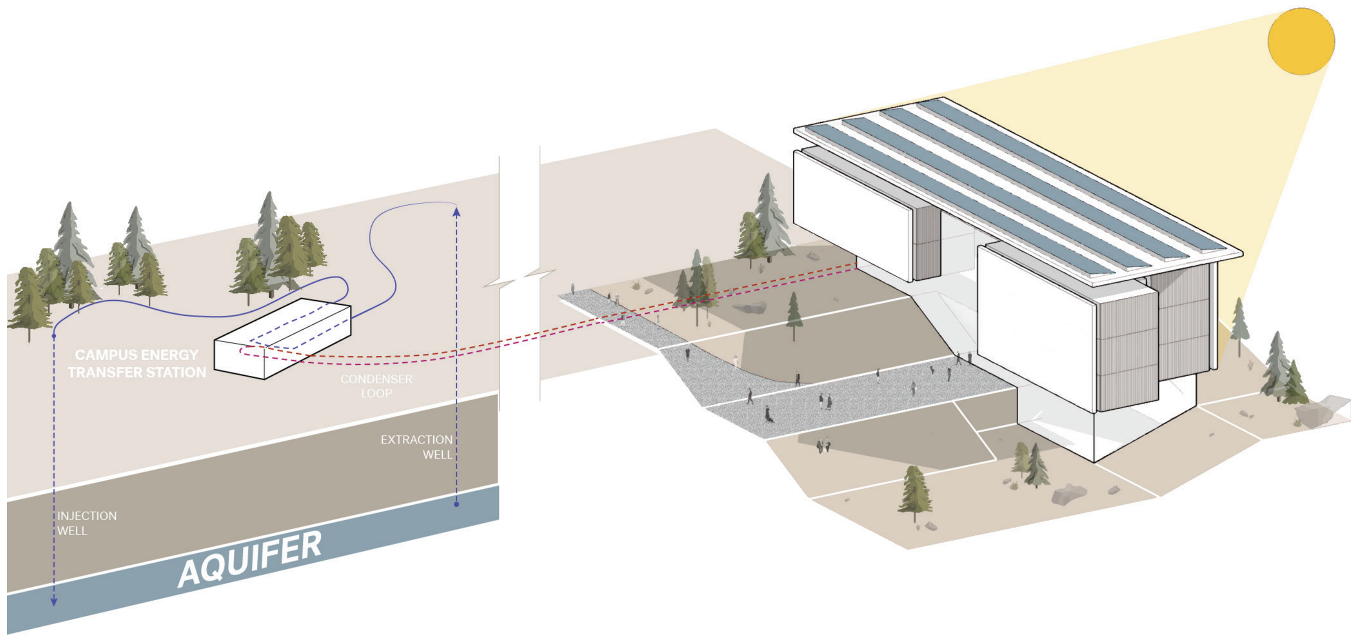
