Biographical Sketch

Drawn to architecture through several interests ranging from community work to set design, Jane Kent pursued the Bachelor of Architecture at Mississippi State University with a minor in English. The semester following her Aydelott travels, she began the Accelerated Master of Landscape Architecture program in tandem with architecture studio. Jane has been involved with multiple research projects over the course of her studies, the first being the exhibition for Fay Jones's unbuilt designs in the Crosby Arboretum. The experience as exhibit coordinator and writer spurred her to join the staff for the School of Architecture's student publication and became the editor-in-chief for the 2019-2020 edition of BARNworks. She is actively involved in the student body in Giles Hall, encouraging conversations surrounding mental health and community involvement. Jane looks forward to continuing her education both formally and individually with the goals of learning how to create healthy, sustainable, and holistic living conditions.

Student:

Jane Kent

Mentor:

Jacob Gines

Buildings:

1. John W. Olver Design Building by Leers Weinzapfel Associates in Amherst, Massachusetts
2. Thorncrown Chapel by E. Fay Jones in Eureka Springs, Arkansas
3. U.S. Naval Air Station Tillamook Hangar B by U.S. Bureau of Yards and Docks in Tillamook, Oregon
4. Old Faithful Inn by Robert C. Reamer in Yellowstone National Park, Wyoming

Institution:

Mississippi State University, College of Architecture, Art, and Design, School of Architecture

Of Timber & the Embodied Americana

A Survey of Structure and Empathetic Design Over 120 Years

"A living material" is a phrase I found often in writings, interviews, monographs, videos when talking about wood. From conversations between Jens Thomas Arnfred and Søren Nielsen of Vandkunsten Architects to writings on the "wooden gods" of Finnish history, the commentary surrounding the product of the forest is vast. As a common material, it has a foothold in nearly every culture across the world, and the depth of feeling that the timber evokes touches back thousands of years.[1]

In the piece *Architecture of the Forest*, Juhani Pallasmaa writes on the qualities of wood as a material, stating:

> The structural strength of wood, its insulating and acoustical qualities, its pleasant tactile character, its variety of texture and colour, together with the ease with which it can be worked and the many ways its surface can be treated, all make it the most versatile of building materials.[2]

This versatility, along with all the other aspects mentioned, creates a dynamic between person and material that elevates the experience of the built place.

This research focuses on the historic and contemporary American application of timber, picked from a variety of regions within the United States: the New England area, the Ozarks, the Pacific Northwest, and the West. Four different kinds of timber construction are explored, unique to both the United States and the local area, ranging over the course of 120 years. By looking through the lens of the intersection between symbolic interaction theory and architecture – a recognition that the built environment informs cultural

interactions between people and with physical place - we can analyze the relationship between structure, maintenance, landscape, empathy, and culture.[3]

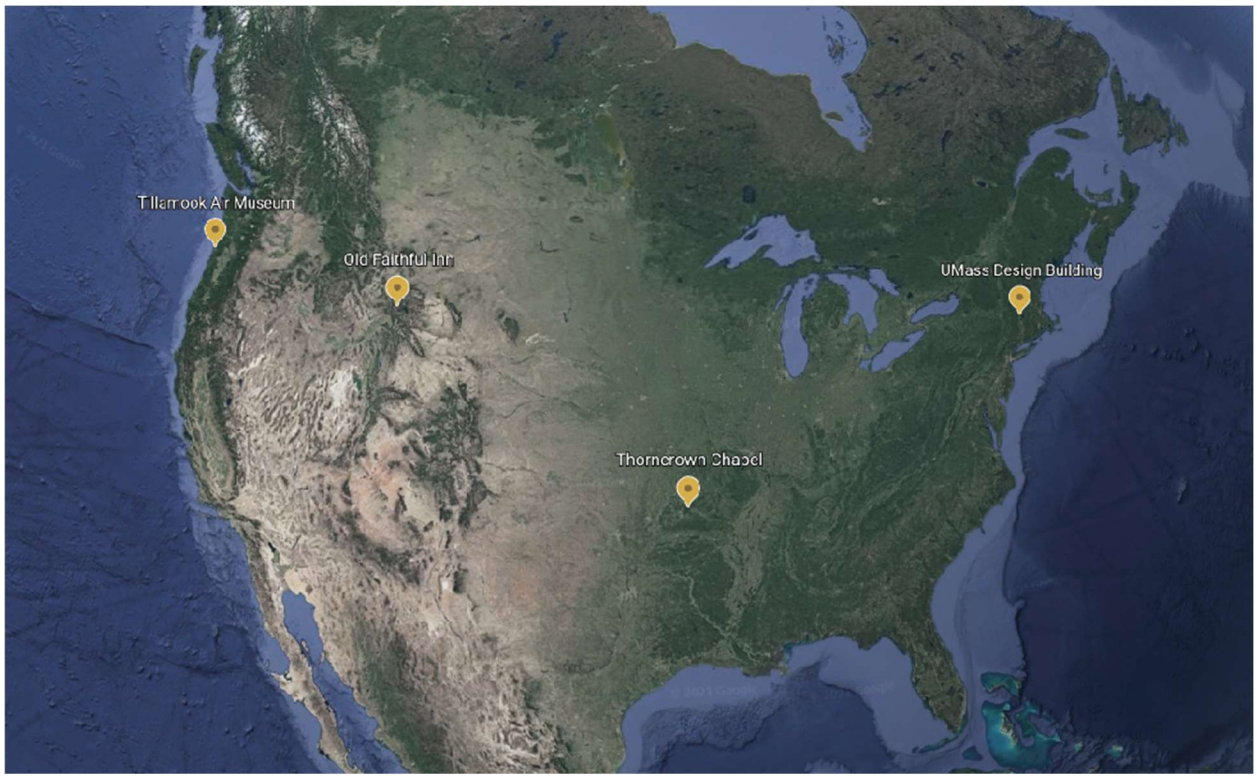


Fig. 1. map of the United States with the locations of buildings studied marked, 2021.

The structures chosen are as follows: John W. Olver Design Building by Leers Weinzapfel Associates in Amherst, Massachusetts; Thorncrown Chapel by E. Fay Jones in Eureka Springs, Arkansas; Naval Air Station Tillamook Hangar B by U.S. Bureau of Yards and Docks in Tillamook, Oregon; and Old Faithful Inn by Robert C. Reamer in Yellowstone National Park. These buildings are different from each other in many aspects – function, age, regional location, scale, etc. – but they share the commonality of timber structure. There are roughly 40 years between each building's construction, starting with the completion of Old Faithful Inn in 1904, the rapid construction of

the Naval Air Station Hangars A and B in 1943, Thorncrown Chapel in 1980, and the completion of the John W. Olver Design Building in 2017.

Wood is a plentiful resource in all the building locations. Its use informs the different styles of architecture, both vernacular and formal. I am particularly interested in the historical and continued use of timber in large scale projects and the current push for use of renewable resources in the face of our present world climate. The secondary characteristics of these projects are the maintenance required for the continued usage of the buildings and the use of local materials in construction.

Each of these three characteristics – timber structure, continued use & maintenance, local and regional materials – show a direct influence on the culture and exist as a historical record of the construction process. Old Faithful Inn with its log structure, Hangar B with its clear-span timber, Thorncrown Chapel with its common materials making an uncommon building, and the John W. Olver Design Building with its cross-laminated timber (CLT) and LEED Gold designation create key points for a survey of timber structures within the continental United States.

I combined my personal experience within the building as a visitor and further research at a distance to help guide this analysis. Throughout my conversations with historians and architects, I looked for answers to these questions, regardless of the differences between these projects: what was the reasoning behind wood as a structural material? How does the building interact with and respond

to the surrounding landscape? What kind of maintenance is required for continued use to be possible?

After experiencing each of the sites, I realized there are other commonalities between them. The orientation of each building surrounds, or is, a centralized open space; a multi-story lobby in Old Faithful Inn, a communal gathering space in the Olver Design Building, the chapel nave, and the enormous height of Hangar B made to house blimps. They all require temporary occupancy of some kind - that of a wayfaring spirit, a student, a visitor in need of rest. These are all aspects that inform a built environment of what it needs to be, and through my research I hope to understand the pieces of these places that make them iconic to American soil.

John W. Olver Design Building

First CLT Mass Timber Academic Building in the United States

Fig. 1. Leers Weinzapfel Associates, standing across the street from the west façade that faces the Fine Arts Center, John W. Olver Design Building, Amherst, MA, 2021.

The overcast sky hung over an empty campus as I leaned against my car, fiddling with my camera lens while I waited. Although no one was walking around, I could hear construction in the distance and there were a scant few cars in the lot with me. It was a strange feeling, being in a college campus made for commotion, for movement and learning, and seeing no one. My visit came at a strange time, both with the pandemic and the few weeks between classes. The spring semester had ended, and it was still a week or so until the summer sessions started, but regardless I was here and curious.

As I approached the copper-colored building, I was met first with the edge of the sidewalk, a far lighter color than the asphalt I'd

parked on, surrounded by a fluffy overgrowth of shrubs on either side. Along the sidewalk were large, flat cut pieces of stone that looked the perfect height to be a bench. Even before entering, I could see the difference between the places of rest, path, and the green not meant for either. I caught eyes with a professor inside the building watching me take countless pictures. Sheepishly, I gestured to the locked door handle, and he laughed, guiding me inside to the space that drew me here to begin with.

Fig. 2. Leers Weinzapfel Associates, view of the east façade that faces the historic district of the UMass campus, John W. Olver Design Building, Amherst, MA, 2021.
Fig. 3. Leers Weinzapfel Associates, under the overhang facing the large rocks on the side of the exterior paths, John W. Olver Design Building, Amherst, MA, 2021.

Timber Structure

Past two sets of glass doors, the path opened up into the Commons, a two-story interior courtyard the three academic programs housed here are centered around. The building is trapezoidal in plan - the east entrance I came in through being the narrower end and expanding towards the west. Walking into this open space, the zipper truss that hovers above the room has a captivating presence. The floor stepped down from where I stood, a path to the left side leading to the west facade's entrance doors - the ones that face the Fine Arts Center of campus. As the center of the floor descended, it created a

series of benches. To the right was a staircase suspended from the roof, leading up to each floor in a long ascending line.

Fig. 4. Leers Weinzapfel Associates, picture of the Commons looking up towards the zipper truss supporting the ceiling, John W. Olver Design Building, Amherst, MA, 2021.

As my eyes traced over the room, the structure of the place was clear. An innovative, ambitious project, the John W. Olver Design Building was Leers Weinzapfel Associates' first mass timber project. Tom Chung, Principal at LWA and lead designer of this project, walked with me through the building, showing me the structural components not as visible as others and talking about the process. For the truss, the massive steel connectors work with the CNC-cut, turned glulams, the weight being pulled from the bracing to the edges of the room where the truss is supported by cross-laminated timber columns. "From Concept to Construction," an exhibit on the creation and design of the Olver Design Building, the description stands:

In concept, the structure is quite simple: each span is divided into equal thirds and at these third points, the loads are transferred to diagonal wood compression members which meet at the middle. The forces in compression are then transferred by steel tension rods to the end points of the truss beam where they are supported by columns along the south side and by a large steel truss along the north.[4]

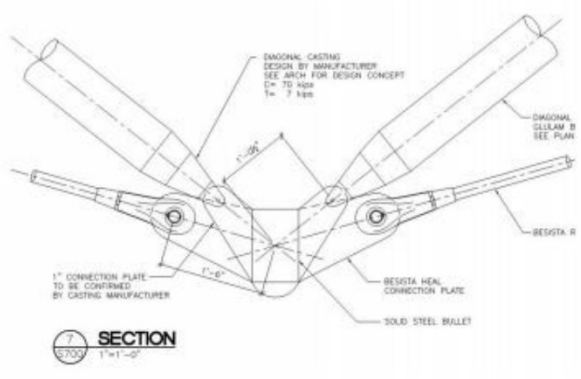


Fig. 5. Leers Weinzapfel Associates, detail drawing of the truss connection, John W. Olver Design Building, Amherst, MA, 2017.[5]
Fig. 6. Leers Weinzapfel Associates, view from directly under one of the zipper truss connections, John W. Olver Design Building, Amherst, MA, 2021.
Fig. 7. Leers Weinzapfel Associates, view looking at the entire zipper truss in a row, John W. Olver Design Building, Amherst, MA, 2021.

This steel truss mentioned isn't visible from the ground level when you walk in - it's only seen when you walk up the CLT stairs to the third floor where the truss stands on the inside of the glass wall bordering the roof garden. As we walked up the stairs, Chung pointed out the massive steel truss sitting on two CLT columns leading from the bottom of the third floor down to the foundation. The truss was made to support the suspended staircase and leave the expanse below free of the columns seen on the south side of the commons.

While one of the most visible parts, the zipper truss and its supports are still only some of the teaching aspects of the building. When I stood in the centralized common space, I could see that the display and communal gathering serves as an anchor point to the learning and educational process. The three programs this building was made for are from three separate colleges: Landscape Architecture & Regional Planning from the College of Social and Behavioral Sciences, the Department of Architecture from the College of Humanities and Fine Arts, and the Building Construction Technology program from the College of Natural Sciences. Despite being separated into three different colleges, these industries work together in the field, and did so on this project with much collaboration between firms and professors. The physical spaces were made to be learned from, as LWA Principal Andrea Leers said:

> "We imagined this building as a teaching tool for the design disciplines. I know from my own teaching experience that there's nothing more potent than being able to talk with students about the space around you—in this case, the collaborative configuration, innovative structure, considered material and detailing choices, environmentally-driven site, and synergistic landscape concepts that define the project."[6]

These concepts directly inform the built environment and how students interact with it. It has also changed how we think about CLT buildings and what they're capable of. In the initial design phases of the project, the structure was steel as was standard on the University of Massachusetts's campus, but after conversations between LWA, the university, the state, and support from Former Congressman John W. Olver, the building's structure shifted. Steel posts and beams were changed to glulam; the floors, the deck roof, the shafts all changed to CLT, and the steel braces were changed to Glulam braces. The floors specifically were CLT-concrete composites, a small summation of how concrete, steel, and wood work together in this building.

