Architectural Honors Thesis: Finding Refuge in the Treehouse

Written by Hope Bailey

Department of Architecture, Oklahoma State University

ARCH 4216: Comprehensive Studio VII

Professor Jeanne Homer

May 11, 2020

When designing a community space for homeless teens from a wide variety of previous hardships there is no doubt that all the small details need to be considered, as was the case with Pivot Community Center. Pivot is a non-profit organization that "advocates, educates, intervenes and counsels youth and families to make a positive difference in their lives" (Mission, *Pivot*, n.d.). Pivot as it currently exists is a shelter for homeless youth, a help center for struggling young adults, an educational facility for learning life skills, and a safe place for those in need to focus on personal growth. Pivot has had a profound impact on countless young adults' lives, encouraging teens to get off the streets, find jobs, learn how to care for themselves, and gradually transition into a lifestyle where they can not only be self-sufficient, but thrive in what they hope to achieve. When designing a community center for such an important organization, it was paramount to not only take Pivot's mission into consideration, but also all the clients and users of this new building – not only homeless teens, but also the life coaches, administration, volunteers, and countless others that aim to improve clients' lives. Thinking of the users of Pivot's new community center lead to a design premise that those that come to Pivot are in need of a space of refuge so they can begin their healing process. Playfully referencing the common place of childhood refuge of a treehouse formed the conceptual basis of the design, which represented an upward journey from a harmful past toward community trust, self-healing, and ultimately, independence. The idea of protective refuge influenced the entire architectural design process from conceptual exploration to the design development of details.

To come to the design premise that those that come to Pivot need a place of refuge, an amalgamation of different perspectives was considered, starting with the early research task to focus on client sociology. As the study of social patterns of needs, wants, and backgrounds of all the different users of the future community center, client sociology was best researched using

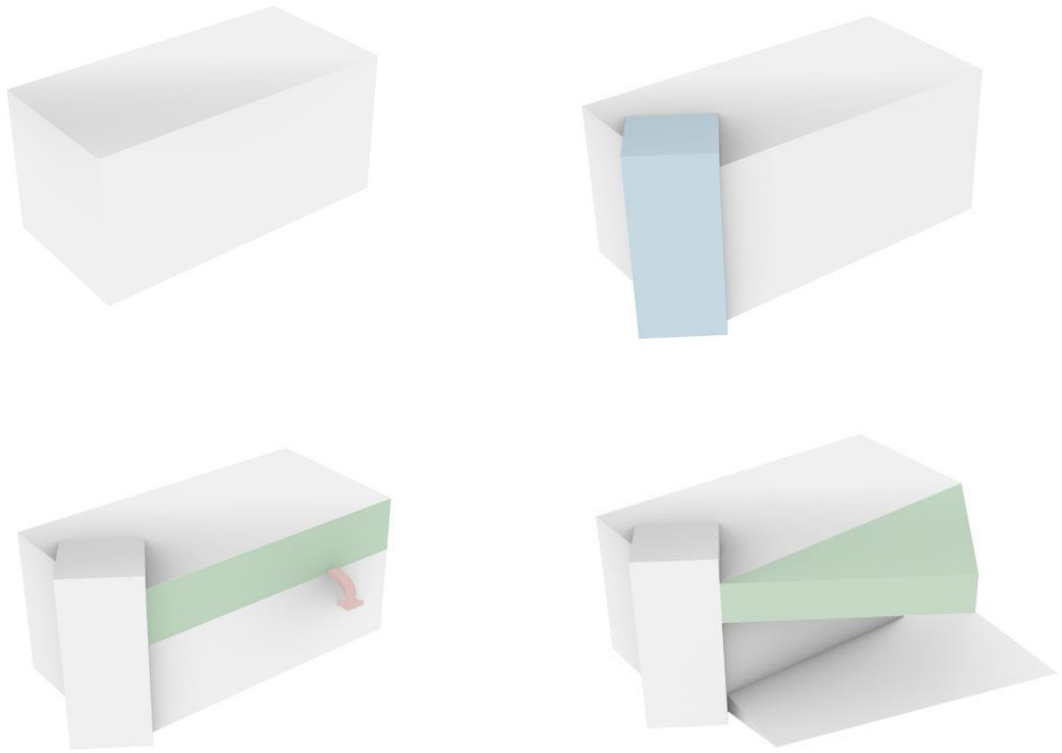
user stories to consider different clients. User stories originated in software design as a way to get into the mindset of different people who might use a new software to ensure that their needs are met/achievable; similarly, through the study of user stories, it was a goal to consider the needs of clients and users at Pivot, so that future designs could meet those needs. Countless variables could leave teens on the streets, from being LGBTQ in a non-accepting home to becoming pregnant to growing up in abusive families that were far worse than being homeless. Because these teens have such a wide variety of backgrounds, many struggling with histories of abuse or mental illness, it was clear that there was no one right design answer for this project. For example, some teens might feel claustrophobic in small rooms while others feel safe. In addition to looking at the needs of the homeless teens and what might make them comfortable in a new space, it was important to consider the staff at Pivot and their wide variety of needs. Many counselors in the existing space had no daylighting in their offices, while life skill coaches needed educational spaces that could engage students and encourage more involvement. Even for administrative staff with little interaction with clients, important needs included staying connected to the community activities while still maintaining enough distance to get their jobs done.