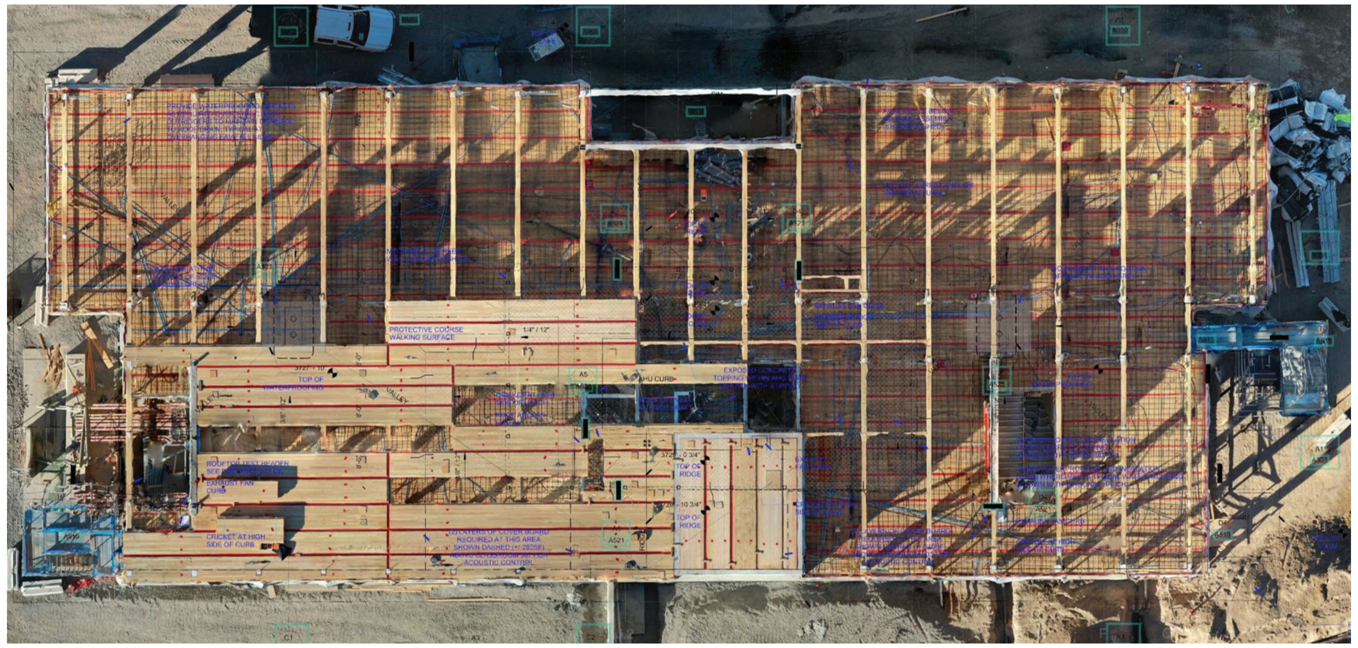