Fig. 8-9. Leers Weinzapfel Associates, views of the large steel truss that supports the north side of the zipper truss, John W. Olver Design Building, Amherst, MA, 2021.
Fig. 10-11. Leers Weinzapfel Associates, detail photographs of the CLT staircase that is suspended from the edge of the zipper truss and bottom of the steel truss, John W. Olver Design Building, Amherst, MA, 2021.

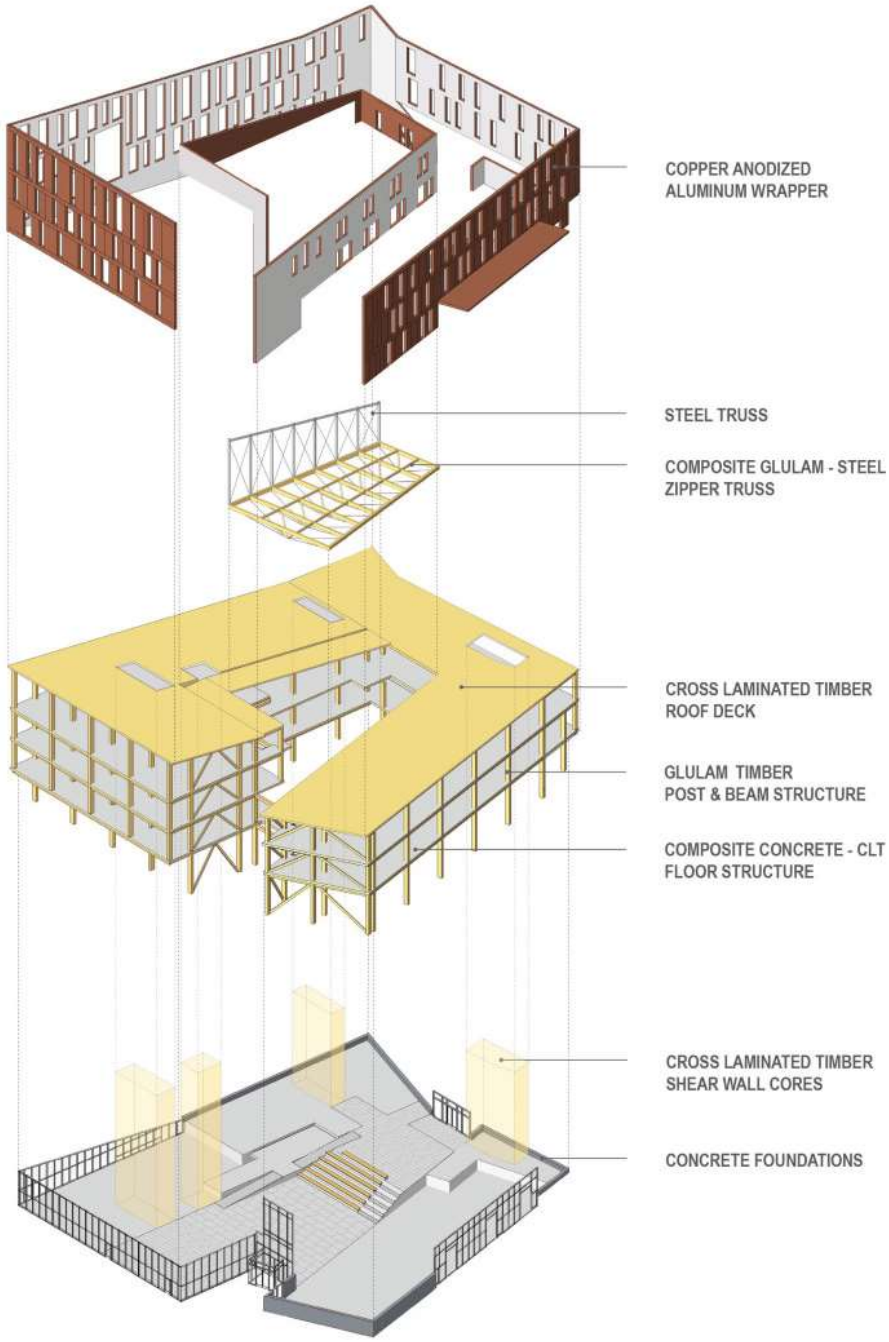


Fig. 12. Leers Weinzapfel Associates, exploded axonometric of the structural aspects of Olver Design Building, John W. Olver Design Building, Amherst, MA, 2017.[7]

Interaction with Landscape

The emphasis on interdisciplinary collaboration worked well with the site proposed on campus; here the building sits at the

intersection between the eastern, historic side of campus and the Fine Arts Center to the west. This conjunction was met with a unique form of the Design Building. To adjust to the scale of each district, it's three stories to the east, from the parking lot and entrance I first came in through, and it's four stories to the west, visible from the grassy area in front of the Fine Arts Center. There is a clear boundary between the site and the surrounding context, but this has less to do with design aimed towards the existing site and more to be prepared for the coming built environment based on the UMass masterplan.

Surrounding the building and on the roof, there is a reinforcement of path - there are places we dwell and occupy, there are places flora and fauna occupy, and there are places we share. There are clearly defined spaces within and without the building as to what is human occupied and what is non-human, but I wonder about the shared spaces. Notes from LWA on this project suggest an aim to pull the wilderness on the eastern edge of the campus, not too far off from the site to the building. I'm curious, is that something that can be brought into campus architecture like this? How about elsewhere?

Fig. 13. Leers Weinzapfel Associates, pedestrian path and stormwater management principles on the north side of the ODB, John W. Olver Design Building, Amherst, MA, 2021.
Fig. 14. Leers Weinzapfel Associates, southeast corner of ODB shows the fluffy greenery on the side of the path closest to the building and short grass on the side farthest, Amherst, MA, 2021.

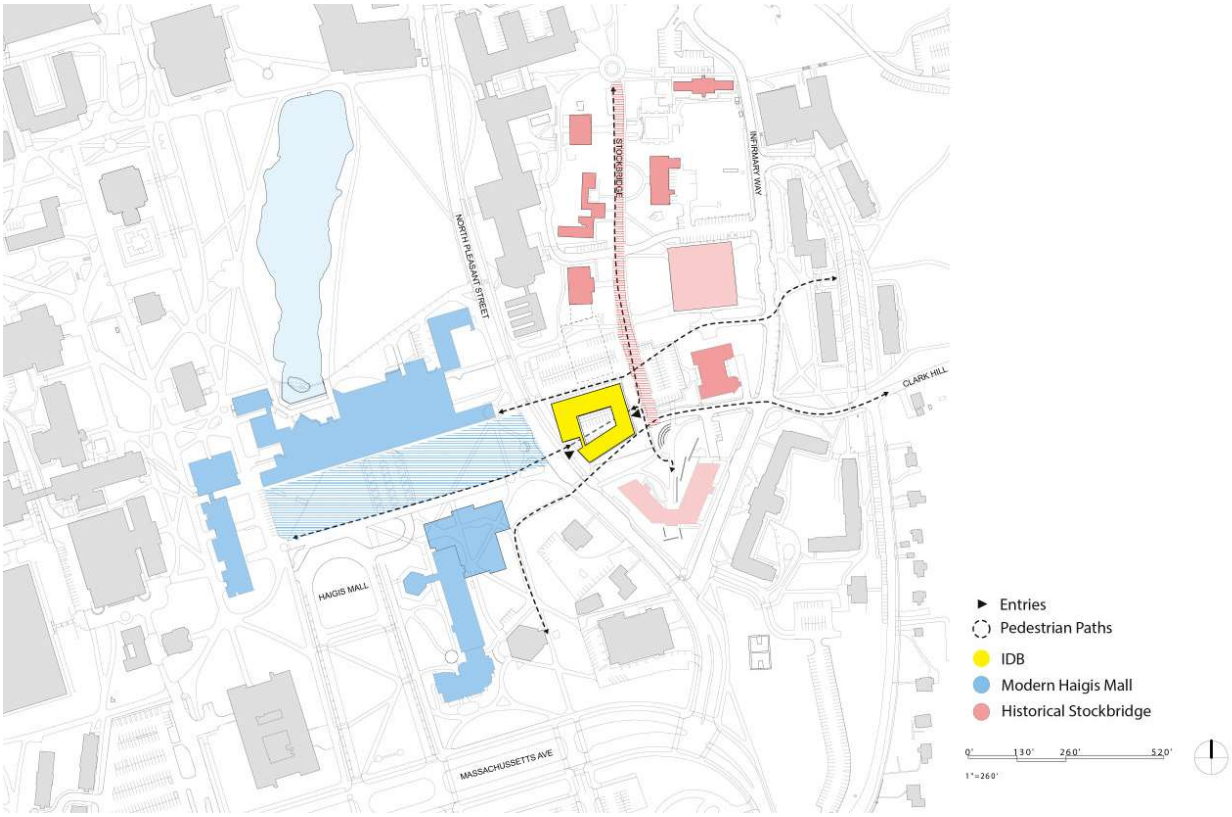


Fig. 15. Leers Weinzapfel Associates, map of the UMass campus with the key location of ODB displayed in yellow, John W. Olver Design Building, Amherst, MA, 2017.[8]

Use of local stone as resting points surrounding the building coupled with the layered stone cladding at the base of the aluminum paneling creates an anchoring in the land. The superstructure made of majority CLT gives the structure a combined, forest-like cluster, and the overall paneling system encompassing the building was chosen to mimic the "color and patterns of forest and trees of the region."[9] One of the reasons for using a wood superstructure is how it fits with the region, described in a case study of the Olver Design Building as this: “the historical context at UMass and in the region features many wood frame houses, heavy-timber buildings, and even wooden road structures such as covered bridges.”[10] Following this reasoning, the building is a physical and metaphorical extension of the region.

Bringing the environment into this structure was designed into another location - the roof garden. The design of this cloister-like space was drastically changed when the steel structure was adjusted to CLT, having to go from designing with 3 feet of soil depth to handling 6 inches of soil depth in some places, but the plant life was still that of an alpine meadow. In the center of the garden, two pyramidal skylights pull up from the interior, an inversion of the shape of the zipper truss supporting from below. The combination of diverse plants, exterior common space, and visible stormwater management creates a built learning environment that parallels an unbuilt one.

Fig. 16. Leers Weinzapfel Associates, roof garden facing the third and fourth floor outcropping, John W. Olver Design Building, Amherst, MA, 2021.

On note of stormwater management, this is another example of integrative design present. The drainage system from the top of the

roof and the roof garden flows to a "'spring source' at the top of the site, filtering the water through bioswales and timber dams to the site's lower end and back to the Connecticut River."[11] This flow of water was visible not just as I walked around the building, but in diagrams displayed at key bioswales and gardens while walking - another chance to educate passersby and not just students from within the building.

Fig. 17. Leers Weinzapfel Associates, downspout on the east façade, John W. Olver Design Building, Amherst, MA, 2021.
Fig. 18. Leers Weinzapfel Associates, view of the bioswale's growth and sheltering between the building and the pedestrian walkway, John W. Olver Design Building, Amherst, MA, 2021.

Continued Use & Maintenance

Four years after the completion of construction, I walked the exterior and interior of the building. The greenery planted had thrived. The wood paneling underside where the facade pushed out to create shelter was still vibrant. The aluminum rainscreen cladding, the glass curtain walls both clean and appealing, this was a building cared for and designed for ease of maintenance. Inside, the massive glulam columns didn't touch the floor; there are several inches of space between where the steel connector anchors the column in the foundation. Intentionally designed for ease of cleaning, this kind of

spacing between column and floor is present throughout the building. This also reduces wear and tear on the wood from passersby.

As we walked up around the second floor, I asked about writing on the walls or columns, students tempted to leave their mark on the building. Chung laughed and gestured to a bench we were approaching, a glulam column left over from construction reused as seating outside the administration offices. There were different colored scribbles covering the thing. "We all signed it," Tom says, referring to the architects and builders, everyone involved in the creation of the building. "The graduating students come by and sign it before they leave." This small vandalism and rite of passage fit the campus, and I was warmed by the sight of the signatures in front of me.



Fig. 19. Leers Weinzapfel Associates, bottom of glulam column in the Commons, John W. Olver Design Building, Amherst, MA, 2021.
Fig. 20-21. Leers Weinzapfel Associates, bench with student signatures, John W. Olver Design Building, Amherst, MA, 2021.

We passed through the hallway joining the administration offices, and I noticed darker lines in the concrete floor. When I pointed them out, Tom said they were from the construction process. While everything settled exposed to the elements, the concrete pulled apart a bit in this area, and it had to be filled in afterwards. Due to the structure of the CLT-composite floors, it didn't indicate a structural issue, just an aesthetic one. The same kind of cracks from exposure are visible on the underside of the CLT staircase.

In 2020, the AIA analyzed the building for its sustainability impact, both in how it uses passive design "while incorporating strategic engineering solutions to minimize energy use."[12] Several key findings show the impact of this project, such as how the academic building uses 54% less energy that the average university building. This comes from many different design strategies, like the use of the anodized aluminum rainscreen, the radiant floor system used in the central commons, and the use of natural light throughout the building. The efficiency of this building directly affects the maintenance of it, and I look forward to seeing how this building ages over the next decades as well as what we can learn from it.

Conclusion

The John W. Olver Design Building has won a long list of awards, the most recent being that of the AIA COTE Top Ten Award in 2020. Multiple case studies have already started the continued observation of this building. This was a first in the United States for many things - the first and largest mass timber academic building, one of the first projects to use the CLT-concrete composite floor system. It pushed the boundaries of what we consider sustainable and mainstream design and construction. This building showed the cost effectiveness of design with the environment and strengths of materials considered at every step of the way. It also shows another shift in industry, moving from on-site fabrication to more accurate and faster prefabricated construction processes.

