A Message from the Editors

This studio took on the challenge of working with a client on a real project with no precedents in the United States: the design of a mass timber parking garage. With evolving urban design considerations, complex code issues, and structural challenges of new materials, we all were tasked with designing the project at many scales and with incorporating many issues and perspectives, all within a 10 week quarter! We would like to extend a huge hand of appreciation to those who provided assistance to all of us throughout the term. To Professors Judith Sheine & Mark Donofrio: you managed to balance a complex and frequently changing schedule while at the same time providing constructive sessions that allowed us as students to develop cohesive designs. We would also like to thank Professor Lech Muszyński from Oregon State University who introduced us to CLT as a material and its manufacturing process, and to Professor Mikhail Gershfeld from Cal Poly Pomona, who spent countless hours working with us on solving the minutiae of the structural issues presented in a project of this ambition. We would also like to thank Mayor Christine Lundberg, Courtney Griesel and everyone at the Springfield Economic Development Agency for being willing to consider a project of this magnitude and purpose, and to include us in the process. And lastly, we would like to thank Valerie Johnson and the DR Johnson Company for welcoming our studio to visit their CLT manufacturing facility.

Ryan Kiesler & Tom Moss
Managing Editors
The Mass Timber Parking Garage: An Introduction

This project was the result of a partnership between the City of Springfield, Oregon and the new Center for Advanced Wood Products Manufacturing and Design, a collaborative research effort of the Oregon State’s College of Forestry, University of Oregon’s School of Architecture and Allied Arts, and Oregon State University’s College of Engineering. The expertise of the two universities has helped to foster new industries, with DR Johnson in Riddle, Oregon manufacturing the first structural cross-laminated timber (CLT) panels in the United States, aided by wood science faculty in OSU’s Department of Wood Science and Engineering. In order for the feasibility of this new wood material to be tested, demonstration projects have to be designed and built and the city of Springfield asked UO’s Department of Architecture, known for its expertise in sustainable mass timber design, to devote a studio to a mass timber parking garage to be built in Springfield as the centerpiece of their new mixed-use urban development in the Glenwood district.

Springfield has a long history with the timber industry and would like their contribution to this new development, the central parking garage, to be a showcase for mass timber products. They are very excited about the potential of using CLT and for the development of a new industry in Oregon manufacturing this material. While mass timber in its more common forms (glu-lams, LVLs, OSBs, etc.) has been used extensively in building projects in the U.S., CLT is just being introduced. As far as we know, there are no mass timber parking garages in the U.S., so, the challenge of designing one using an innovative new material was especially exciting for the faculty and students in the studio.

In order to tackle this problem, we had a number of collaborators. The Mayor of Springfield, Christine Lundberg, Community Development Manager John Tamulonis, Senior Economic Development Analyst Courtney Griesel and Assistant City Manager Jeffrey Towery gave us insight into the urban design parameters of the site and their parking consultant, Rick Williams, gave a talk to the studio on the requirements for the parking garage. Architect and UO alumnus Samir Mokashi provided us with insights into building code requirements and UO Professor Brook Muller gave a talk on integrating the parking garage into the environment. We had invaluable assistance from Cal Poly Pomona Professor Mikhail Gershfeld, a structural engineer specializing in timber, who visited the studio four times during the quarter. The faculty integrated these multiple consultants into a studio process that led the students, who worked in teams of two to four, from the large scale of site analysis and urban design to the small scale of timber structural details. The nine projects in this book are the results of these efforts. We look forward to the next stages of development of the Springfield mass timber parking garage.

Professors Judith Sheine & Mark Donofrio
The City of Springfield is a community with a proud history in the timber industry. It is also a community with a desire for a bright future in timber, a future boasting of sustainable practices in both secondary timber manufacturing and use while maintaining an eye for what is innovative and spectacular. The fabrication and use of Cross-Laminated Timber (CLT) in Oregon is just that; Sustainable, Innovative, and Spectacular. CLT is a large-scale advanced timber product made of sheets of cross-hatched wood which can be cut into correct dimensions for wall, floor and ceiling panels, thereby reducing the waste of materials and time in construction of multi-story commercial buildings.