DIAGRAM OF GEO-EXCHANGE SYSTEM

BUILDING THE PROJECT

PARTNERING WITH JURISDICTIONS

Swinerton and SRG took a proactive approach in the Pre-Application conference with the Authority Having Jurisdiction (AHJ). Before the first meetings with the AHJ, the team collected a significant amount of information to present. In the session, issues and suggested solutions were discussed, outlining the pros and cons for each, along with the resulting effects they would have on jurisdictional inspections and approvals. By demonstrating the team's expertise in these initial meetings, mutual needs and expectations were clearly defined. Following these jurisdictional meetings, the team was asked to host a lunch and learn for plan examiners and field inspectors on the topic of mass timber code approvals. The team chose to go one step further and make a full presentation to them, entitled "Mass Timber and How It Relates to Code Adoption." Working with the Tolleson Design Institute, the Alternate Means and Methods studies were presented to the Central Oregon Chapter of the International Code Council (ICC) at their headquarters. The ICC is the primary jurisdictional organization for Bend, Oregon, where OSU Cascades is located.

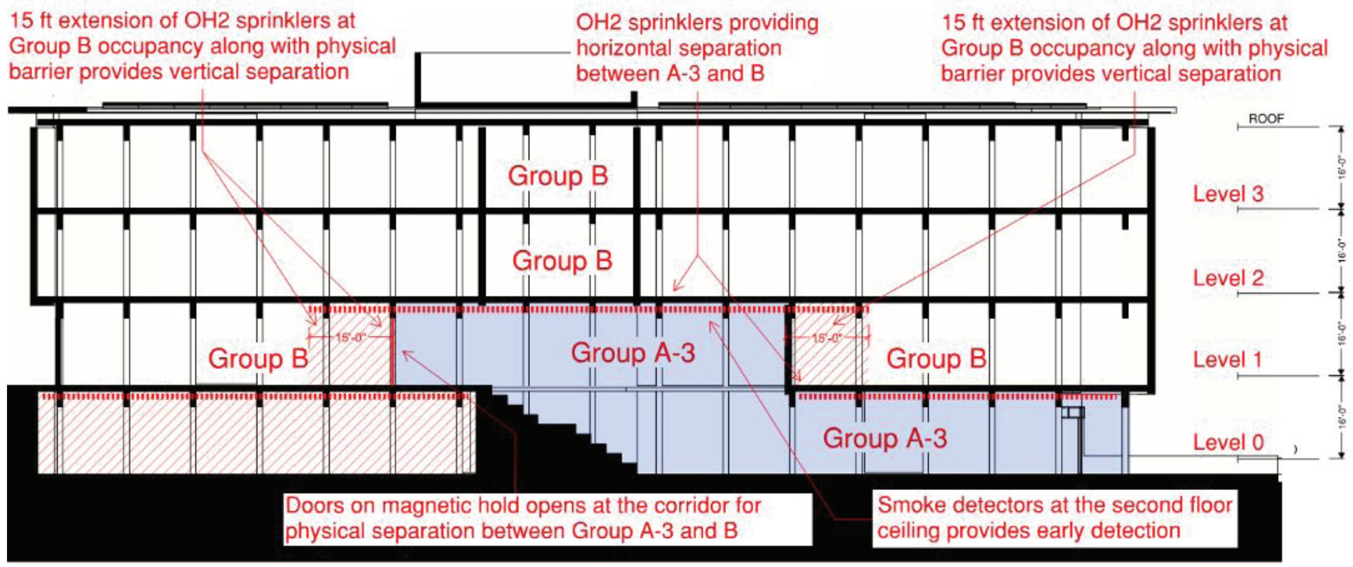


AERIAL VIEW FROM DRONE TAKEN DURING CLT INSTALLATION

ALTERNATE MEANS AND METHODS

Edward J. Ray Hall's program included both B (Business) and A (Assembly) occupancy spaces along with a desire to keep the building as open as possible to allow programs to flow together seamlessly. Normally B and A occupancies would need to have a fire separation between them per the code. The intent of the Oregon Structural Specialty Code (OSSC) for requiring fire resistance-rating for occupancy separation is to prevent fire migration, provide a barrier against smoke migration, and ensure structural support is maintained for the required duration. This separation helps manage the distinct hazards associated with each occupancy. Group A spaces typically have a higher occupant loading, which poses greater fire risk concern compared to Group B spaces.

The project team enlisted the firm Code Unlimited to perform Alternate Means and Methods (AMM) studies to outline ways to keep the A-3 occupancy at the basement and ground floor levels open to the B occupancy on Levels 1,2 and 3. Instead of following the prescriptive code path, the consultant's research indicated an Alternate Means and Methods approach could be used to separate the A-3 occupancy from the B occupancy at the basement and ground floor levels, while allowing the spaces to remain open to each other. This was accomplished by implementing a combination of active and passive barriers that greatly assist in preventing the spread of fire and smoke and allow occupants to safely egress the building. In doing so, it ensures visual transparency while maintaining occupant safety by providing the code-required separation between the Groups A-3 and B occupancies.



W/E BUILDING SECTION - OCCUPANCY GROUP A-3 (INDICATED IN BLUE) WILL BE PROTECTED BY OVERHEAD SPRINKLER LINES WHICH WILL EXTEND 15 FEET INTO THE GROUP B OCCUPANCY AREAS ON LEVEL 1 AND THROUGHOUT THE ENTIRE FLOOR ON LEVEL 0. A PHYSICAL BARRIER WILL BE PROVIDED BETWEEN THE TWO AREAS. SMOKE DETECTORS WILL BE INSTALLED ABOVE THE TWO STORY OPENING.