Again, I'm curious as to what this means in the scheme of things. By making decisions like this, the industry removes the necessity of

craftsmen who know the material, moving to computational strategies for design and relying on engineers and architects to design. Is this similar to the industrialization of daily commodities like hand towels, cups, and clothes? What does this say about the industry changes for architects? Is the response to find the beauty and intricacies in structural detail like in how the zipper truss here works? This building's design and construction works within the contemporary American culture around digitization and industrialization. As we push further into this kind of architecture, we have the opportunity to learn from buildings like this.

For students, this is a teaching building. On a larger scale, this building demonstrates what CLT is capable of for a similar price value to steel and concrete with a lower carbon footprint - something necessary to recognize for building innovation moving forward in the face of the rapidly changing climate and industry. As mentioned before, the push for a mass timber superstructure to replace the original steel was finally realized when former Congressman John W. Olver "intervened and argued that this structure and the use of wood could support the rural forest economies in Massachusetts, that a $3M guarantee was put in place by the legislature."[13] Due to how and when it was constructed, this building will likely be used as a case study for years to come for innovative construction, energy efficiency, and site integration.

Thorncrown Chapel

Repetition of Standard Lumber within a Sacred Space

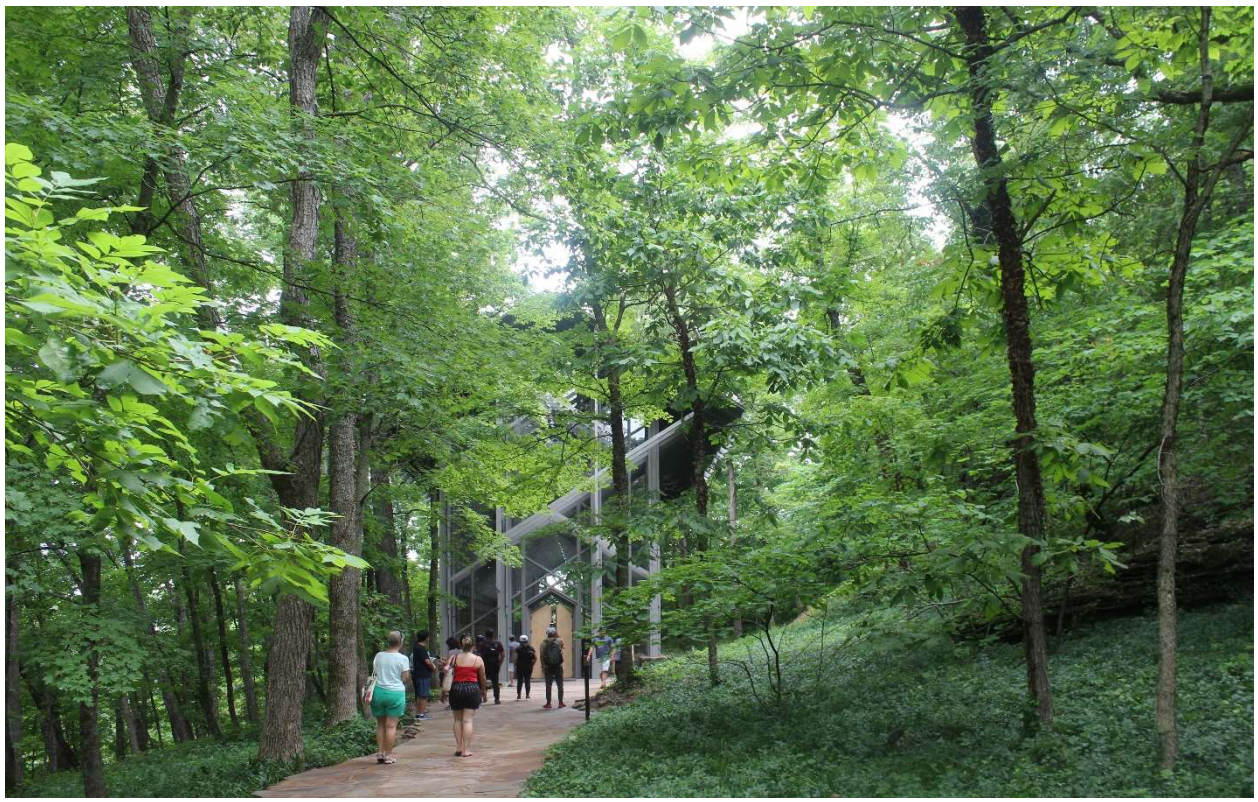


Fig. 1. E. Fay Jones, view of the front elevation halfway down the single path to the chapel, Thorncrown Chapel, Eureka Springs, AR, 2021.

The late June humidity stuck to me like a second skin as I left my car, stepping through the gravel towards what I knew to be the chapel. I could see road and some scattering of cars for the 9 o'clock Sunday service, but I was late by some minutes and alone in the parking lot. Through the trees to the north, I could see the beginnings of a stone path and a small building. What I couldn't see was the chapel, but I hurried forward anyways. Rounding the corner near the smaller structure, I could see parts of the chapel peeking through the leaves and branches, the soft grey-brown coloring of the wood letting me know I was walking in the right direction. Although I knew I was late for the service, the surrounding woods almost kept me

outside - it's hard to describe just how green the place was. The path straightened out, with only gentle curves moving with the ground leading to the great entrance doors, and then I could see it. Or rather, almost all of it. The trees' lower branches reached over the leading stones on either side, shading me even more from the overcast sky and creating a full canopy as I neared the building. Ahead of me were the light toned, angular wooden doors that shielded the interior of the chapel from my view on the path. When I reached the doors and pulled the handle, I tried my best to make no noise and made eye contact with the attendant sitting in the back pews. She smiled and gestured me forwards into the nave, and as I finally sat down in the chilled interior and looked up, I was immediately enraptured with the sight before me.

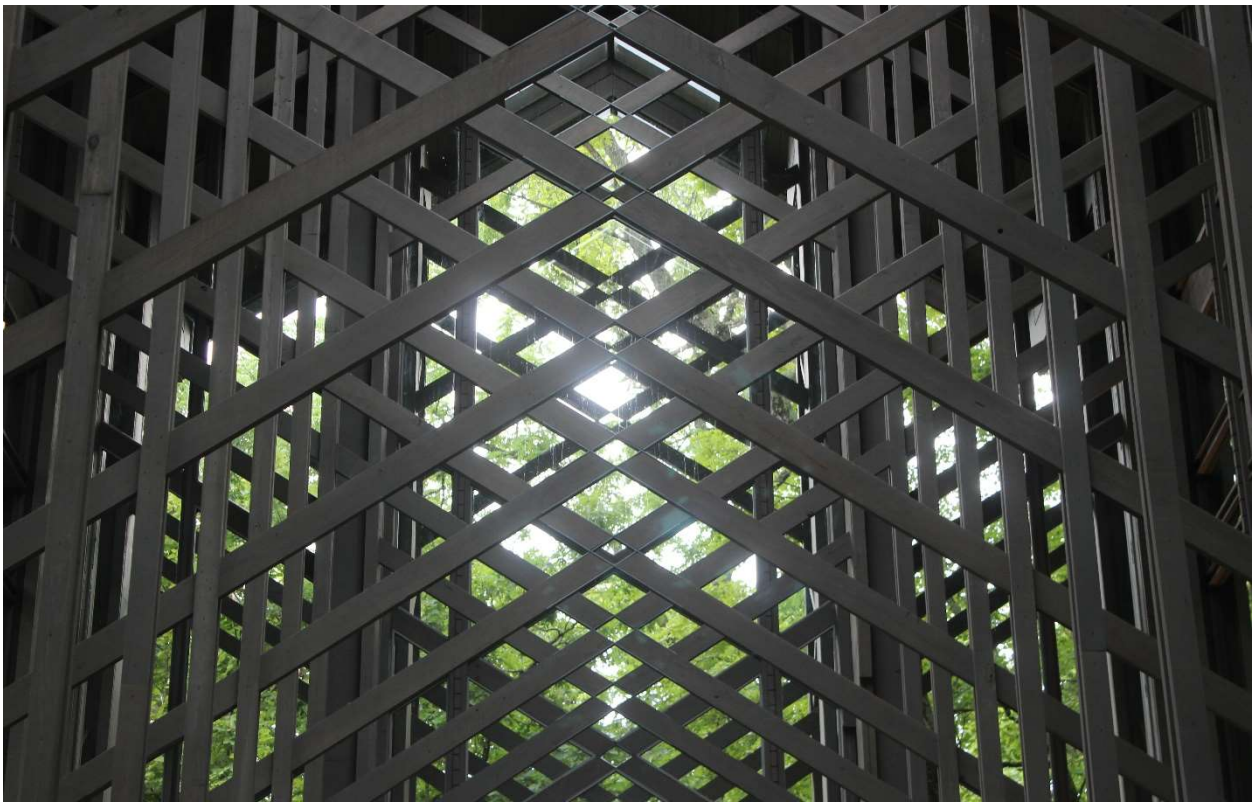


Fig. 2. E. Fay Jones, wooden structural connections in the interior of the chapel, Thorncrown Chapel, Eureka Springs, AR, 2021.

Timber Structure

This was the sacred space architect E. Fay Jones described as an inversion of gothic design "through changes in materials, and by making a tensile structure rather than a compressive one."[14] Rows upon rows of clean wooden connections filled the space above my head, seemingly an extension of the branches that shielded me on my way inside. In an interview with William Lake Douglass in '83, Jones spoke on the choice of utilizing standard lumber sizes in construction:

> Thorncrown Chapel, in Eureka Springs, is as good a demonstration as I have come up with of the 'organic,' of having every part and every piece play a technical role, as well as participate in the central idea. We put the Chapel in a very restricted site with limited access; and we tried to leave much of that natural place undamaged. This meant we had to build with small pieces that could be brought in over a trail through the woods. No piece of the building could be too big for a couple of men to carry in. But the 2 x 4s and 2 x 6s had to be put together in a well crafted way, with a great degree of accuracy because of the repetition of pieces.[15]

The standard sizes of the southern pine work in a framing that is both sound and elegant – moving past the structural necessity and into a delicate ornamental design with vertical members draping down to hover above the heads of those seated in the pews. The on-site assembly of the trusses adds an element of imagined tactility, the understanding that although the bracing is out of reach now, it had to be touched during construction and grew from there.

The lumber crossed themselves repeatedly to create a woven canopy, having been described by architect and professor Robert McCarter as "linear elements interlacing to form the diaphanous enclosure of the ceiling and walls, the cascading three-dimensional spatial structure floating overhead while our feet rest on the simple

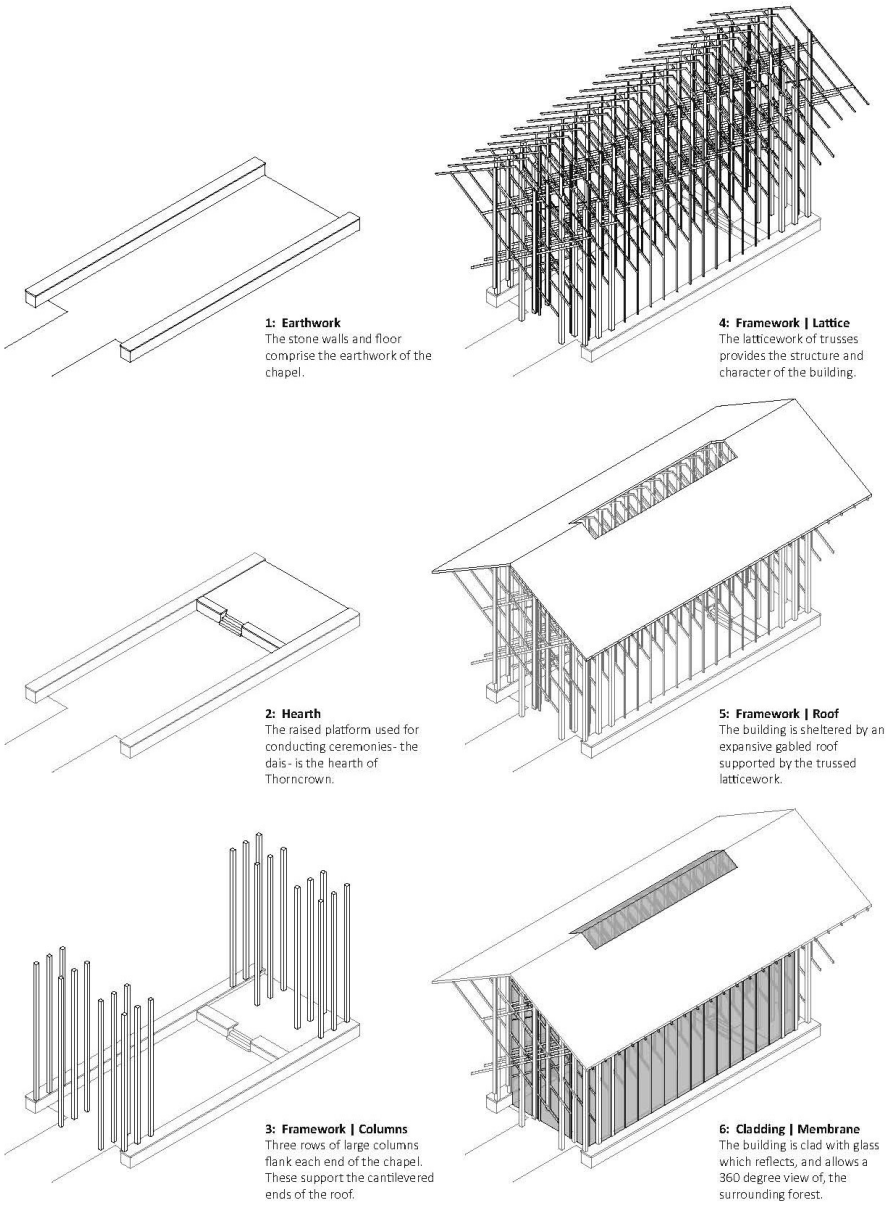


Fig. 3. E. Fay Jones, diagram of structural components of Thorncrown Chapel from *Introduction to Architectural Tectonics*, Eureka Springs, AR, 2021.[16]

and quiet stone floor."[17] Visible within this structural assembly were the bracing connections, a quiet display of the strength in the wood. At the meeting of opposite structural members, there is a void. What one would think is the primary point of stress in the structure is gone – instead, the timber is bracing with a rhomboid shaped steel connection, plating on either side of the wood as it reaches for the

center point. As described by Chad Schwartz, the joint works with the load transfer and "distorts the perception of the stability of the structure while assisting in the perception of the floating of the building's roof."[18] Schwartz describes the two main motifs present in the chapel as that of the cross – visible in the lanterns and lectern – and of a rhomboid motif, best exemplified through the steel connections, but seen everywhere in the building, from the ever present bracing to the door to the windows and mullions.