In 2015, the City of Springfield partnered with the University of Oregon to explore the use of CLT in the construction of a parking structure to be located in the Glenwood Riverfront Redevelopment Area. This unique and very visible redevelopment area presents an opportunity to pioneer and display sustainable and forward thinking urban design practices. Sitting along the Willamette River, between the downtowns of Springfield and Eugene, near the University of Oregon campus and adjacent to Interstate 5, the Riverfront Redevelopment Area provided a unique opportunity to present a non-traditional design for a very traditional concept of a parking structure.

At the time of the Riverfront Parking Structure project initiation, CLT was not manufactured in the United States, requiring builders interested in the material to source from outside of the US, often overseas. Additionally, no large scale commercial structure had been built entirely of CLT in the US, limiting the community’s exposure to the design possibilities of the material. The design and construction of a parking structure using CLT not only presented an opportunity to use a sustainable and innovative product in a traditional structure as never done before, but it also presented an opportunity to create a catalytic Riverfront area project with the hope of encouraging the manufacturing of CLT by Oregon based mills and plants, revolutionizing and revitalizing the Oregon timber industry.

The design of a multi-story mixed-use parking structure constructed primarily out of CLT presented the perfect opportunity for engaging the bright minds of architecture faculty and students at the University of Oregon. Students were provided a physical footprint to work within; the number of parking spaces needed, and basic context of surrounding redevelopment. They were asked to think creatively about the experience of being in and around the structure as both a driver and a pedestrian and about the structure as both necessary infrastructure and art.

The designs included in this book are beautiful, inspiring, and incredibly forward thinking; they are illustrations of what is possible without compromising what is necessary. While the concepts maintain logical circulation and parking design with a strategic orientation to the riverfront and redevelopment areas, they also display insight into the beauty and future of CLT in large scale commercial construction. Each design is unique and stands out from the next, providing the opportunity to think about how we interact with parking and CLT differently in each set of images.

We were honored to be a partner in this leading edge opportunity to bring CLT to the Glenwood Riverfront Redevelopment area. It is our hope that you will find these designs to be an inspiring reflection of some of the things we value at the City of Springfield: bright minds, sustainable practices, and the innovation of industry and urban areas.

A Letter from the Mayor

Mayor Christine Lundberg
Springfield, Oregon
What is Cross-Laminated Timber?

Cross-Laminated Timber (CLT) was developed in Switzerland and is increasingly widely used in Europe, both in modular construction and, more recently, in tall buildings. Similar to glued laminated beams, which have been in production and widely used in construction for many years in the United States, CLT employs layers of wood that are laminated together to form large slabs. Each layer of the slab consists of 2 x 4 or 2 x 6 pieces of Douglas Fir or Spruce glued together; these layers are laminated together with the 2x wood running in opposite directions for each layer, similar to the thin cross-laminated layers in plywood. CLT is generally manufactured in slabs that are 3, 5 or 7 layers and that are 10’ x wide and up to 60’ long. These slabs can be used to form floors, ceilings and walls and can, in many cases, substitute for concrete or composites of steel and concrete typically used in these applications.

CLT is being produced in Canada and OR Johnson in Riddle, OR is now producing the first structural CLT panels manufactured in the U.S., with the first installation planned for a mixed-use building in Portland, OR.

What are benefits of using Heavy Timber products for construction?

Oregon has long been known as a state built on the timber industry, and, with CLT in production in Riddle, the state is leading a resurgence of the industry within the nation. Currently, most of the logs harvested in Oregon are shipped raw to Asia. By using raw timber to produce high value manufactured products such as CLT, new jobs can be created in the timber manufacturing sector. This sector has been hit hard by environmental concerns, but CLT allows environmentalists and timber industry leaders to come together. Environmentalists have come to believe that cutting small logs from forests helps to sustainably manage them for healthier growth and to stave off large devastating forest fires. Architects and engineers are increasingly concerned with the carbon footprint of materials used in construction, and CLT and other mass timber products that sequester carbon provide significant benefits over the use of concrete and steel in the area of embedded energy. CLT can also save costs in construction. It is lighter than concrete, which allows for smaller foundations. Like pre-cast concrete, it can be manufactured off-site and quickly assembled on site. It can also be precision milled using CNC technology to fashion it into custom shapes with openings for doors and windows, further facilitating both design and construction. CLT has been incorporated into the 2015 International Building Code and further integration is anticipated for the 2018 IBC.