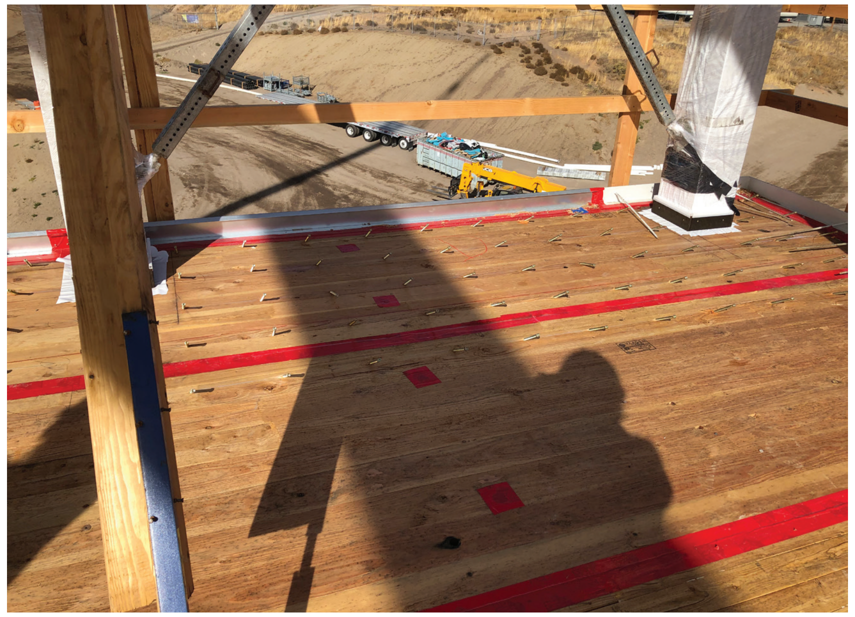
OSU Cascades / Tallwood White Paper

FIRE RATINGS

The Oregon Structural Specialty Code defines the fire rating requirements for various building components, such as the exterior walls, roof, and floors. Type IIIB construction, which was determined to be the most economical construction type to use for a building the size of Ray Hall, requires columns located within the exterior wall of the building to be fire-rated to a 2-hour rating. The code allows extra wood layers to be used to achieve a 2-hour fire rating based on the idea that the outer layer (called the char layer) could burn slowly and predictably if a fire were to occur without affecting the structural integrity of the building. The need for a char layer adds two inches in every direction, for a net addition of four inches. This significantly increases the amount of fiber required, which in turn makes the columns bigger and more pronounced. As an alternative to this, Swinerton and SRG chose to pull the structure inboard of the exterior envelope. In doing so, the columns are no longer part of the exterior fire rating, instead becoming non-rated structure allowed by the selected Construction Type. This allowed the project to avoid extra fiber for the columns and its associated cost.

Pulling the structure inboard, however, created an additional challenge. The CLT panels needed to be able to overhang beyond the columns to carry the building envelope. To overcome this, a composite slab was utilized to achieve the cantilever required on the building's weak axis. An innovative use of technology was the utilization of a unique screw machine for installation of the composite action panels. The device simultaneously plunges multiple screws into the face of the CLT. The machine runs horizontally, allowing the installer to walk along with it and perform work in a much more ergonomically-safe manner.

On the lower level, where the beams and columns penetrated the envelope to create the colonnades, the project team decided to laminate the columns with drywall to achieve the required rating.



COMPOSITE ACTION SCREWS BEFORE CONCRETE IS POURED.

SCREW INSTALLATION MACHINE

PANEL RATINGS

CLT panels have varying grain, stiffness and strength attributes depending on the species and grade of lumber used. Choosing a stronger structural rating on the panel, such as an E-rated designation, requires the use of higher-grade materials and lam stock in the panels. Lumber can be mechanically graded and receive an MSR rating that serves as a measure of its strength and stiffness. Using the MSR rating, the design team can select the best 'recipe' for panels used in each portion of the project based on the loads at that location.

Edward J. Ray Hall utilized both stress-rated panels and panels with a composite deck at the perimeter of the building, a procedure that structurally binds the concrete topping slab and the CLT deck. The process involved utilizing screws that penetrate into the surface of the CLT. When the concrete slab was poured the screws 'married' the CLT with the concrete slab, allowing the wood and the concrete to act in a composite manner.