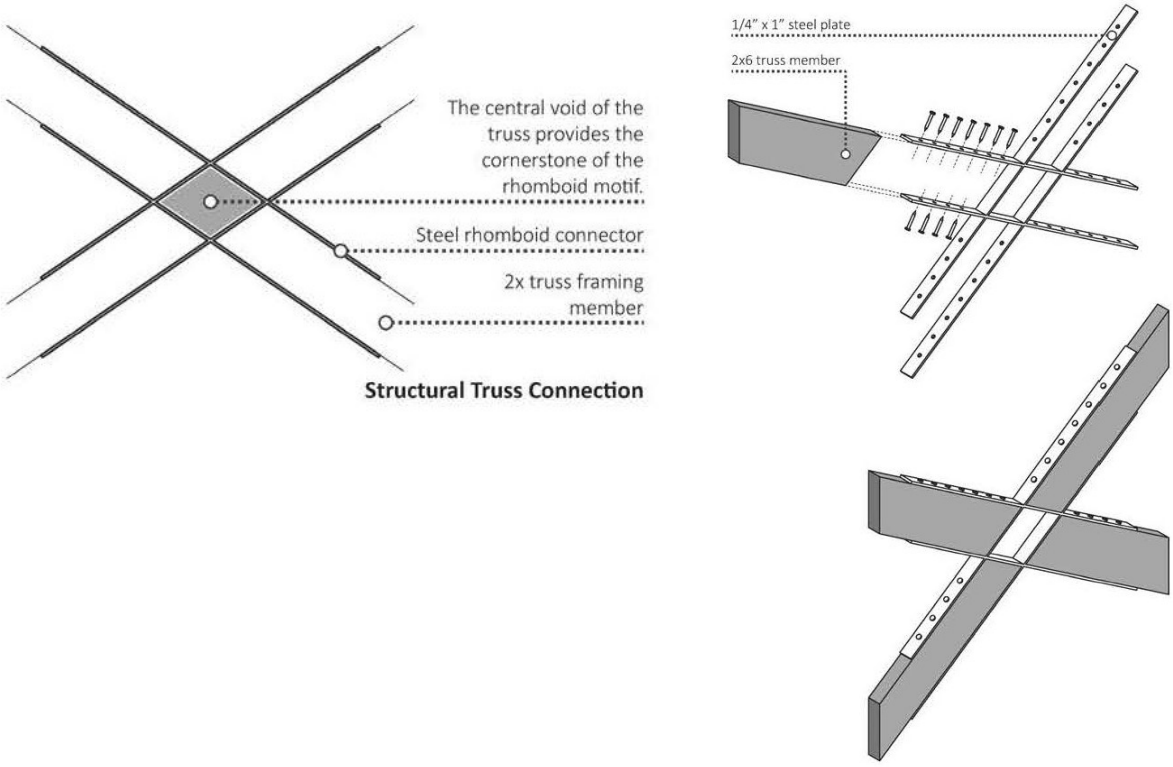


Fig. 4. E. Fay Jones, structural truss connection diagram (left) and truss connection detail (right), Eureka Springs, AR, 2021.[19]

As taken as I was in the repetitious connection of the wood, my eye was drawn further up into the startling height of the space. The timber members pulled from the exterior walls into the center of the building; the structure entirely inside instead of supported from the

exterior like traditional Gothic buttressing. Here is where I could truly grasp the connection between Jones's precedent of Sainte Chappelle in Paris and Thorncrown Chapel, the connection between them a part of what had Jones calling Thorncrown "Ozark Gothic." Both chapels are single room structures, with the intention of being a sanctuary of meditation for the passing traveler. While Sainte Chappelle is 32 feet by 99 feet, Thorncrown is 24 feet by 60 feet, 48 feet tall. Sainte Chappelle was built to house the Crown of Thorns and was such an inspiration for Jones that it became the smaller chapel's namesake.[20]

Following the bracing up to the ceiling, I reached the apex of the gable roof to find a skylight that illuminated the room, allowing for a clear view of the overcast day. In *Fay Jones: the Architecture of E. Fay Jones,* Robert Ivy describes more of the precedence in Saint Chappelle:

> A kaleidoscope of leaves and sky, seen through tall, clear walls and overhead skylights, suggest Sainte Chappelle's stained lancet windows. Jones, who says he "saw the potential for light play on the structure," enlarged the skylight on the roof's ridge to increase "the sense of drama."[21]

Fig. 5. E. Fay Jones, view of the cross bracing from a seated position in the pews, Thorncrown Chapel, Eureka Springs, AR, 2021.
Fig. 6. E. Fay Jones, window mullions, Thorncrown Chapel, Eureka Springs, AR, 2021.

Although I have read multiple times of the stunning quality of the shadows cast by the wood framing and the presence of the sunlight on the flagstone, that was something I didn't see for myself. Instead, the heaviness of the clouds in the sky prevented me from seeing those dramatic shades but did offer a clearer view of the connections. The lack of glare maintained the illusion of sitting in the trees.

Interaction with Landscape

Despite the inverse form of this buttressing – or maybe because of it – the repeated bracing lends itself to a sense of anchoring, of groundedness. For a building that could be perceived as top heavy, I felt encompassed by the form created. The canopy of the wooden members above my head were connected to the ground by these layered wooden columns, and the columns themselves led to a stacked fieldstone wall. The walls run the full length of the chapel from the entrance to the podium on either side of the pews. The material choice here is deliberate as well, something Dr. Karen Cordes Spence described in *Presence and Absence*:

> Religious or not, there is a familiarity about this type of structure in the landscape, witnessed in the history or individuals who have been either brave or naive enough to attempt to settle the rocky hills of the Ozarks. Connections are also made to the natural surroundings as the stone walks and low walls reflect the rocks that are found both underfoot and in ledges that protrude from the rolling terrain. Anyone who walks through an Ozarks forest recognizes both the materials and the forms.[22]

On the east side, the stones acted as retaining wall - I could see the slope from the edge of the hill meeting the stacked pieces. On the west, the wall shifted the sightline up; I couldn't see the ground, but I could see the forest stretching out until there was an endless layering of branches, trunks, and leaves. Once again, the green was a

surrounding force, visible through the glass on all sides of the chapel. The materiality of the flagstone floors and fieldstone retaining walls acted as connection to the site just as much as the trunk-like wooden columns.

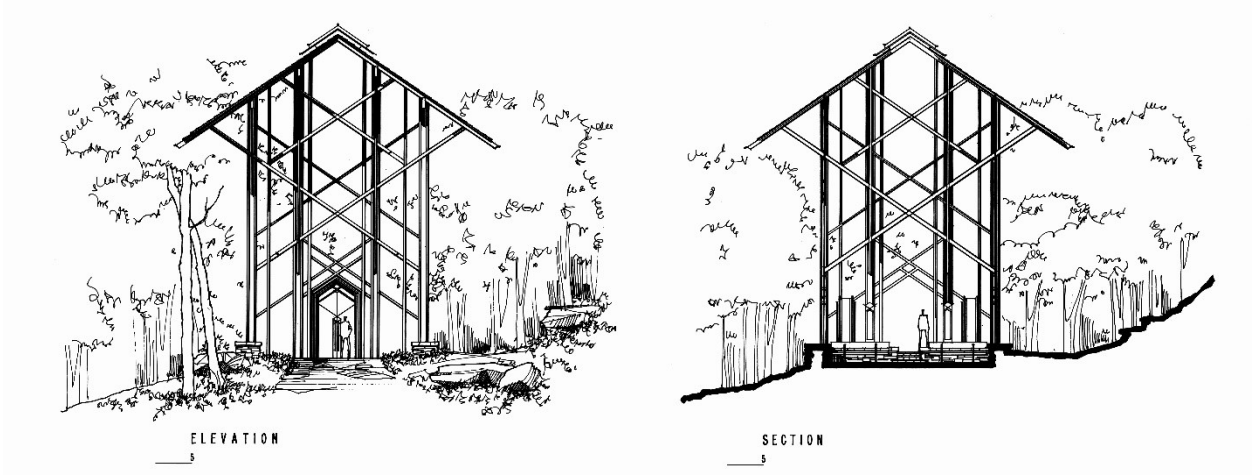


Fig. 7. E. Fay Jones, elevation and section drawing, Eureka Springs, AR, 1980.[23]

Fig. 8. E. Fay Jones, view towards the west from inside the chapel looking at some of the 12 lanterns and the forest beyond, Thorncrown Chapel, Eureka Springs, AR, 2021.

When asked about influences on his designs, Jones said "Frank Lloyd Wright and the principles of organic architecture have had the greatest influence on my architecture. Those principles have to do with relating, symbiotically, a building to its site, and with displaying and using materials honestly."[24] This symbiotic relationship between building and environment is visible both in plan and section as the walls and floor create an intervention in the site that works with the surrounding environment – not interrupting the movement in the forest. This connectivity to the environment is also exemplified by just how much glass defined the single room. The structure of the building was wood anchored in native stone, and in between the wooden columns and bracings were hundreds of pieces of glass - over 6,000 square feet of glass broken up into 425 separate windows. The transparency coupled with the trunk-like columns supporting the roof and walls made me feel like I was in the forest itself, not just in the chapel.

Continued Use & Maintenance

As I was being entranced by the forest and her building, the sermon began. The sound of the piano filled a cavity I hadn't noticed was there. The man led the congregation in several songs. As we stood and sang, I looked out the windows again and watched as the wind moved the flora, and I found myself wanting to be a bird or a squirrel so I could see the chapel from the heights and crevices. What hidden gems did the critters see that we couldn’t? But it felt like there was a way we as people were meant to experience this place, with its singular path and its symbiosis with the forest.

Another man came forward. Pastor Doug Reed began to speak, telling the story of Thorncrown and his father, Jim Reed. Doug Reed has been the pastor for Thorncrown's wayfarers for over thirty years, but Jim Reed was the founder of the chapel and reached out to Fay Jones to design the space. In an article released when Thorncrown Chapel won the AIA 2006 Twenty-five Year Award, the origins of the chapel site are described:

> In 1971 Reed purchased the land that is now the site of the chapel to build his retirement cabin. However, other people admired the location and would stop at his property to view the beautiful Ozark hills. "It became evident to us that the tourists liked our driveway," Dell Reed, widow of Jim Reed, said in a 2004 interview. "They would come into our driveway and have picnics. One afternoon Jim said 'wouldn't it be great if somehow, way back in the woods, we could build those folks a glass chapel?' They all seem to want to get off the highway and into the woods."[25]

As the pastor spoke, I recognized Thorncrown Chapel is a traveler's church - there isn't one continuous congregation. With something over 2,000 visitors a day at the peak season, how could there be? When I looked around the handful of people who had made it out to the service in early morning, I saw a variety of folks - some bikers whose motorcycles I'd passed coming in, a handful of couples both older and young - and regardless of our differences, we had all decided to make the trip to see this glass chapel in the woods.

The sermon continued, and while my ears listened, my eyes wandered past the pastor's shoulder through the glass behind the raised floor under the podium. Right before the thick of the woods began again, there was a cross rooted in the ground. Just off center of the chapel, from where I was sitting in the left pews, it lined up perfectly in my eyesight with the peak of the wooden mullions bracing

the glass and I couldn't help but grin. I knew I had to try and take a picture of this piece, but I also knew it was going to be lost in the greenery behind it. With that small treasure in my mind, I looked around the chapel.

There's an ethereal yet humble quality to the site. As I left the building after the sermon, I wanted to walk around the back, into the forest itself, climb a tree, anything to feel more tactile, but the singular path did not wrap around the chapel, and the multitude of signs saying "please do not walk past this point" at the edges of the stone kept visitors in line. People milled past me, staying on the path, a show of respect.

The chapel exists off donations only, so it's a direct representation of the care the culture has for the building and environment that was created to be a place for meditation.

Over the years, there is the expected level of maintenance: cleaning of the hundreds of glass panels, keeping the stones polished, removing cobwebs as they form. Any storm or snow damage to the roof would have been met with replacement of shingles, but there hasn't been any large damage caused. When I was walking inside, I looked for signs of repair and found very little, but I did see an orange cluster of dripping from the timber draped down over the congregation. This could be issues with the sealing and treatment of the wood, or in a worse case, if the sap is mixed with sawdust, this could indicate the presence of carpenter bees. Such is the trouble with a building in the woods, but it is understandably worth it for an experience like this one.

Fig. 9. E. Fay Jones, looking past the raised floor for the pastor's podium into the woods behind, faintly visible is the steel cross embedded in the ground, Thorncrown Chapel, Eureka Springs, AR, 2021.

Conclusion

It’s typical for buildings and sites to be placed on the National Historic Register of Places at least 50 years after they're built - Thorncrown Chapel was added within 20 years. Among many other accolades, the chapel received the 2006 AIA Twenty-five Year Award, a national AIA Honor Award in 1981, and is considered one of the 20th century’s greatest works of art. This was E. Fay Jones’s first chapel and would define the style he described as “Ozark Gothic,” represented in many of his structures following this one. Robert Ivy describes Thorncrown’s architectural language as American, “tied to place and time, and… emerges from and evokes the American landscape and spirit.” The precedence of this kind of building comes from the land and environment itself.