The Parameters

The site for the garage is directly across the street from the planned Hotel & Conference Center in the Northeast corner of the site. The block that includes the garage is also planned to have a combination of housing, retail and office space. Although teams had strict requirements to include 400-425 parking spaces, housing on the west side of the block and a space for formal events in their proposals, the studio was given creative license over the remainder of the block. Some projects chose to incorporate retail into the plan of the parking garage, while others chose to enclose the garage on three sides with a combination of office space and retail. Taking advantage of natural topography and location, a number of teams also chose to explore ways of managing the watershed in an ecologically constructive manner, drawing inspiration from previous parking garage projects at the University. While the development planners didn’t explicitly ask for this in designs, most projects included a pedestrian path through the site that would link the centerpiece Hotel and Conference Center with the housing and park blocks.

Codes required the separation of the garage from the housing block by twenty feet and a two-hour rated fire wall. The site, around 300 feet wide at its largest measurement, therefore was narrowed by about 60 feet, creating difficulties in an already challenging design. Type IV construction codes also puts restrictions on heights of the structure, so projects had to include: at least 375 (preferably 425) parking spaces, two-thousand square feet minimum of event space, and a third program element such as retail or office spaces, contained within an approximately sixty-thousand square feet site that was limited to four ‘floors’ of heavy timber construction.
The Cascadia Subduction Zone, found offshore the coasts of Washington, Oregon, Northern California and British Columbia, is classified as the quietest subduction region in the world. Prior to theories proposed by Tom Heaton and Hiroo Kanamori in the 1980s, the prevailing thought was that the zone was unable to produce significant seismic activity. Heaton and Kanamori, however, proposed that the zone was just in a period of prolonged silence by comparing the region to zones in Chile, Alaska, and the Nankai Trough off the coast of Japan. Without evidence of earthquakes, however, there was no supporting proof to this theory. Recently, further research by teams from Oregon State University, the University of Washington, and the USGS provided data of consistent seismic activity over the course of unrecorded history, and evidence that there is the potential for high seismic activity in the region in the relatively near future. While current codes do not address the extent of this potential, as a studio, we accepted the challenge of designing a mass timber structure that can withstand the forces created by high seismic activity in the region, as called for in current codes. While there are many well-known techniques for resisting seismic forces in concrete and steel, it is a challenge that designers of tall mass timber buildings must address in new ways. New solutions usually come from regions with high seismic activity, and engineers in New Zealand have already provided innovative built solutions, which the studio drew upon. Each project in the studio developed entirely different proposals to resolve these potential forces, taking advantage of the inherent structural properties of CLT and combining them with small amounts of steel to demonstrate that tall buildings employing CLT are feasible within seismic zones.


KAITO [box-kite]

Inspired by traditional Japanese wood buildings, as well as the structure of a box-kite, Kaito takes the traditional solid, heavy form of the concrete parking garage and turns it on its head by creating a structure that appears light and delicate, but utilizes cross-laminated timber shear walls as a contrast to this intricate form and to provide the necessary structural integrity. Deriving the form from the kite, the garage breaks the spanning members into smaller beams, and intersects them throughout the structure. Separating these smaller elements provides opportunities to appreciate the unique quality of the material at a human scale, while at the same time creating a structure that is not only capable, but aesthetically pleasing. These members create a repeatable and modular structure that could be replicated, but also responds to the conditions imparted from the Glenwood site.

Areas for micro-shops are cut into the massive shear walls at the south edge of the site, and areas for larger retail space is reserved under the structure on the east side of the structure. An access point to the hotel and conference center is located across from the main staircase on the north-west part of the site.

Due to the proximity of the Willamette River, the structure incorporates rain catchment and filtration through a constructed wetland in the center of the courtyard structure.
The connection is the crucial element to the project. The structure is focused around this abstract pattern, and to ensure that visitors thought that each element was continuous, each connection and joint had to be hidden at these points. The language that started at each of these points carries throughout the project, creating something beautiful and uniform. Throughout our time working on the project, we went through numerous iterations of the connection to make sure this was the result, and we made the decision to sacrifice structural efficiency in order to create that appearance.

DIAGRAMMATIC SITE MODEL left.