UTILIZATION OF DRONES

Innovative construction techniques and technology were at the heart of the Oregon State University-Cascades, Edward J. Ray Hall project. Beyond the physical construction of the project, one of the most unique innovations was the utilization of aerial drones. Each day, Swinerton would fly a Mavic 2 Pro drone over the jobsite. The drones provided more than basic photos. The team implemented Drone Deploy software, which provides aerial footage and data by photo-mapping the project site, creating a 3D model, and then sharing these models with our design and trade partners.

The drone and software proved critical as the team was prepping for the slab-on-grade concrete pours. The consultant reviewing the drone footage noticed that one of the stem walls wasn't poured due to a design update. After receiving notification, the site team was able to make some adjustments to the pour sequencing to avoid delays in the slab-on-grade concrete work.

Utilizing drone footage elevated the team's coordination efforts by proactively identifying potential installation issues. It gave Swinerton a visual understanding of any schedule impacts and how the team could improve trade partner sequencing beyond the life of the project.

DRONE PHOTO OF CONCRETE SLAB POUR LEVEL 0

COORDINATION WITH TRADES

The COVID-19 pandemic created a fast-moving ripple effect in the timber industry. It closed many Oregon timber mills, creating a lam stock shortage that squeezed the market for wood needed for CLT construction and shrank the labor pool. Swinerton foresaw the situation and proactively worked to find an alternate supplier, Lloyd's Lumber. However, shortly after teaming with them, in September 2020, massive wildfires in Oregon occurred. Not only was Lloyd's Lumber forced to shut down, but many of their employees tragically lost their homes and could not immediately return to work. The team then moved to Plan C to locate additional lam stock. The search had multiple competing priorities that contributed to the challenge; the wood had to be of the necessary grade and it needed to be a visual match to the mass timber that had already been installed. Thanks to Swinerton's established connections in the industry, they were able to successfully find suitable lam stock.

When the fabrication process was nearing completion the radio frequency press at Vaagen Timbers broke down. This had critical ramifications for the project timeline, as the press is used to create the high-grade CLT roof panels. Vaagen Timbers consequently had to fly in a technician from Europe during the heart of the pandemic, who was required to quarantine for two weeks before starting to repair the press.

With no time to lose, the team started looking for an interim solution to keep the project moving during the technician's quarantine period. Through detailed consultations, a hybrid solution was found. The key to the solution was determining which of the panels could only be done at Vaagen and which panels could be fabricated by other manufacturers.