U.S. Naval Air Station Tillamook Hangar B

Timber Trusses and the Feat of Structural Engineering

Fig. 1. View from northwest of hangar from a mile away before entering site, Tillamook, OR, 2021.

After driving down the coast where the Pacific meets the cliffs, weaving in and out of tsunami zones, the road flattened out onto farmland. North of Tillamook, there's a town - a village really - named Garibaldi, and north of that is Rockaway, and so the pockets of people stretch dotted along the railroad that follows the continent's edge. The tracks kept me company as I drove towards Tillamook and then even after leaving the last buildings on the road, the wood and steel led me to the hangar.

The highway out of the city curved around a bend of trees, and directly down the road I could see the structure - the words AIR MUSEUM were painted on the side, sections of lighter tin showing in

the surrounding rust. Even three miles away, I could tell it was massive, but the actual scale of the place is difficult to comprehend. It wasn't until I walked inside the building itself and bent my neck as far back as it could go that I recognized the true monumentality of this hangar.

Fig. 2. Exterior views of the hangar, disrepair visible, Tillamook, OR, 2021.

Timber Structure

This structure was the last building of the four that I visited, and although I had been tempted to use the word "cavernous" to describe the open, central spaces in each building before this, it really only applies to this one. Standing outside the building was diminishing enough but walking into the arched structure where dirigibles (blimps) had been stored 80 years prior had me feeling quite small. Reaching 170 feet above my head was the apex of the complex truss system that spanned the building, 1050 feet long, 296 feet wide. The few spotlights aimed towards the ground, hoping to illuminate the trusses or perhaps the floor, created deep shadows within the timbers making it difficult to capture any decent photos. Seven acres of pavement is housed under the system, not including the two stories on either side of the central storage initially intended

for offices and other utilities. There are 51 double-arched frames, cleverly engineered out of timber ranging from 3 inches by 8 feet to 6 inches by 14 feet, connecting to form a rigid frame capable of spanning large distances and large heights.[26]

The central space inside the hangar is divided into two main uses: exhibition space for the Tillamook Air Museum, with displays of aircraft, a train engine, a variety of historic fire trucks, and what looked like rented-out storage space. Outside of the hangar's south side - past the public access of the museum on the north side - there were piles of logs; it's likely the second half of the hangar is used somehow for the forestry industry, too.

A railroad track cuts through the center of the hangar, laid down for ease of delivering materials when servicing the blimps as well as during the construction process itself. Functionally speaking, the hangars have been described as such:

> The hangars were constructed in three main sections; two identical supporting structures of concrete located at each end of the hangar with a massive center section covered by a wood-framed, 484,932 square-foot arched roof. The end sections consists of two pillars, six huge doors and a brace connecting the two pillars at the top. The pillars are used as "pockets" to house the hangar doors (three in each pillar). The brace is also used as a guide for opening and closing the doors.[27]

By sheer volume of wood used and the "dimensional magnitude," the hangars were counted as some of the largest buildings in the world. Hangar B as it still stands is the largest clear-span timber structure in the world, only comparable to the other hangars built with the same plans.[28] The other materials are concrete for the foundation, and asphalt and galvanized tin for the roofing, two layers measuring in upwards of 13 acres of tin per layer.

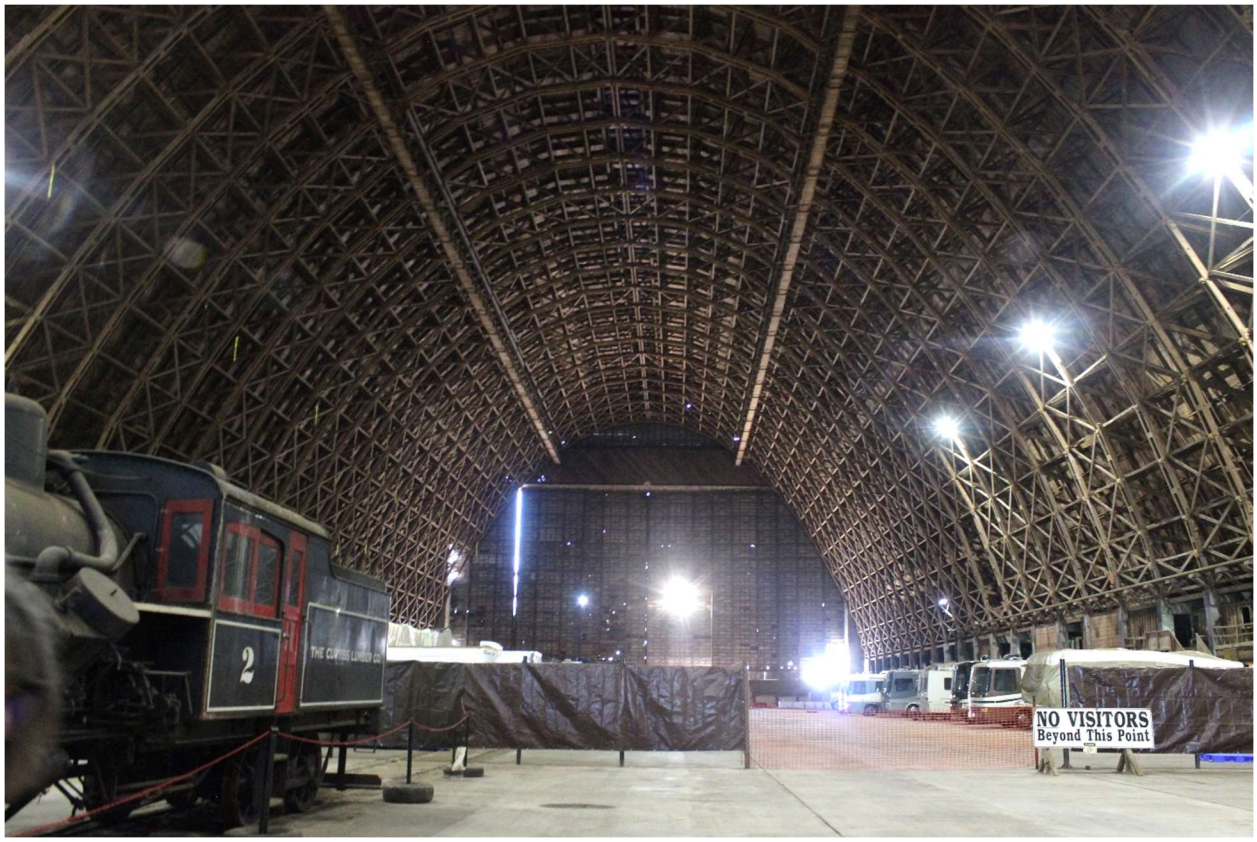


Fig. 3. Southwest view from inside the hangar, Tillamook, OR, 2021.

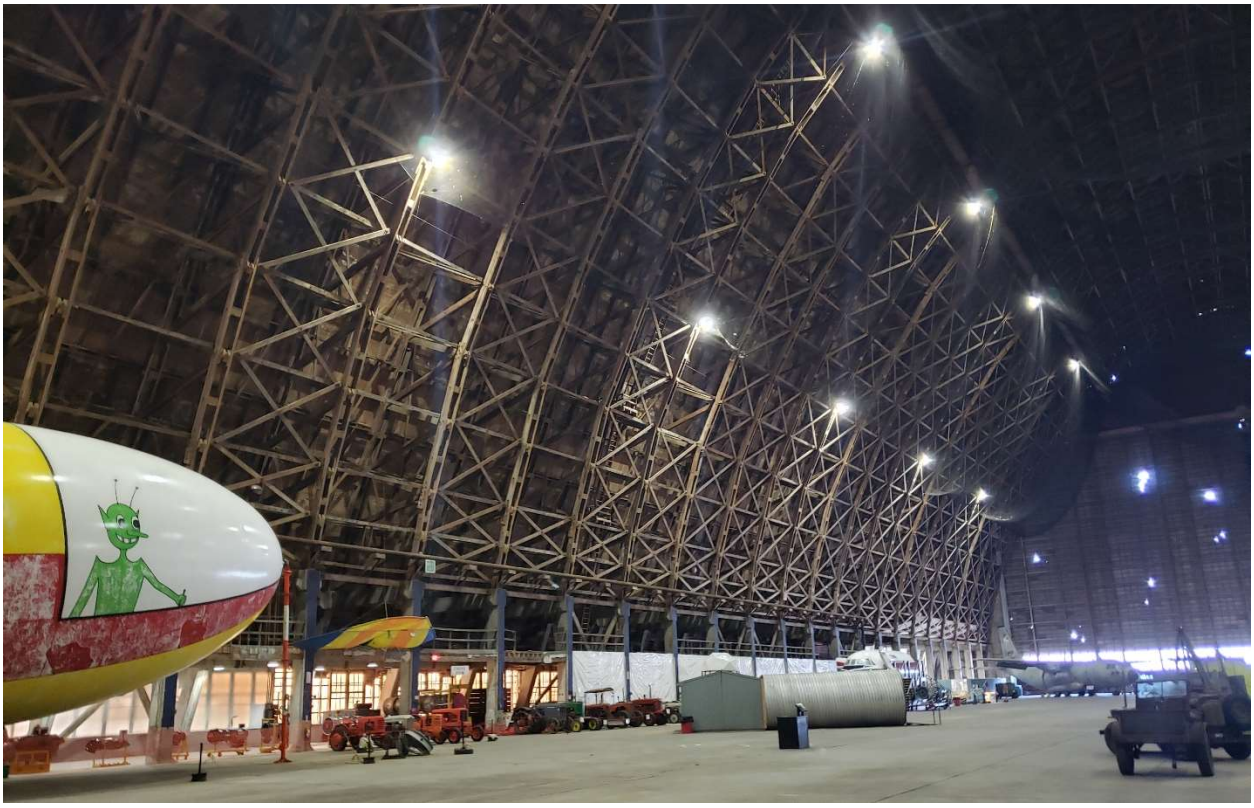


Fig. 4. Exhibits scattered throughout the floor with the truss system above, Tillamook, OR, 2021.

When it comes to the construction and material choices of Hangar B, there's several important factors to keep in mind. The hangar was built based on semi-permanent construction design specifications in reaction to restrictions in place due to the United States entering World War II. These were detailed out in the registration form submitted for the National Register of Historic Places:

> In general, the unit stresses used were those indicated by the Joint Committee recommendation for concrete structures, American Institute of Steel Construction for structural steel work, and the City of Portland, Oregon building code for timber construction, except that unit stresses were increased in conformity to directives of the Bureau of Yards and Docks wherever any appreciable saving of critical materials could be made by such procedure.[29]

The hangars likely used semi-permanent because of the speed the building needed to be erected; the engineers might have needed to use different guidelines for it to be a permanent structure.

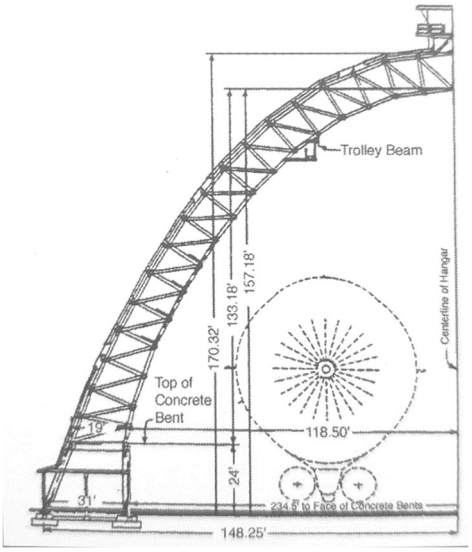
> Hangar "B" was started in October 1942 and finally finished on August 15, 1943. Hangar "A" was started on July 26, 1943 and finished except for the final roofing on August 27, 1943, in just 27 working days--avoiding the costly delays and bad weather that affected the construction of Hangar "B."[30]

The choice in structure for this building comes out of necessity. The naval station was needed quickly, and the hangars were going to be some of the largest ever made. Ideally, the structures would have been made of steel, already known to be able to span such large distances. But steel was vital to the war effort, needed for battlecraft and other mechanisms. The material used needed to be plentiful and not diminishing the amount of steel available. So the engineers turned their sights to wood. There had been no creation of a clear-span wooden structure like this before, and the space below the trusses needed to be open so the dirigibles stored there would have enough

space. Wood wasn't just used for the arched trusses, however; they were also used in many other ways:

> Wood gutter and wood downspouts replaced metal ones. Wooden fence posts were used over steel. Concrete structures were designed with as little metal reinforcing as possible. The underground gasoline storage tanks were made of prestressed concrete instead of entirely from steel. By substituting wood for metal, an estimated 2,050 tons of steel per hangar were saved.[31]

The wood had to come from somewhere, and that somewhere needed to be nearby. Energy and time couldn't be wasted with the necessity of this structure. Much of this lumber came from forests in Oregon, but there was some sourcing out of California. The amount of this lumber numbered over two million board feet, "about equally divided between the framework bracing and the decking.[32]



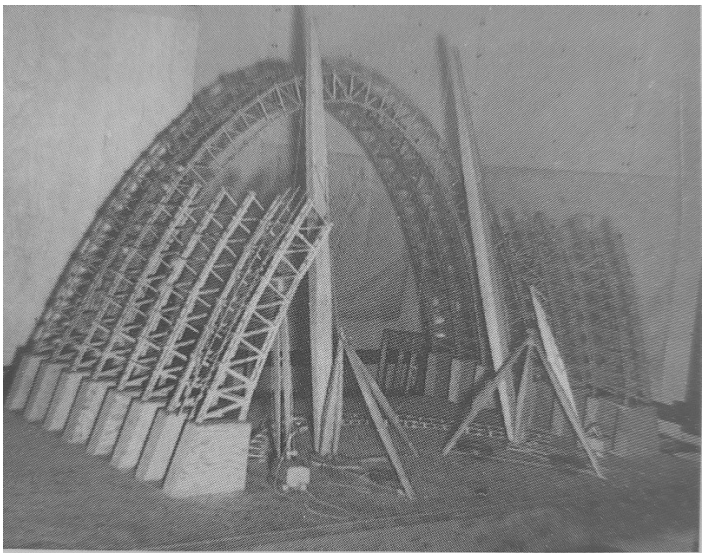


Fig. 5. Diagram of truss connection, detail from exhibit inside of the Tillamook Air Museum.[33]
Fig. 6. 1/4" scale model of timber truss system. The only known piece of this model sits in the Tillamook Air Museum exhibit.[34]

Fig. 7. Ladder as it climbs up the edge of the arched truss system, Tillamook, OR, 2021.