LATTICEWORK opposite.
KAITO MASS TIMBER PARKING GARAGE | KARGO

initial site boundary conditions

3-5 stories
60 ft setback

extruded site footprint
remove voids for extraneous program

resulting form
shear walls
shear walls
lattice structure
columns

FORM FINDING DIAGRAMS
SECTION THROUGH THE RETAIL

STRUCTURAL DIAGRAMMING
above FORM FINDING DIAGRAMS
opposite SECTION THROUGH THE RETAIL
Placement of vertical circulation for pedestrians relates to active areas to provide convenient access points. These vertical access zones support the hotel and conference center, retail businesses, and the residential edge. Each egress point contains a stairway and elevator for integrated, universal public access to both levels of the split parking floors. Fire stairs are accessible on the north-west and south-east corners, with an accent stair and elevator facing the hotel and conference center. All stairs and elevators have access to light and views, providing pedestrians with a pleasing and safe experience.

SCHEME DIAGRAMMING

top left. SHEAR WALL SYSTEM
The flow of vehicles interacts with the different structural systems. Monolithic shear walls not only provide structural support for the ramps but are also detailed to act as thresholds for way-finding and reference. The gaps between shear walls contain all vertical circulation, with the exception of the north-east stair, and create a juxtaposition between the lattice-like structure of the parking bays and the solid CLT cores of the vertical circulation, creating a dramatic experience that highlights the heavy timber construction.

left. PEDESTRIAN CIRCULATION
The exposed stair and the plaza
The flow of vehicles interacts with the different structural systems. Monolithic shear walls not only provide structural support for the ramps but are also detailed to act as thresholds for way-finding and reference. The gaps between shear walls contain all vertical circulation, with the exception of the north-east stair, and create a juxtaposition between the lattice-like structure of the parking bays and the solid CLT cores of the vertical circulation, creating a dramatic experience that highlights the heavy timber construction.

left. MICROSHOPS LINING THE SOUTH EDGE
opposite right. THE EXPOSED STAIR AND THE PLAZA
opposite left. THE EXPOSED STAIR AND THE PLAZA
opposite left. THE EXPOSED STAIR AND THE PLAZA
A large open space in the center of the parking garage allows rain to fall into a constructed wetland on the ground floor. This wetland passively cools and cleanses water that may have come into contact with contaminating materials and supports an active ecosystem. Control systems store this water throughout the year as it is cleansed by micro-organisms and releases the clean water to the nearby Willamette river to correspond with and support salmon migration. Likewise, the large atrium space improves daylight quality within the garage and connects drivers with the wetland ecosystem in which the parking garage is actively engaged.

**SCHEME DIAGRAMMING**

**RAMP PLACEMENT** top right.
Ramps between parking floors connect both split levels of the garage. The staggered floor plates allow ramps to be half the length otherwise necessary to ascend or descend through the parking structure, and stacking the ramps minimizes the area used for circulation. Separating these ramps from the drive aisles improves way-finding and avoids circulatory confusion, making the parking experience as easy and safe as possible. Also, the ramps interact with the open space for visual and experiential interest. The middle ramp allows one to loop continuously on one floor, change direction, and gives the user ample choices for parking location.

**WATER COLLECTION** right.

Above: GROUND FLOOR & UPPER FLOORS

Left: HERONS LANDING IN THE WETLAND
KUMA
The secondary structural connection weaves together eight members in order to create a system that appears light and also provides enough clear space for most vehicles to pass under. These quad-members contain fire-suppression systems and conceal lights to dramatic effect.

ANDO
The primary structural connection weaves together seven members to create a light yet structurally robust connection to that carries the CLT floor plates above. Small members stacked together function as one deep girder.
above left. MICROSHOP FACADE MODEL
left. CONNECTION DETAIL MODEL
opposite. SHEAR WALL & STAIR MODEL
For this project we re-framed what a parking garage is, from a passive, single-use structure to something that does so much more. We kept the CLT structure simple yet expressive both inside and out, allowing the parking garage to be easily constructed but also stands as a symbol for what this new wood material can do. The parking garage becomes Block number one, the anchor point of change to this new and exciting area.

The construction will also be an opportunity to tell a story about the material, where each prefabricated panel is labelled with a QR code so that visitors now and in the future can see the life that this wood has taken on in its lifetime. In this way, the parking garage can become a catalogue of pieces that make up the whole.
We designed this garage with the concept of changing the purpose from a passive, single-use structure to something that does so much more. Not only does the parking garage support cars and visitors to the neighborhood, but also it provides energy and waste management systems for the neighboring businesses. The garage cleanses the storm water run-off and creates a better ecological environment for all. The garage creates a closed loop system supporting the ecology and neighboring urban context.
Traditional parking garages are big masses and only serve one function in their life span: accommodating cars.