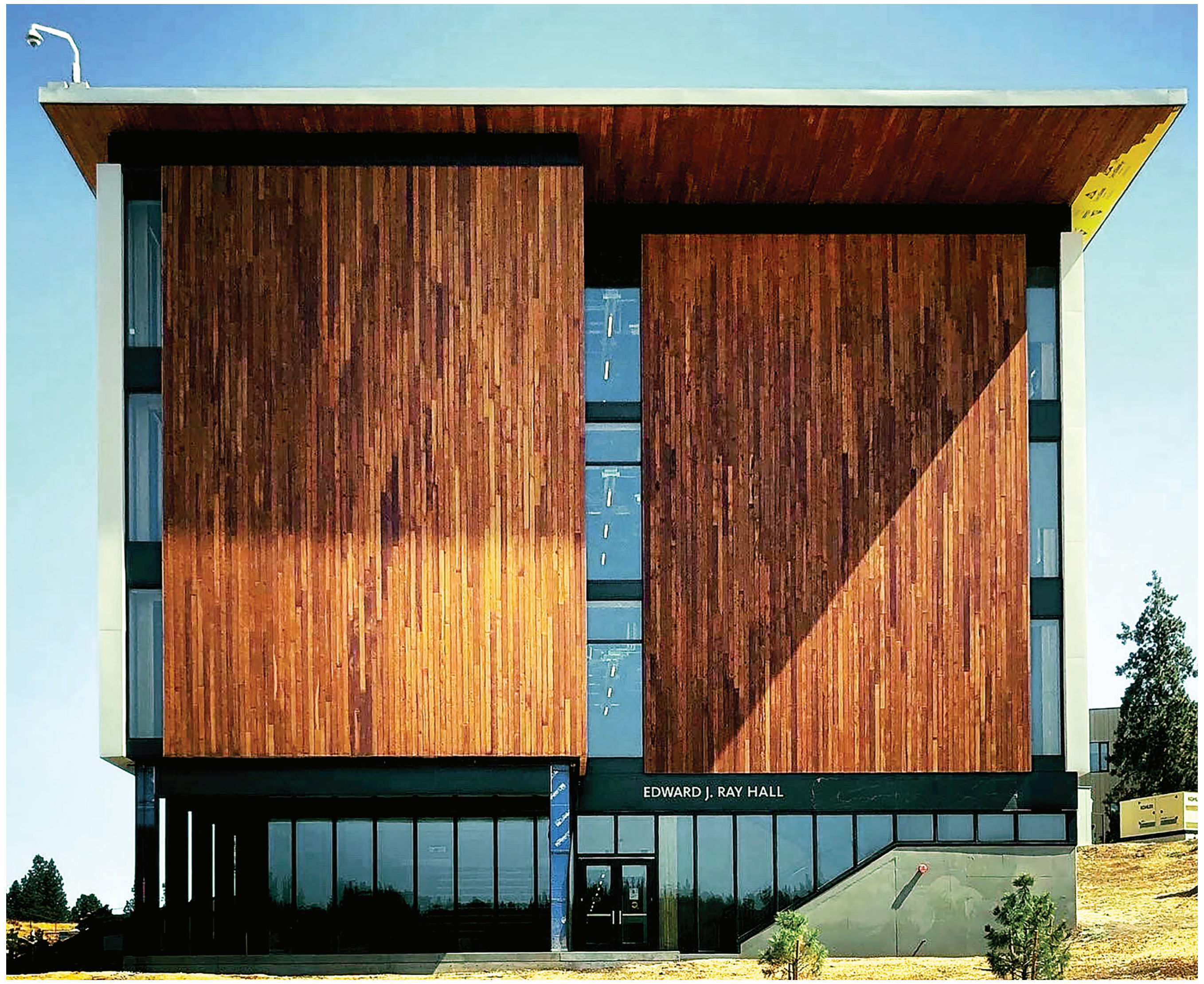
The team once again came together and determined that the interior panels were likely a candidate for an alternate manufacturer. Unlike most general contractors, Swinerton has invested in a dedicated business unit focused on mass timber, Timberlab, with a focus on overcoming market constraints, that can coordinate with manufacturers and suppliers, produce detailed shop drawings, provide timber engineering as required, and prefabricate panels and beams using sophisticated CNC equipment. This meant that Swinerton had the digital files on hand which would allow the panels to be supplied by an alternate, suitable manufacturer.