Interaction with Landscape

As far as connection between structure and site goes, the first thing to acknowledge and remember is that Hangar B, along with Hangar A, were two structures that the naval base was centered around. It was an entire system that worked together to direct and service the 8 “K” series airships housed in Hangar B, and any other aircraft housed in Hangar A. The site of the base was chosen specifically for its protected site and climate, the northernmost location on the Pacific coast where freezing and icing conditions weren’t considered a major hazard. Other justifications stated are as follows:

> The Tillamook valley was a naturally protected site between San Francisco and the Straits of San Juan de Fuca which made it an ideal base for patrol of this coastal region. Work began on the "Lighter-than-Air" station immediately with the clearing of 2000 acres of dairy farm land four miles south of the city of Tillamook and six miles inland. This area at the southern end of Tillamook Bay was composed of old gravel bars, filled-in riverbeds and sedimentation. It required over two million cubic yards of gravel for grading.[35]

The intruding terraforming necessary for the base to be secure from flooding began as soon as the site was chosen. Ditches were cut into the ground quickly and bridges for the railroad tracks built. During the construction process, a storm hit and flooded the valley, and much of the debris had to be cleared away. However, the storm highlighted problem areas within the site, and construction moved swiftly afterwards.

The naval base itself isn’t protected under the National Historic Register like Hangar B is because most of it is either in disrepair or torn down completely. Hangar A burnt down in the 1990s and removed from the Register following its destruction.

Fig. 8. Hangar B from the north end on the site, Tillamook, OR, 1943.[36]

The naval air station and its hangars weren't the only areas that blimps were serviced. A total of 17 wooden hangars, ten of which built from the same plans as Hangar B, were placed in the following areas: 2 in Glynco, Georgia; 1 in Hitchcock, Texas; 1 in Houma, Louisiana; 2 in Lakehurst, New Jersey; 2 in Moffett Field, California; 3 in Richmond, Florida; 2 in Santa Ana, California; 1 in South Weymouth, Massachusetts; 2 in Tillamook, Oregon; and 1 in Weeksville (Elizabeth City), North Carolina. The sites of other hangar locations were kept in close proximity to both water for function and forestry for materials. Again, the military could not afford to waste time and

resources shipping in that amount of wood from far reaches and needed for it to be plentiful nearby. Although there is the physical connection with the landscape in the timber sourcing, the nature of the military bases was that it forced the land into the ideal shape for function.

Eight of these dirigible hangars have survived until today, a testimony to the skill of engineering for structures meant to be temporary. Of the surviving hangars, Tillamook's Hangar B is the only one that remains open to the public thanks to the continued support of the Tillamook Air Museum. However, the maintenance of such a massive structure has its difficulties.

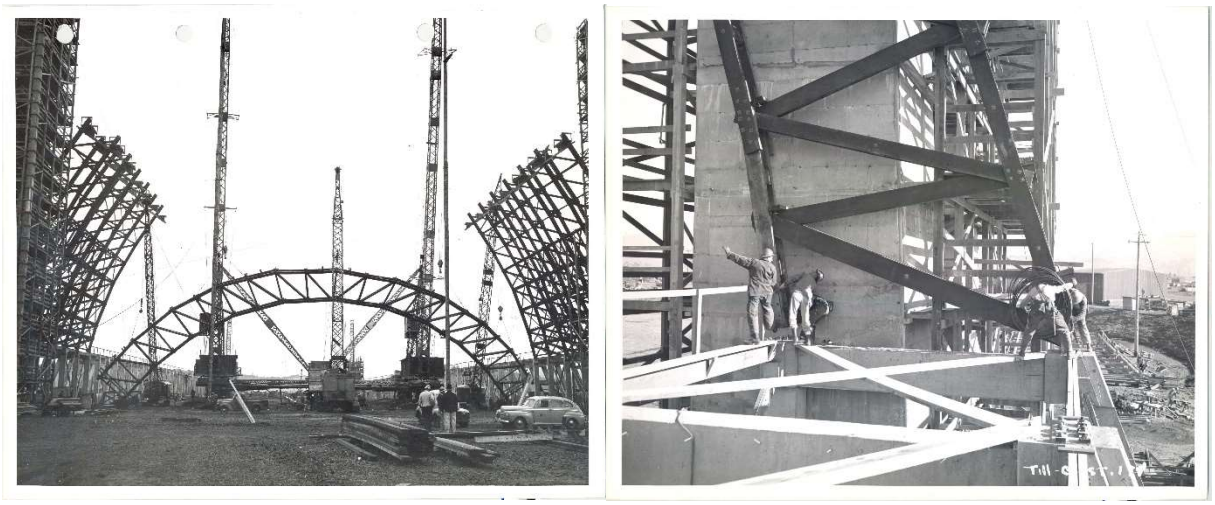


Fig. 9-10. Construction process photos of Hangar B, note the scale of the truss pieces to the people visible, Tillamook, OR, 1943.[37]

Continued Use & Maintenance

The continued use and maintenance of the hangar directly correlates with its inception. In early 1941 as the Civil Aeronautics Authority scouted for potential sites for airports the military could use, the land around Tillamook was found suitable, and the CAA insisted to the county on giving them $400,000 towards construction.

However, the people of Tillamook County refused multiple times. The economic burden of purchasing the land for the CAA and then taking on the maintenance costs wasn't reasonable for this rural farmland, the grass strip they used as an airport met their needs.

The CAA insisted, and after getting Congressmen involved, the Tillamook County was informed the plans were already created and the money already allocated. As it stands, the military would only fund the airport for the period they were present, regardless of the initial pressure to build beyond the County's needs. The presence of this airport was advantageous when the sites for blimp hangars were being chosen, and while the "original size of the airport planned by the CAA was 200 acres, this swelled to 1,965 acres to accommodate the Naval Air Station."[38]

Despite being commissioned in December of 1942 and the Blimp Squadron (ZP-33) arriving in August of 1943, the Navy was already making plans for cutbacks in the blimp program. The Station was only active from 1942 until 1948, and when:

> …the Navy decided to close the Station at which time the County negotiated a lease with the Navy and a Commission was appointed to operate the Airport. In 1963, that Commission formally acquired the hangars and after the loss of Hangar A, the remaining hangar was established as a museum in 1994.[39]

The closing of the station began the long series of handoffs, passing the maintenance cost for the structures along from the military to the county and several different commissions. The purpose of the hangars changed several times, from the lumber industry to a brief span of aviation Lighter-Than-Air (LTA) developments, but the cost of maintaining the building is heavy. As previously stated,

Hangar A was destroyed in a fire in 1992, already having survived a smaller fire in 1955. It's unknown how the fire started, but the hangar had been used for storage temporarily, and over 7,600 tons of straw fed the flames. The remnants of the massive structure are still visible only a little way off from the museum; currently the footprint is being used for industry waste disposal.

Fig. 11. Remnants of Hangar A filled with telephone poles, the facing end columns visible at the far end, Tillamook, OR, 2021.
Fig. 12. View of the concrete paneling covering the hangar doors in disrepair, Tillamook, OR, 2021.

The formation of the Tillamook Air Museum likely saved Hangar B, and visitors come in every year to see the intensity of the structure and the exhibits inside. However, once again the cost of maintenance is difficult to bear. According to the 2013 article "Future of Tillamook blimp hangar in question as air museum prepares to move," the following was stated:

> The port commissioners thought they found help after FEMA came through with $44.5 million for the port after a 2007 storm did serious damage in the area. They budgeted $4 million of that to put a coat of epoxy on the roof – 192-feet-tall at its pinnacle – hoping to seal up some of the holes. "Then we did an engineering study on it and found out the roof will not hold anymore," said Young. "It is to capacity now. Just to do the roof and the one beam on the building, I think we figured between $12 and $15 million – maybe more because we don't have a firm bid on it…"

> "We band-aided what we could," [Michele Bradley] said. "After the storm damage in 2006 and 2007, just to mobilize a contractor to come in just to deliver roofing materials was quite a challenge. It's all rounded and there are very few places to stack materials. To even get a bucket of nails up there, that's a long haul for a bucket and rope."[40]

Aside from the difficulty with storm repairs and roof maintenance, there's also the possibility of needing to handle materials no longer used in construction like asbestos walls and dangerous fireproofing materials thought usable during the initial construction. However, the air museum is still functioning, and after a conversation with the archivists at the Tillamook Pioneer Museum, there is a current effort to repair the roof. Regardless of the initial resistance to the military insertion in the county, decades later the people of Tillamook continue to care for this structure.

Conclusion

Hangar B is one of 17 dirigible hangars built during WWII across the country, and one of 10 built with similar plans. Through necessity in a time of war, the space was created for a specific purpose with a brand-new kind of structure using the materials available and ample. In spite of the semi-permanent construction, Hangar B has survived almost 80 years in the face of damage, changing function, and difficulties of maintenance. This hangar is an artifact of American engineering and the strides in aviation made during WWII and was placed on the National Historic Register as a significant building to our history.

Old Faithful Inn

"Largest Log Structure" and the First of an Iconic Style

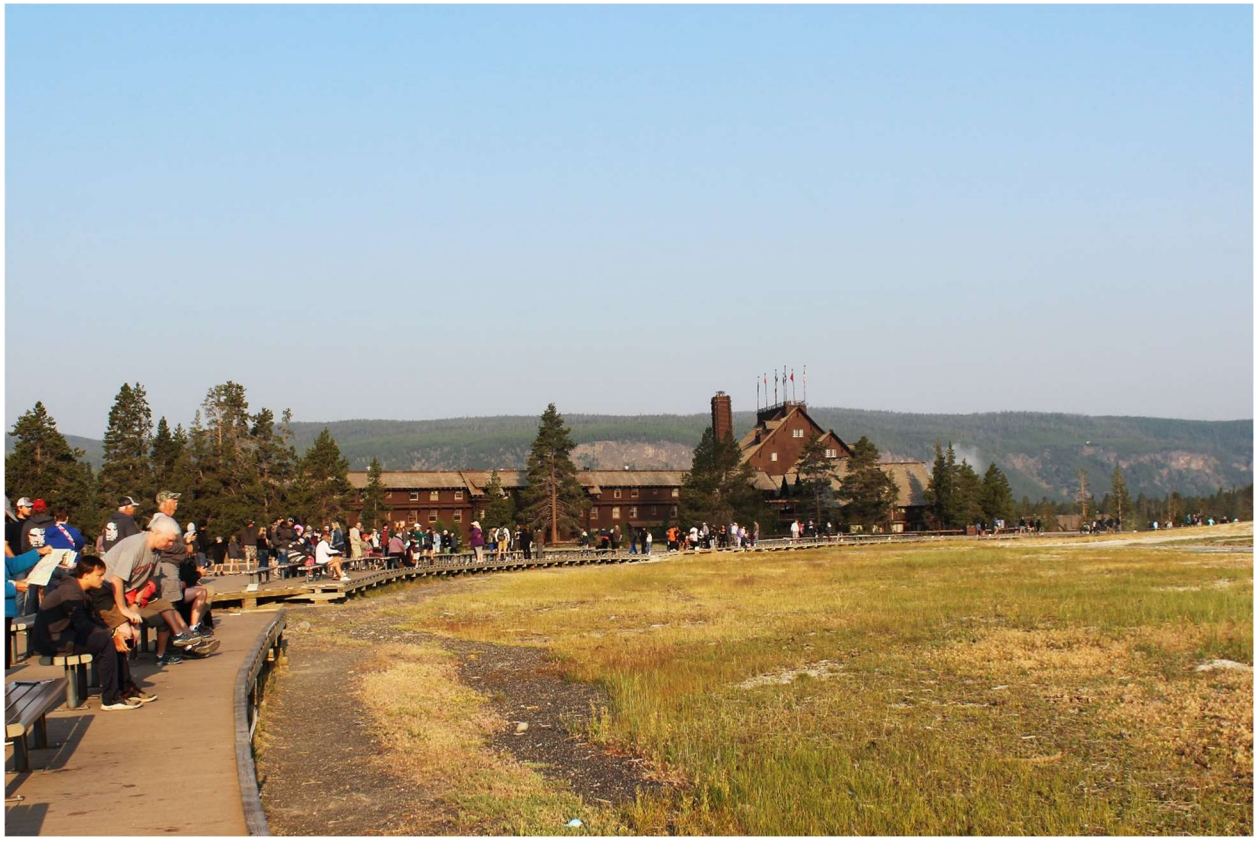


Fig. 1. Robert C. Reamer, view of east façade standing just south of the Old Faithful Geyser, Old Faithful Inn, Yellowstone National Park, WY, 2021.

There's something otherworldly about the landscape in Yellowstone - it's no wonder some early visitors from east of the Mississippi called this place "Wonderland" years before the park was established. So, when I woke up hours before dawn the day of my visit, I struggled to keep my eyes on the road and not on the quickly changing landscape. From mountain pass to valley, riverbed to forest, I drove past and through what the summers are like in a subarctic climate. After a couple hours, I reached the upper geyser basin, site of Old Faithful and its historic district. As we waited on the benches surrounding the geyser, over my shoulder I could see the eastern side of the inn,

nestled between the pine trees. We had just started murmuring about what happens if the geyser stops being so faithful when it erupted. Water gushed for several minutes before subsiding and I walked to the edge of the boardwalk to watch the stream leave the area around the geyser, flowing under the wooden path into groves from all the eruptions before. I wandered - following the water like a child follows a bug - towards the inn.