We divided this mass into two smaller volumes to match the neighbouring buildings and allow daylight inside.

The result is a building with two masses connected with light bridge elements.

GROUND FLOOR & SITE CONNECTION
438 parking spots
430 sq. ft. / parking spot

40 electric car charging stations

10 ADA parking spots

2 bicycle parking stations

23,000 sq.ft. of PV panels

2,100 cb.ft. of water collection
SECTIONS

*top left: INITIAL CONCEPT SKETCH

SECTION REVISION SKETCH

*top: SECTION NORTH-SOUTH above.
The connections are designed to be primarily wood that locks into place sandwiching members between the next. The horizontal beam elements are fixed to the columns by threading rods throughout the entire structure and forcing the two elements together.

The exterior fins that act as lateral bracing split the columns and rest underneath the beams. Wood acts as a defining framing element while this steel members rest in between or concealed, acting as a subtle contrast to the celebrated wood structure. These fins extend down to the sidewalk, framing each commercial space and connecting the garage to the public space.
EXTERIOR PIN MODEL, far left.
RAILING MODEL DETAIL, left.
STRUCTURE MODEL, above.
SKETCHES & PLANS
ROOFTOP VIEW opposite.
DETAIL CONCEPT SKETCHES above.
UPPER LEVEL PLANS right.
Vertical circulation for pedestrians are conveniently located at opposite corners, with one stair and elevator core on the north east corner, an irresistible stair at the center, and another core at the southwest corner. The pathway from the park blocks is extended through the garage to better connect pedestrians and bikes to the commercial street.

Cars enter through the entry point from the north, making it very accessible for hotel valets to access the garage. The ground floor supports valet, commercial parking, spaces for housing residents, as well as service spaces. The cars circulate around a central light well that breaks up the mass of the garage while bringing light and air into the structure, and acts as a point of way-finding.
The most famous parking garage in the United States is 1111 Lincoln Road Miami garage by Herzog and de Meuron. Transparence-V attempts to take the general structural principle displayed in that project and reinterpret it into a wooden structure. The project is simple and efficient in its floor plan while at the same time creating a connection with the adjacent Hotel & Conference Center, Willamette River and Park Blocks to the west of the site. There is also space left on the site for residential and retail spaces, as well as a courtyard that pedestrians can occupy walking across the site. Creating a complex and imposing feeling, the structure both makes reference to the weight of the materials used while at the same time pushing the limit of what timber construction can achieve.

The design is centered around the use of this V-shape, and it offered a large amount of flexibility in the structure as it translates into very effective resistance to both vertical and horizontal loads. For lateral load resistance, there are a couple of methods used in combination that all use the V-shape columns. The project uses shear walls, found on either side of the ramp and on the wall facing the park, so that people in the park are also able to engage with the parking structure.

The project is an ambitious utilization of the capabilities of the CLT material, and the use provides an appropriate tip of the cap to precedent while at the same time bringing a new solution to the problem.
The structure of the garage is expressed in ‘V’-shaped columns that occupy the same line of action both North-South and East-West throughout the structure. Surrounding the ramps are ‘V’-shaped braces perpendicular to these creating a two-way bracing system throughout the structure. The structure, while attractive in its abstract nature, is a consistent language that responds to the direct paths of forces down the structure. These ‘V’-braces can also be reflected vertically to create ‘X’-bracing to carry loads directly through the entire structure. The final result is a ‘manufactured forest’ that displays the weight as well as the innate strength of CLT.
The project also has columns that act as moment frames when sandwiched between two 3’ deep beams. The floor system is made up of two, three ply CLT panels sandwiching the secondary glu-lam beams.
The New Mill is a display of mass timber construction old and new. It was designed to blend old heavy timber construction techniques with time tested concepts together with innovative CLT design joinery and shear resistance systems.

This is a garage designed for people. We divided the building into two portions and used the gap between them to connect the park to the West and the hotel and conference center to the Northeast with a pedestrian path. Pleasant and enjoyable pedestrian circulation to and from the vehicles parked in the garage out to the street was a primary concern in our design concept.

The primary half of the garage sits on the Southeast corner of the site, over one story of retail space.