The wants and needs of staff, in addition to the need for a variety of types of spaces for teens, played a huge role in informing the decisions that helped develop the final exterior form. While initially looking at a two-wing massing concept with a protected middle outdoor space, separating functions of the building across a wider footprint could divide activities in the building, creating “dead” spaces where activity would be limited and uninviting when events weren’t scheduled. For this reason, it became important to break needs down into different areas of the building where activities could be seen and shared where appropriate. Ultimately, by using

the building section as a tool to understand interior relationships, the final massing solution (see Figure 1) reflected the multitude of needs of different users, reinforcing the treehouse concept with a strong emphasis on the journey upward. Because the largest single space was the Multipurpose Space, taking up two stories vertically, it was easy to start with a three-story box, knowing there was a need for at least one story for more private programmatic activities, like counseling and education.

Figure 1

Simplified Massing Diagram

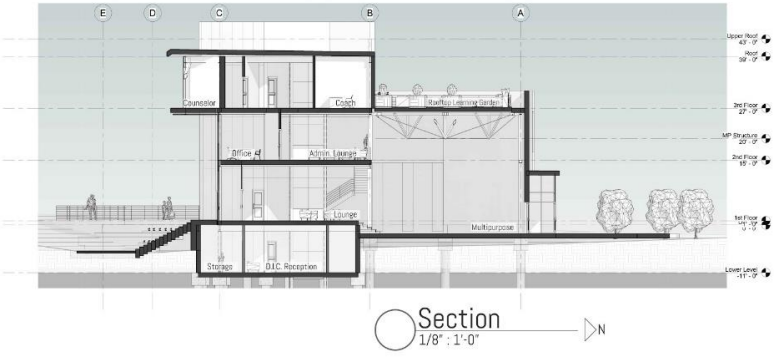


Note. In Figure 1, the light blue mass is the "trunk" of the treehouse concept, where visitors would journey upward either by the grand staircase or the adjacent elevator. As the apex of the journey, the green represents the third floor "canopy," jutting over the south plaza to create a sheltered exterior space, and to give visual importance to the function of the 3rd floor as the space where clients focus on personal growth and healing.

Also informed by the building mass in section, interior masses were designed to create a flow of activity from one space to the next (see Figure 2). Because a connection to outdoor spaces was important to promote nature-oriented healing, outdoor plazas were designed on both the north and south of the building, with public community-building spaces in between the two plazas on the interior. By using most of the first floor as community-building space, encouraging activity and movement through the building, an issue that many staff brought up about clients feeling a sense of belonging, involvement, and trust in the community around them at Pivot was addressed. Additionally, in the section of the building, the administration's need for space and visual connection was addressed by placing their offices on the second floor of the building, giving them the capability to look into either the Multipurpose Space or the south plaza as a daily reminder of the good they're achieving for Pivot's clients. With the first and second floors visually and actively connected, the final functions of counseling/education and a private Drop-In Center were left to the 3rd Floor and Lower Level, respectively.

Figure 2

Building Section from Schematic Design



Note. In this section diagram, the 1st and 2nd Floors are visually connected, as administration can see into the Multipurpose space and adjacent south plaza. The 3rd Floor and Lower Level are completely visually separated,

giving privacy to those being dropped off in more precarious life situations (on the Lower Level), and those focusing on self-healing and personal growth (on the 3rd Floor). By organizing the building program in section, it was easier to address some of the major programmatic divisions effectively, while still maintaining a cohesive space where activity is invited and encouraged in the public spaces, with private spaces left private.

As the team shifted focus to making the building functional, the treehouse concept became intertwined with the structural design. With the goal to reflect the treehouse concept on the interior as well as the exterior, a design decision was made to keep a large part of the structure timber, creating a biophilic, comforting design for clients and staff. As a compromise between expense of glue-laminated timber structure and structural efficiency of steel, most of the visible structure was designed in timber, leaving steel where drop-ceilings concealed structural members. Two major structural elements where steel and timber combined became integral to the building design – an exterior space framed truss on the third floor "canopy" and the king post tie-rod three-dimensional truss on the ceiling of the Multipurpose Space holding up the occupied roof above. The space frame exterior truss on the 3rd floor was a decision made to ensure that the partially-cantilevered floor would be structurally sound, but also to give the 3rd Floor more visual importance from the exterior, while conceptually tying back to the treehouse concept with a branch-like appearance. To complete the treehouse look, the exterior 3rd Floor truss uses steel W-shaped columns with glue-laminated timber crossbeams spanning up to 60 feet (see Figure 3). Alternating crisscross patterns across the truss creates a cohesive look with the tripod column supporting the 3rd Floor "canopy" in addition to feeling like multiple small branches creating shadows on the interior of the 3rd Floor. Creating a similar branch-like appearance, the king post tie-rod three-dimensional truss on the interior of the Multipurpose Space was chosen for its dynamic appearance, playful design, and space-filling qualities (see Figure 4). Because the Multipurpose space had such a massive interior volume, a structural element was chosen that