Fig. 2. Robert C. Reamer, walkway leading to the front entrance, Old Faithful Inn, Yellowstone National Park, WY, 2021.
Fig. 3-4. Robert C. Reamer, views of Inn seen on the path towards the entrance, Old Faithful Inn, Yellowstone National Park, WY, 2021.

Timber Structure

For the average visitor, walking into the lobby of Old Faithful Inn starts with the portico - its huge, stacked log supports around the edges and thick, smooth columns holding up the floor of the porte-cochere. The path from the geyser had me wrapping around the east wing, under the massive shelter, and towards the bright red doors with wrought iron handles and "Old Faithful Inn" etched into a weathered but polished wooden plaque. As I entered the building, I was greeted by the warm sight of wood and soft, yellow light.

The entryway to the lobby is filled with a forest of trunk-like columns. Ahead of me I could see the monolithic fireplace and people milling about, and I walked forward, leaving the shelter of the entry to look up into a yawning seven-story space that defines the center of the Old House, the original build of the inn. Lining this space is a series of log columns and beams, bracketed by knotty wood.

Fig. 5-6. Robert C. Reamer, central multi-story lobby lined with ornamental wooden bracing, Old Faithful Inn, Yellowstone National Park, WY, 2021.

Although the hotel has been referred to as the "world's largest log structure" and certainly appears as such, it is a bit of a misnomer. Park Ranger and author of Old Faithful Inn, Crown Jewel of National Park Lodges Karen Reinhart states:

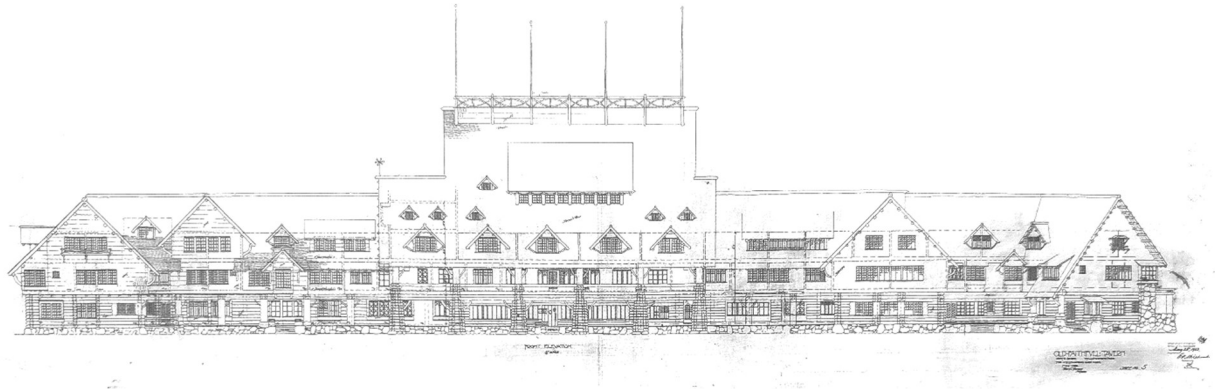


Fig. 7. Robert C. Reamer, front façade elevation drawing, one of the few drawings we have of the Inn, Old Faithful Inn, Yellowstone National Park, WY, 1903.[41]

> …only the first floor of the Old House is constructed of load-bearing unhewn logs. The first floor is eleven logs high; each log was scribe-fitted and saddle-notched, requiring practiced and patient workmanship… The second and third floors are constructed of a traditional wood frame - a construction scheme much lighter in weight than log. Both floors are cantilevered two feet beyond the first floor's perimeter, a design that would have been impossible with the continued use of log walls.[42]

But the lack of structural pressure on the wooden details climbing up the lobby didn’t read as simply ornamental. It was easy to look and imagine the strength of the tree in the face of the weight of the load, from the floors above to the roof looking skyward. The knotty wood bracing the beams branched off the columns, the repetition of the bends and curves giving the feeling of being within the forest. The understanding of the craftsmanship that went into finding the right crooked pieces can be seen within the notches.

Robert C. Reamer, the architect of Old Faithful Inn, was a quiet man with complex designs and intense character. During construction, he was present on site with the crew of the day, making decisions based on the wood received or found. For the creation of the ornamental bracing, it is known that:

> Reamer sketched instructions on a shingle and gave directions to his crew to find particular and peculiarly shaped pairs of pine

> branches. Subsequently, they searched for crooked limbs of lodgepole pine wherever they could find them. Reamer and his team of workers creatively matched up sets of similar bends and twists to create the lobby's picturesque pseudo-supports, giving the lobby it's woodsy atmosphere.[43]

Speaking with one of the Inn employees revealed some interesting tidbits about the unconventional building process Reamer put forward. Although I pressed to find other references, I was left with the understanding of Reamer's construction habits based on my conversations with the rangers and small details within drawings. Reamer had his elevations and floor plans to work off, but when it came to the day-to-day building process, he worked with the crew of the day to create the details as it was being constructed. Reamer's practices were far closer to what we would consider vernacular building practices, starting with the initial design but acting as master craftsman on the ground. We can see the difference in the drawings that have survived and the actuality in details within the facades built - there are false windows not present in the original drawings and more dramatic dormers in several places than what was drawn.

Reamer's involvement, or obsession really, with the construction of the inn was noted many times - comments on him unshaven, unwashed, but moving around the site giving directions every step of the way. Regardless, as noted in *Old Faithful Inn, Crown Jewel of National Park Lodges*, "under the creative genius of architect Reamer, approximately forty-five hardy artisans of log, stone and iron erected perhaps this country's most famous western lodge."[44]

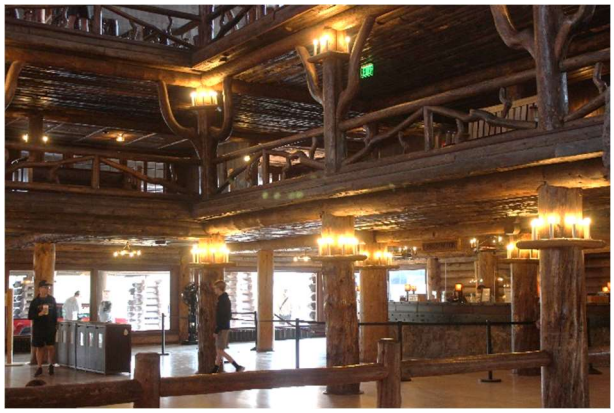


Fig. 8-9. Robert C. Reamer, images of the knotty wood bracing and the lobby columns, Old Faithful Inn, Yellowstone National Park, WY, 2021.

The materiality of the building grounds the experience of walking through the halls. The dominant material, in color, in texture, in size, is wood. The Lodgepole pine, *pinus contortus*, is the predominant species of tree in the park and is used in a multitude of ways, such as "beams, rafters, railings, posts, balconies, balustrades, staircases and decorative supports." This repetition of wood surrounded me with texture. It wasn't just the pieces within touching distance that pushed this feeling, even the ceiling "was veneered with pine slab wood - perhaps the leftover slivers from the Inn's flat sawn wall logs. A *Haynes Guide* noted 'there are over ten thousand logs in its lower story.'"[45]

Accompanying the wood and acting as anchor, the stone of the foundation and base of exterior walls is also sourced directly from Yellowstone. The monolithic volcanic rocks "lend basal support to Old Faithful Inn, quarried from rhyolite cliffs near Black Sand Basin." Aside from the actual sourcing of this material from the immediate environment, there's more history in the formation of the stone itself - "an igneous rock, rhyolite is a relic of the latest cataclysmic

volcanic event in Yellowstone country."[46] This choice in material directly impacts the connection between building and landscape.

Interaction with Landscape

The use of materials sourced from within miles of the site for the Inn inside the confines of the park boundaries is incredible in and of itself. Taking rhyolite and grounding the hotel with pieces of Yellowstone, taking the Lodgepole pine and creating a space for rest - these materials are intrinsically connected to the environment surrounding the structure. As strong as these design choices from Reamer are, there is more to the interaction of building and landscape than just material sourcing.

In the scope of the National Park itself, there are pockets of near urbanity in key areas around the 3,468 square miles of Yellowstone, and the old faithful historic district is the most famous. Part of this is how all the pieces work together, something added to and expanded on since the beginnings of development in this area.

The orientation of the front entrance isn't facing the geyser, but rather an old service road that has been expanded on as a parking lot. The inn is also situated on the site of its predecessor, a shabby little hotel referred to as the Shack Hotel. It was built in 1885 much too close to the Old Faithful Geyser but wasn't adjusted during construction or condemned afterwards despite being within a quarter mile of the geyser, which was in fact illegal. However, the building limit was decreased to an eighth of a mile with the Hayes Act passing in 1894. Despite this finagling, the Shack burnt down quickly after

the act passing, and a temporary facility built in its place. The train tycoons could see the potential in Yellowstone and continued with plans for a hotel in the location.[47]

Within the building itself, there are several connections to the outside landscape, despite most pedestrian activity within the building sheltered by the walls. The vast open space within the lobby has deep shadows only broken by the presence of windows dotted along the facades, but the deepness of those shadows is enveloping. The shelter of the knotty wood and other timber textures push the feeling of being within the forest, and the light quality has been commented on by the tour guides, who have "theorized that the assorted window sizes and shapes admit light into the lobby like 'light through a forest canopy.'"[48] This connection is shown again in the presence of the fireplace, which has been described as this: "sitting in the

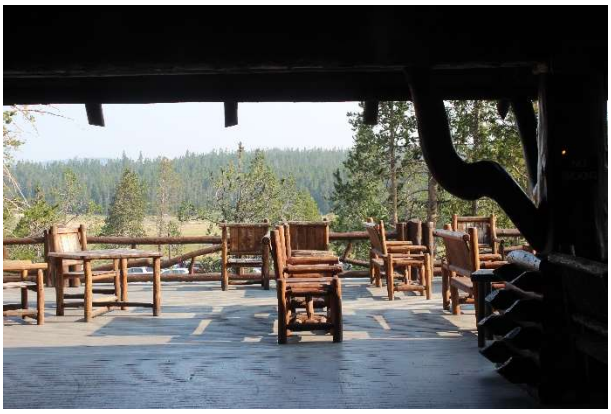


Fig. 10. Robert C. Reamer, view of the second floor porch towards the northern geysers and parking lot in front of the Inn, Old Faithful Inn, Yellowstone National Park, WY, 2021.
Fig. 11. Robert C. Reamer, view out window on third floor looking towards the rest of the Old Faithful District, Old Faithful Inn, Yellowstone National Park, WY, 2021.

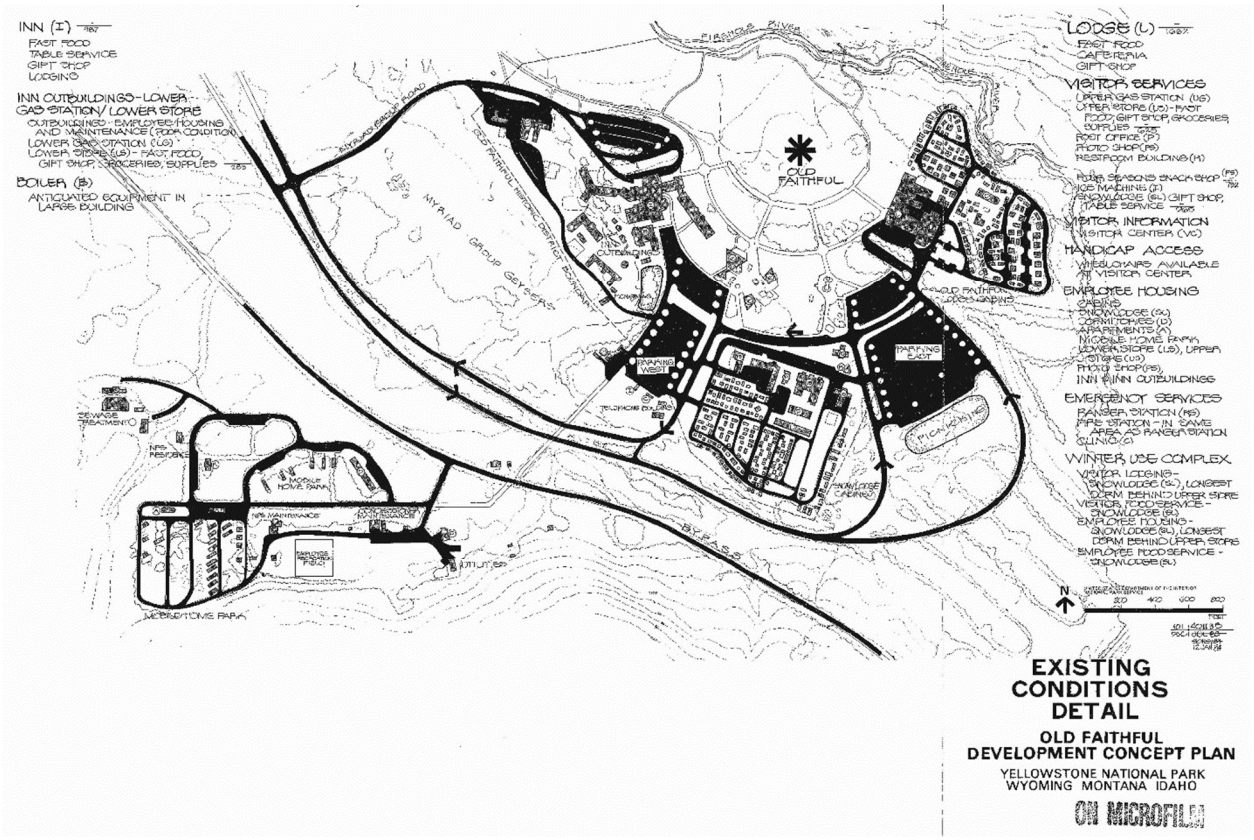


Fig. 12. Conceptual plan of existing site for proposed changes to the district in the 1980s, Old Faithful Inn, Yellowstone National Park, WY, 1985.[49]

southeast corner, is the behemoth 15 ½ foot eight-hearth fireplace crafted from 500 tons of native volcanic stone… The tapering fireplace stretches forty-two feet before pushing another forty feet behind the roof."[50] It truly is a monumental, anchoring moment that stretches from the foundation through the roof, a literal connecting force for the structure.