The smaller portion of the garage sits above a double height space for special use such as a restaurant space that complements the hotel. This space would operate the pavilion located on top of this portion of the garage.

The structure utilizes cantilevered beams, which allows ample space for both vehicle circulation while allowing the edges of the structure to be used by pedestrians, in a glu-lam post and beam system that carries the loads to the ground. CLT cores, diagonal bracing and post-tension cable bracing to resist lateral loads.

The New Mill is a celebration of the history of the timber industry in Oregon combined with the new advancements in the material, made for the people.
The entire building concept rotates around addressing the different edge conditions of the site, and how the pedestrian interacts with them. North is the river, northeast is the hotel, west is the park, and south is more housing. How the pedestrian interacts with those was the most important aspect of the project.
SITE MODEL IN CONTEXT opposite.
SECTION MODEL THROUGH ALLEYWAY above.
Knife plate joinery and fitch plate bracing, as well as hidden steel connections, highlight the combination of steel and wood in the project. A split ring connection piece connects the post tensioned cable system to CLT shear panels that dissipate earthquake and other lateral forces.
OVERLOOKING THE RIVER above.
The parking garage has 405 parking spaces which bring the square footage per parking space to about 450. This does not include ground floor parking which has been reserved for retail employees and housing.

The main vehicular entrance was placed on the north end and is divided into 3 lanes, one for entry, one for exit and one that is reversible to deal with high demands at certain times. Vehicles travel a loop through the parking and ramp system, and all loops are wide enough to accommodate two way traffic. Once parked, a person can use the perimeter walkway to access one of the 3 vertical CLT cores that house stairs and elevators. These cores provide easy access to retail (southwest), the hotel and plaza (northeast), and to the pedestrian walkway and brewpub (north).
SITE SECTION: NORTH-SOUTH below.
The design of Momentum is driven by the concept of simplicity and elegance. This design integrates function and beauty in a way that is unique to heavy timber construction. It highlights the simplicity and elegance of the timber structure, allowing the wood to speak for itself in support of Springfield’s historic timber industry and the emerging technology of CLT.

Our project focuses on bringing all parts of the site into one cohesive strategy. By combining the perspective of the pedestrian, car as well as the ecological viewpoint to the project, our resulting proposal has carefully looked at how each part of the project affected each of these environments, and as a result of our efficient layout and low building height, our structure is able to rely on a wood moment frame system, which is specific to our project. The moment frame eliminates the need for cross bracing, creating a design of openness and reiterating the simplicity of the structure. This allowed the opportunity to use details in a way that articulates the elegance of the structure, and further refine the appearance of the parking garage.
THE SITE, THE PEDESTRIAN, AND THE CAR
The site serves an extension of the hotel and convention center as well as a connection between the park blocks and proposed retail street. Therefore, the footprint of our parking structure was limited to allow for a plaza and a pedestrian path to cut through the site. With this smaller footprint, we pulled the vertical circulation out, for both cars and people, in order to achieve a simple and efficient parking layout. The separate ramp also provides the perfect opportunity for a rooftop event space facing the river.

opposite
CONTEXT CONNECTION CENTRAL
CIRCULATION & EXTENSION OF HOTEL

left
FIRST FLOOR PLAN & TYPICAL FLOOR PLAN

THE SITE, THE PEDESTRIAN, AND THE CAR

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As a sustainable feature of the project, rainwater collection and filtration is integrated into the facade through the functional and aesthetic planter boxes.

The pedestrian connection is emphasized throughout the project.

Ground floor plan opposite.

Planter box detail right.

Plans & details
Connections are simple yet elegant, using hidden knife plates that protect the steel in case of fire and also serve to showcase more of the timber structure.
STRUCTURAL DETAILS

above. WOOD SCREEN SYSTEM
Compliments the heavy timber structure and articulates the structure in a simple and elegant way. Highlights the nature of the material through the project.

opposite. FACADE SCREEN DETAIL
The screen system hangs off the edge of the building by thin steel plates which bolt into the CLT panel floors.
The courtyard cut through the parking structure is a multifunctional space that provides daylight to the center of the building as well as a central location for rainwater collection. Rainwater is also collected and filtered through planter boxes that are integrated into the façade. The star serves as an elegant centerpiece for the plaza, and a place to view the filtration process and the CLT parking structure.
The main circulation for both pedestrians and vehicles are located at the north of the structure and are referential to each other. Pedestrian egress is also handled on the south of the structure.