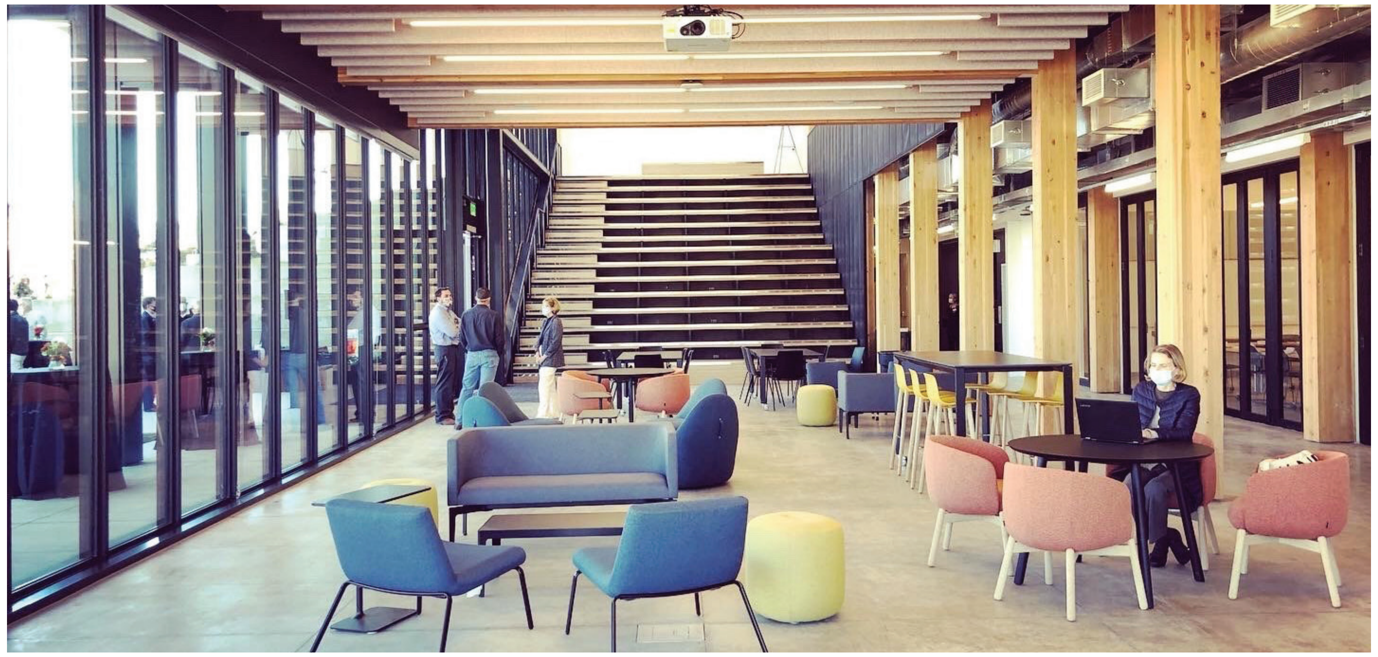
An alternate CLT supplier, Katerra, was contacted, who agreed to supply the non-composite panels within the necessary timeframe. In order to match the grain of the wood already being used in the project, the lam stock needed for the visible outer layer of the CLT was transferred from Vaagen to Katerra.

The lam stock used in the remaining layers was supplied by Katerra. This cooperation between two manufacturers, that would normally be seen as competitors, allowed the project to continue, thus mitigating the effects of delay caused by Vaagen's malfunctioning press and the quarantine requirements. The collaboration allowed Swinerton, Vaagen, and Katerra to all work together in ways that had never happened in the industry. As a result, the team achieved a common goal that was profitable and successful for all three parties.