The columns on the first floor with their curved edges have a tactile quality to them. These were the true log columns present in the building, and as my hand passed over the smooth wood, coated with a protectant of some kind, my fingers traced the dips and crevices of some twisting critter's path. These were the "whimsical tracings of one of Yellowstone National Park's small, unsung creatures - the pine

bark beetle - were fine examples of Mother Nature's artwork."[51] Although Reamer had kept the bark of these columns on during construction, in 1940 the bark was removed - perhaps for ease of maintenance or lowered fire hazard. As the bark was removed, this unintentional collaboration with the creatures of the forest was revealed.

Continued Use & Maintenance

Over 120 years have gone by since the opening of Old Faithful Inn, and it has undergone many changes - it's had to since the rate of visitors moving from several thousand visitors a year in 1904 to over 3.8 million visitors in 2020 despite the pandemic. Even in the first couple decades of the hotel's function, Reamer was contacted several times by Child to design other structures on site or even expand the Inn itself. Initially, as opposed to adding another lodge on site, when the number of visitors threatened to overwhelm the initial Old House, the East Wing was added in 1914. And when the visitors kept pouring in, the West Wing was added in 1927.[52] Of the original 140 guest rooms in the Old House, only 87 of those are still available to book. Over the years, the expanding lobby came at the cost of rooms, as did the creation of the gift shop. In *Old Faithful Inn, Crown Jewel of National Park Lodges*, some of these trade-offs are listed:

> For a more roomy access to the second floor veranda and to increase the sitting area for the mezzanine bar, several rooms were consumed… When the East and West Wings were annexed to the Inn and with the creation of public bathrooms, even more Old House rooms relinquished their initial roles.[53]

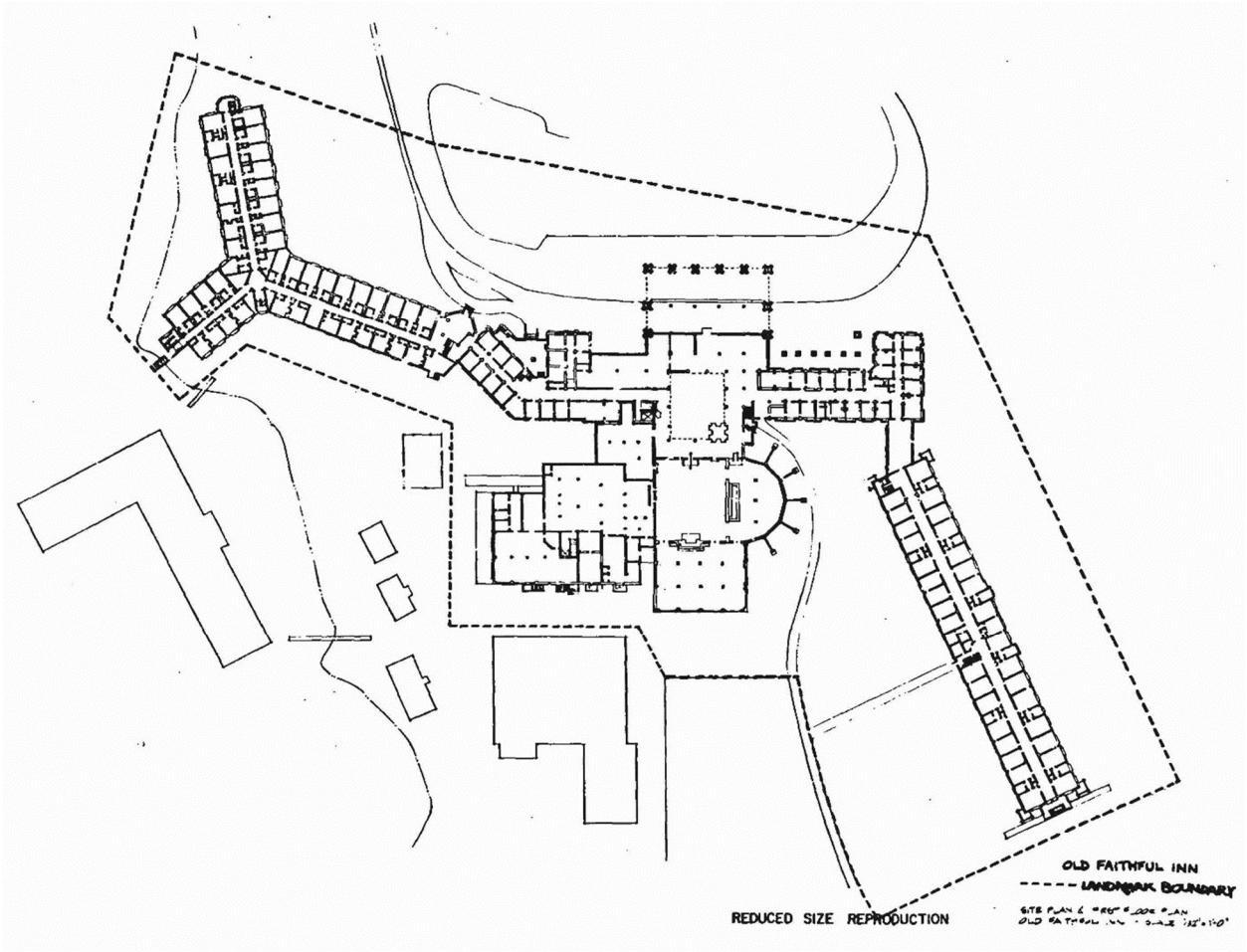


Fig. 13. Robert C. Reamer, floor plan of Inn with Old House, East Wing, and West Wing drawn out, Old Faithful Inn, Yellowstone National Park, WY, 1973.[54]

I wandered the lobby for hours, taking pictures and talking with the Inn employees. A woman greeted me as I entered the gift shop - she was sitting on a stool just outside the doors, clicker in hand and smiling eyes. We talked and laughed and bonded over school pride even half the country away from her alma mater, and when I asked about any books on the history or construction of the inn, she gestured to the shelves in sight, saying "Ruth should be in later." Ruth Quinn is a historian, longtime Yellowstone employee, and author of *Weaver of Dreams, the Life and Architecture of Robert C. Reamer*.

Later, I would speak with Quinn as she manned the back door into the lobby. The fireplace was within arm's reach as she gestured to the stones and said "When the earthquake hit in the 50s, this collapsed through the floor. It had to be rebuilt, and up there -" she pointed to the peak of the ceiling to a little treehouse-like platform called the Crow's Nest, "-there used to be a band that played up there. But after the earthquake it was closed off." Quinn continued, and again pointed up, this time to the third floor where the balcony met the west wing. I could see the shift in the floor as it wanted to sag down, but timber structure underneath reinforced it. This was yet another piece of the Inn affected by the earthquake and time.

After my conversation with Quinn, I walked up to the third floor, taking pictures as I went. As I reached the top floor, there was a little gate barring a staircase that leads to the Crow's Nest, knotty wood as ornamentation for the railings. A sign on the gate read:

> Thought to be the realization of one of architect Robert Reamer's childhood fantasies, the Crow's nest rises 76 ½ feet to the ceiling of the Old Faithful Inn. During the early years of the Inn, an orchestra would play in the room at the top and spectators would watch from the various landings as guests danced on the lobby floor below.
>
> On August 17th, 1959, an earthquake measuring 7.5 on the Richter Scale rocked Yellowstone Park. The trembler twisted some of the support timbers for the Crow's Nest, making it unsafe for the number of guests which currently visit the Inn.

My gaze was drawn again to the fireplace, even more impressive from the height of the third floor. Aside from reconstruction of the fireplace itself after the earthquake, there was maintenance and damage control required for the chimney flues - six of the eight flues needed to be cleared of debris after the tremors. The construction of

the chimney as it extended through the roof and up was changed from log enclosed brick to steel as a safety measure.[55]

The construction and maintenance of the Inn has changed many times over the past century, from additions to the building to updated materials, rearranging the first floor for visitors to reconstruction post-disaster. These adjustments over the years have been necessary for a variety of reasons, and the time and effort put into this structure signify the cultural importance and care we have for this resting place.

Fig. 14. Robert C. Reamer, detail image of exterior alpine-like wooden ornamentation, Old Faithful Inn, Yellowstone National Park, WY, 2021.
Fig. 15. Robert C. Reamer, rear view of the Old House with the stacked log chimney and the widows walk visible, Old Faithful Inn, Yellowstone National Park, WY, 2021.

Conclusion

Robert C. Reamer was a 29-year-old, self-taught architect who drew the first sketches for Old Faithful Inn on a train ride to Yellowstone. Over a century later, millions of people visit the park to see the stunning land and the building on it. Along with the importance that Yellowstone National Park holds in American identity and history, the structure of the Inn itself holds importance in typology and architectural style. The typology of a multi-story lobby surrounded by balconies and vertical circulation is distinctly

American, and although Reamer wasn't the first to use this kind of design, he was the first to do so in such a large scale with natural materials, conversely to the common steel and concrete.

Defining what's become known as "Parkitecture," the style associated with the largest names in National Parks like Mt. Rainier and Yosemite, Old Faithful Inn exemplifies the aesthetic accompanying the western frontier. The nostalgic rusticity of the hotel ties use of natural materials and drawing from the site context with the allusion of old building techniques to reinforce the idea of the American west. As such, instead of being torn down when the need for more capacity became too much for the Old House, it was expanded and maintained. When disaster hit the building, it was repaired. The value this building holds doesn't just belong in written history, but tangible structure we can visit and rest in, as it was intended.

Of Timber & the Embodied Americana

A Survey of Structure & Empathetic Design Through the Last 100 Years




Fig. 1. Robert C. Reamer, ornamental knotty timber connection inside lobby, Old Faithful Inn, Yellowstone National Park, WY, 2021.
Fig. 2. Rows of the timber truss system inside the hangar, NAST Hangar B, Tillamook, OR, 2021.
Fig. 3. E. Fay Jones, repetition of steel connections inside the chapel, Thorncrown Chapel, Eureka Springs, AR, 2021.
Fig. 4. Leers Weinzapfel Associates, bottom of steel connector for one segment of the trapezoidal zipper truss, John W. Olver Design Building, Amherst, MA, 2021.

The visitation of each of these locations in such different regions highlighted the capabilities of native timber. The changes in scale and purpose, and the ability to learn from these buildings as we continue to use them both help give a base to a survey of what we've built and how we've built it over the past 120 years. This research in timber structures came not just from an anthropological interest, but also that of necessity. Our construction habits need to move in a sustainable, renewable direction faster than we have been pushing

them. By visiting these locations, I had hoped to gain a new understanding of how buildings persist through time and how we build for longevity.

Amid the height of skyscrapers and the start of the Prairie School of design, the Old Faithful Inn's construction contributed not only to the specific style of the National Park Service's western buildings but also utilized local materials like lodgepole pine and rhyolite. After standing for over 100 years, this presents an opportunity to diagram the connections and observe the process of maintenance, paired with a comparative analysis of the landscape itself for the very materials used in creation.

As the world's largest clear-span wooden structure, the Naval Air Station in Tillamook's Hangar B has lasted beyond a speedy construction in the face of America's involvement in WWII by almost 80 years and is in continued usage as a museum displaying a private collection of aircraft. The use of accessible materials – when the need for metals, glasses, & plastics were going towards battlecraft – in this massive scale allows for some beautiful connections, despite the necessity aiming to streamline the design for time and cost. The current necessity for sustainable building practices makes this an important case study, both its successes and its failures.

Fay Jones's design of Thorncrown Chapel is highly empathetic to its surrounding environment, with nearly the entire structure made of organic material, primarily pine. Blending the moment between the Ozark hillside and the interior, this structure is full of graceful connection. Within 20 years of its construction, Thorncrown Chapel was

placed on the National Register of Historic Places and remains in use as a place of worship.

Leers Weinzapfel Associates completed the LEED Gold Certified John W. Olver Design Building in 2017 as the first and currently largest cross laminated timber academic building in the US, ushering in more timber construction on a dynamic, multipurpose scale. Both proactive and reactive in its design, the ODB works with the suburban fabric of the college campus to create a unique form to serve the program inside.

There have been many changes throughout the past 120 years - the pre-fabrication process of the Olver Design Building is a long way from the sourced material and on-site fabrication of buildings like Old Faithful Inn and Thorncrown. This could be an indication of a shift in construction methods, but it could also be a change based on the function of the building. Old Faithful Inn is likely more of the construction method change, but the method was unconventional even for the time period. Thorncrown had its own issues with getting the workers to move quickly - moving according to "Ozark time," the construction workers choosing how fast they move and how often. All three of these buildings differ from the dirigible hangar, created out of innovation and necessity, and spurred by the war effort.

Connecting these buildings captures a snapshot of the versatility of wood and provides insight into the changing processes identified over the past century. The process of construction evolution, the process of maintenance, and the process of design empathy are seen in these four projects, even though they differ in typology and program.

The buildings are connected through their common material and serve as landmarks for Americana, telling a rich story of the possibilities of building with wood.

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[29] Ibid., 14.

[30] "Aviation," 126.

[31] "History of NAS," 11.

[32] "Aviation," 126.

[33] "History of NAS," 11.

[34] Ibid., 12.

[35] "Aviation," 126.

[36] Photograph courtesy of the Tillamook Pioneer Museum

[37] Photographs courtesy of the Tillamook Pioneer Museum

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