The moment frame is designed to handle the lateral loads that might occur either north-south or east-west. By distributing the stress points around the structure, the structure still has plenty of space for parking.
The connection relies on knife-plates that are bolted through the both 3 foot deep horizontal glu-lam members and half-inch rods that connect the glu-lam members through the column. Post-tensioned cables also run through this connection to the column and knife-plate. A 7-ply CLT decking rests on top of this connection, and a 3-inch concrete topper provides the final finish for the flooring.
The Loom is a weaving connection of economy, community, and the environment, accomplished in part though the use of new timber products to the state of Oregon. Cross Laminate Timber, or CLT, is the main structural element, enabling us to create dynamic spaces inside and out.

Additionally, The Loom seeks to strengthen the community connection to the existing historic resources of Springfield’s agricultural industry and the Willamette River, to foster community growth through civic spaces for the people of Springfield and Glenwood to gather and play, while simultaneously learning about the river and the modern sustainable wood industry in the state of Oregon.
A rolling landscape provides a connection between the riverfront and the parking garage. The green belt helps to address the ecological need of the river system while creating a soft transition between the two program features of the Glenwood refinement plan.

**EARLY CONCEPTUAL WORK**

**ROLLING LANDSCAPE DIAGRAMS** opposite.

**CONCEPTUAL SKETCH** right.

Sketch of rolling parking structure, the roof line steps down as it reaches the river.
Major exterior program forces influence the design. The building must respond to the hotel and ecological needs from the Hotel to the Northeast, the Willamette river from the North, and the proposed park blocks to the West.

Strategically placed corridor systems allow pedestrians and users of the parking garage to permeate through the building.

Additionally the parking structure extends outward into the surrounding landscape, building a program integrated within the Glenwood Refinement Plan.
SITE DOCUMENTATION
above, FIGURE GROUND SITE MAPS

a. FIGURE GROUND
b. FINGERS OF GREEN
c. PARKING
d. ACCESS
PARKING GARAGE PLAN

a. GROUND FLOOR PLAN
b. FIRST FLOOR PLAN
c. DECK STRUCTURE PLAN
d. DECK STRUCTURE PLAN

above: INTERIOR COURTYARD PERSPECTIVE
Cross laminate timber can be pre-fabricated to a variety of shapes and sizes, standard rectilinear panels can be stacked on top of each other between floors to provide continuous shear walls of lateral bracing.

Similarly, other shapes can be explored; for example, slanted CLT shear walls can allow a slight movement in each wall location while still transferring load. Additionally, this method creates a playful interior.
CLT SHEAR WALL LAYOUT
Slanted CLT shear walls provide the primary means of resisting lateral forces. Walls are located on a standardized grid, maximizing parking and structural efficiency.

BEAM SYSTEM
A network of glu-lam beams intersect shear wall and columns supporting the CLT decking above.

CABLE X-BRACING SYSTEM
Thin cables around the central courtyard and south facade provide additional shear resistance along both the north-south and east-west axes. Cables are placed to the exterior of the structure to keep the interior parking area as open as possible.

STRUCTURAL SYSTEM

EXTERIOR RENDERING
STRUCTURAL DETAILS

1/3 CONNECTION MODEL, right.
CONNECTION DETAIL, opposite.
THE LOOM
3 LAGUAN PARKING GARAGE | SECTION PERSPECTIVE

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THE SITE

The site of the Mass Timber Parking Garage was carved out of the wilderness near the city of Portland. With the construction of the first timber-framed parking garage, architects set out to create a truly unique structure that would represent the future of sustainable design. The architects were inspired by the surrounding nature and designed a building that is both functional and environmentally friendly.

The Willamette River

Flowing through the city, the Willamette River has been a key source of inspiration for designers. The building's design incorporates elements of the river's natural beauty, such as its curve and flow. The architects sought to create a building that is in harmony with the river, rather than competing with it.

MASS TIMBER PARKING GARAGE | THE Loom
The major concept of the structure was to create a wooden monument, an icon of mass timber building for the city of Springfield, utilizing cross laminated timber and glu-lam columns. The parking structure would be a beacon for advanced wood technology and begin to tap into the roots of what will make Oregon a future leader and critical participant in the development of building construction.
A continuous ramp allows for a simple and efficient system for vehicular circulation and parking access, while being easy to access the pedestrian corridor providing safe entrance and exit to the parking garage for users of the building.