could fill some of that volume while creating visual interest on the ceiling of the massive space. The king post tie-rod three-dimensional truss worked perfectly because it could tie back to glue-laminated columns, creating a cohesive look.

Figure 3

Final Exterior Rendering of Building, Showing 3rd Floor Structure

Note. In this exterior view, the 3rd Floor exterior truss is aligned with the mullions on the curtainwall behind the structural truss system. Behind the 3rd floor fascia and parapet, beams imbedded within the roof and floor system tie the truss back to larger structural columns on either site of the truss.

Figure 4

King Post Tie-Rod Three-Dimensional Ceiling Truss in Multipurpose Space

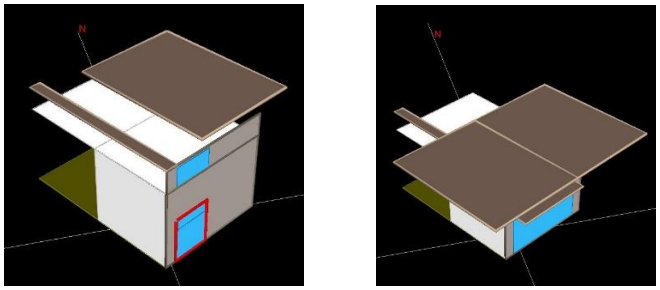
Note. In this interior view of the Multipurpose Space, the king post tie-rod three-dimensional truss system is seen connecting back to glue-laminated timber columns on either wall. This truss holds up the occupied roof space above.

In addition to incorporating structural components which tie together with the overall building concept, another challenge was to create a functional mechanical system that could meet code without compromising major issues like cost or building design. When initially looking at mechanical equipment, a Variable Air Volume (VAV) system was chosen for its inexpensive and efficient qualities, as it could be placed within a drop-ceiling. This system was paired with one Air Handling Unit, an air-cooled chiller, two boilers, and a transformer to make up all of the major mechanical equipment for the building. When analyzing and re-analyzing the building performance for code compliance, many students chose to use a geothermal pump as an energy-saving measure in their own mechanical designs. Even as the building developed, it was a personal goal to achieve code-compliance based on performance in the most inexpensive possible way, which included not substituting the VAV system for a system accompanied by expensive geothermal wells. To achieve code compliance based on performance despite the large percentage of glass in the building, a patinated zinc rainscreen shade system frame-mounted to the exterior of the building reduced the cooling load of the building, decreasing the needed energy to cool the building. To keep the concept and look of the building consistent, the rainscreen also featured a custom branch-like design which brought light into the building like light through tree canopies in nature. Achieving code compliance based on energy performance also relied heavily on high-performing glass in the curtain wall system, high performing thermal insulation, and thick concrete systems in the lower level retaining wall. To ensure that energy performance standards were met (standards of 15% energy saving from baseline design to current design), two different programs were utilized: eQuest, determining peak cooling loads throughout the year in both the baseline design and in the current design (see Figure 5), and Cove

Tool, which analyzed the 3D Revit model and other mechanical load factors to determine the Energy Use Index (EUI), Carbon Dioxide Reduction, and energy performance compared to the 2030 baseline for office buildings in the United States (see Figure 6).

Figure 5

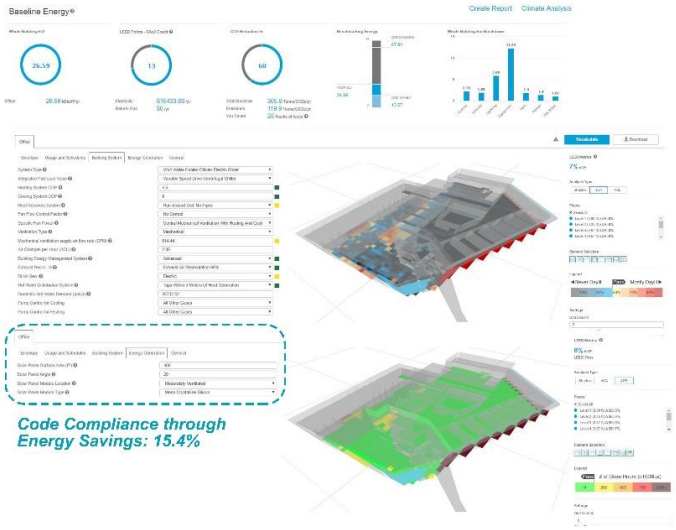
eQuest Models for Baseline (left) and Current Design (right) Factors



Note. In these eQuest models, the peak cooling load was determined for the focus space only. The baseline model included 30% glass, baseline requirements for material R-values, and no shading, while the current model has the full wall of glass, three different shading devices, and R-values of high performing glass.