CLT INSTALLATION

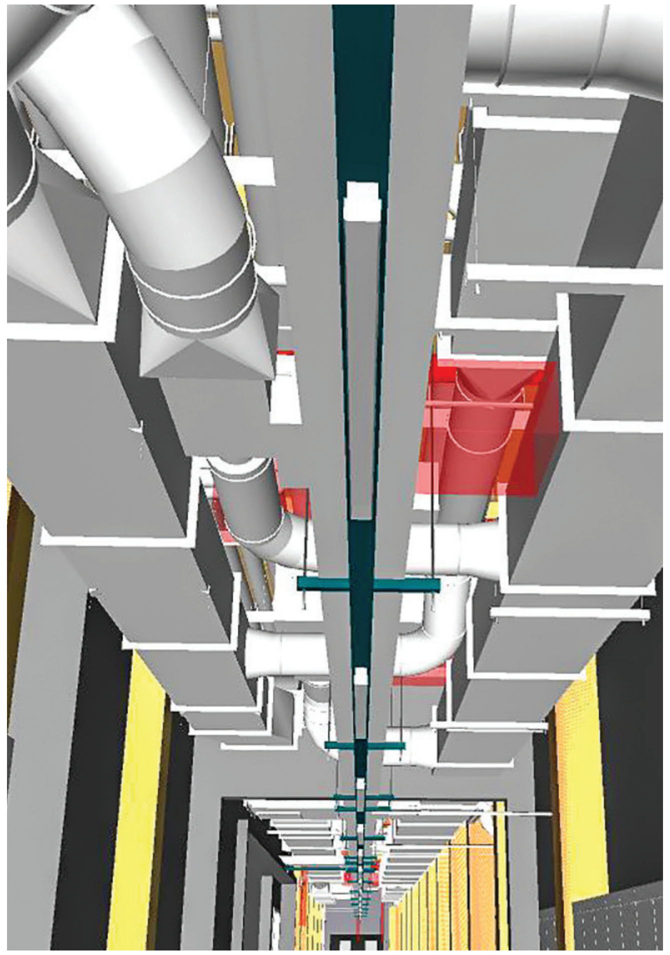
OSU Cascades / Tallwood White Paper





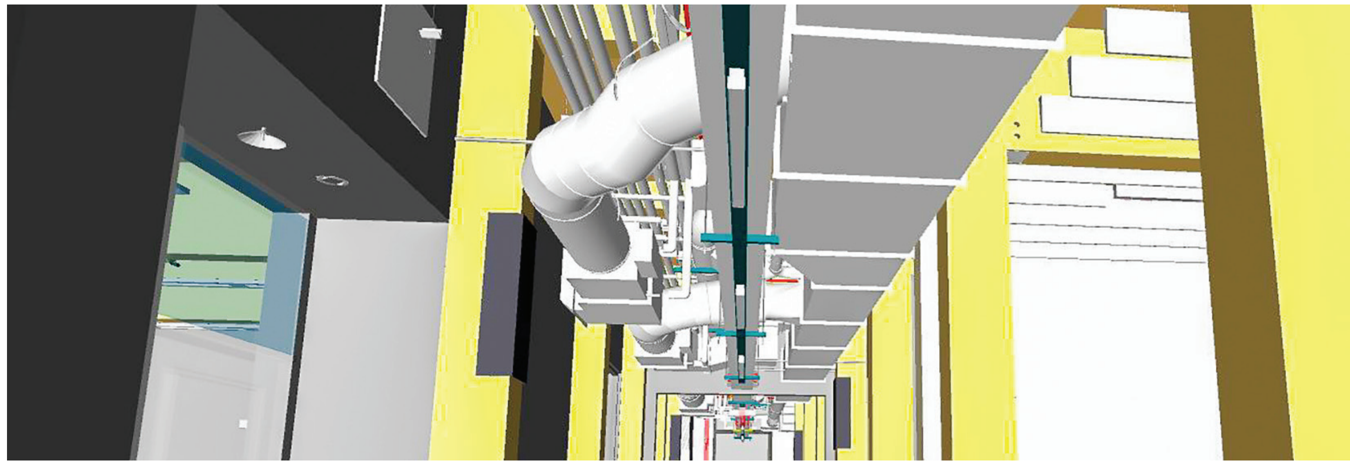
INSTALLATION OF CORD REELS WITHIN THE CLT

Swinerton and SRG chose to insert the junction boxes for cord reels, projectors, and light fixtures within the cross-laminated timber. Use of BIM models for fabrication allowed these items to be fabricated in the shop instead of in the field. Furthermore, this improved the clean aesthetics of the interior by creating a smooth ceiling. The BIM model took a major effort to build, but the effort was worthwhile. The side-by-side images of the corridor at Level One illustrate how the team was able to run mechanical ductwork, piping and access for valves etc., within the corridor, keeping the classrooms and labs free of these items.



BIM MODEL OF CORRIDOR

PHOTO OF CORRIDOR



BIM MODEL OF CORRIDOR

Oregon State University Cascades

SRG

SWINERTON