The sloping shape of the structure required meticulous planning of the various setback angles to accommodate the form and, more importantly, the automobile.
MASS TIMBER PARKING GARAGE

INTERIOR COURTYARD
A network of steel fins and hangers tie the floorplates into the central structural steel core. This central space allows light to percolate throughout the slanted interior form.

INTERIOR PEDESTRIAN CIRCULATION
Pedestrian circulation is pushed adjacent to the central space, providing a safe corridor to walk to and from one’s automobile, while maintaining the structural form.

EXPLODED AXON OF STRUCTURE
Multiple layers of thick wooden members, beams and columns and CLT decking come together to create the structure, while a CLT core provides lateral stability.
At the street level, the sloping structure keeps the space open, setting precedent for future development.

The lobby space provides a well-lit centrally located access point for the building. Engineered CLT timber is the highlight throughout the project.
The glulam column and beam connection is made through a steel knife plate. This connection strategy helps to create a seamless wood feel and provides fire resilience as the structural connections are insulated within the wooden members.
Panelling takes a proven glu-lam system and pushes it farther with the use of CLT technology in order to showcase new building technologies in mass timber that will be able to compete with the standard pre-cast systems.

Additionally, Panelling presents a simple, efficient, and repeatable design that will stand as an elegant showcase of modern woods construction, engineering, and design.

Kevin Concolino | Seth Sorenson
Despite being the first structure to be built on the new Glenwood development, the parking structure must respond to and accommodate the future growth in the area. Our team looked at both environmental conditions and urban conditions to inform our design.

INITIAL CONCEPTUAL WORK above.

CONCEPT DIAGRAMS

As a part of our design method, many small site models were made to understand the overall size and massing of our proposals.

CONCEPT MODEL opposite.
SITE AND FLOOR PLANS

SITE PLAN

FLOOR PLANS 1-3 above.
Shear wall layout throughout the plan adequately resists seismic shear forces. Care was taken to place structural walls for both performance and spatial definition.
The structure is arranged to provide adequate and efficient space for parking, while material differences in the flooring provide a guide for pedestrian circulation, aiding the overall safety of the space.
NATURAL VENTILATION: PANEL SPACING ALLOWS FOR WINDS TO COOL BUILDING

RAINWATER COLLECTION: COLLECTS IN CISTERN, TREATED, FLOWS TO RIVER

below EAST WEST SECTION

VIEW TO THE WILAMETTE RIVER
PHOTOVOLTAIC PANELS: ON ROOFS AND SHADE STRUCTURES

CO2 REDUCTION: FLY ASH USE IN CONCRETE BASE

below NORTH SOUTH SECTION

VIEWS TO THE PLAZA, HOTEL, AND CONFERENCE CENTER
A glu-lam beam and column intersection detail reveals the steel knife plate connection into the wooden members.

A bay model revealing both the beam and column connection via steel knife plates and steel cable bracing.

above: KNIFE PLATE AND STEEL CABLE CONNECTION DETAIL
The new mass timber parking garage in Glenwood builds upon Oregon’s rich history in the timber industry. Using glu-lams, cross laminated timber, and steel connections, this structure pioneers the use of wood technology in the United States. With invaluable guidance from wood engineering specialists and technical consultants, we designed a mixed use retail and parking garage to serve the future needs of this promising district.
A small conceptual study helped to understand site massing and the program relationship at the very beginning of the design process.

Quick sketches helped to visualize specific moments in the design of the parking garage, specifically the main pedestrian stair we hoped to use as a way to highlight CLT and glu-lam materials as users of the parking garage entered and exited the space.
EGRESS and CIRCULATION
above: EGRESS DIAGRAMS
In mass timber buildings, egress is a key factor in design. We wanted to be sure to create an intuitive and efficient means of exiting the building in the event of fire.

opposite: INTERIOR
Steel guard rails along the perimeter of the parking structure allow light to permeate into the space.
VEHICLE CIRCULATION above.
CIRCULATION PERSPECTIVE opposite.
An all wood staircase at the Northeast corner of the site highlights mass timber construction in an elegant manner, allowing users of the parking space to interact with the material every time they enter the garage.
5/16 SITE MODEL above.
PARKING FLOOR PLANS opposite.
SECTION
below SECTION WITH CONNECTION DETAILS