Figure 6

Cove Tool Final Building Information, Including Daylight Analysis

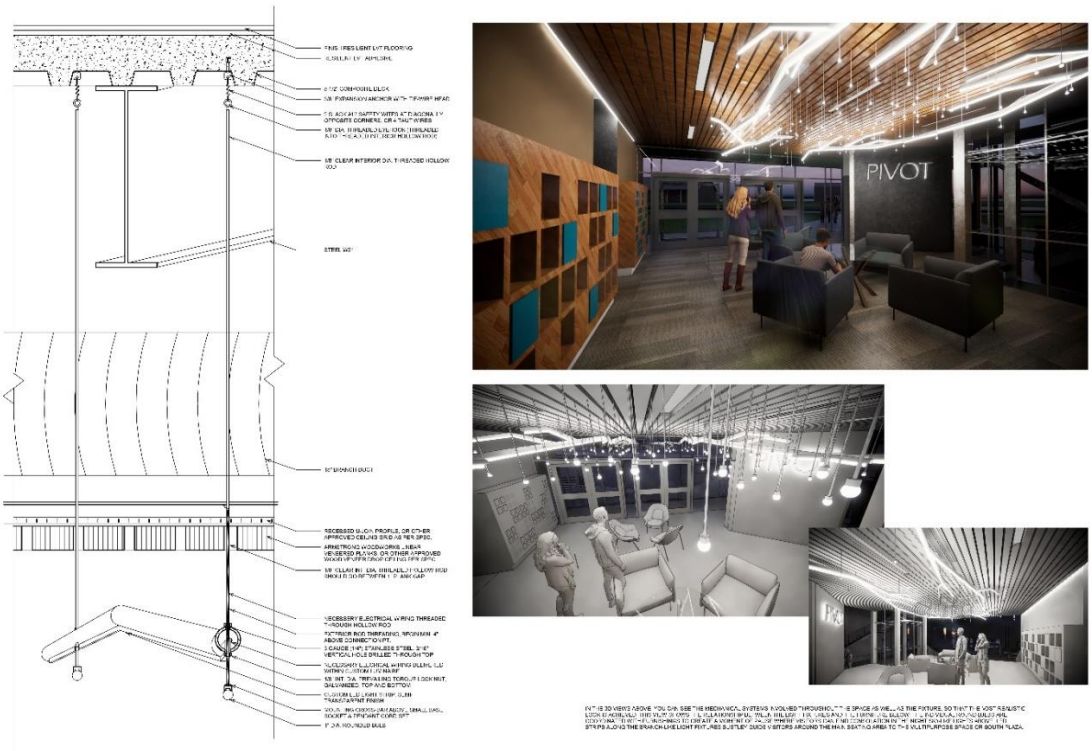


Note. In the CoveTool model, the EUI for current design had to have more than 15% energy saving from the baseline design in order to comply with code. Though baseline values are not shown, the final design had a 15.4% energy reduction using only the shading system, high-performing insulation and glass, and a small PV system.

Once the exterior envelope, structure, and mechanical designs were complete, interior development, including detail design of one component, were primary areas of focus to tie interior design to the overall conceptual design and design stance. For the interior detailed design component, an accent light fixture in the focus space was deliberately chosen for its potential to reinstate a feeling of refuge. Because the chosen focus space was the lounge on the 1st Floor, the space was both an entry point into the building and a space for clients to relax and wait for appointments or do homework. As a space of both transitioning and relaxing, it made sense to create a light fixture that could draw attention to the seating area while also using geometry to draw visitors through the space. Harking back to the overall concept of a treehouse, the designed light fixture was reminiscent of looking through branches at stars, with LED strip lights moving through hollow steel sections shaped like branches and individual bulb lights to look like stars (see Figure 7). This fixture not only connected to the overall concept, but strengthened the lounge space as a moment of pause for potential clients entering the building for the first time, for clients needing to get away from activities in the Multipurpose Space, or for anyone waiting to learn more about Pivot.

Figure 7

Detailed Design Component: Lighting in the Lounge



Note. The detailed design component includes the actual lighting detail itself, informing how the fixtures work together to hang from the structure above. On the right are views showing the lighting designed in the 3D model.

The design premise of a place of refuge played a role in all aspects of project development, from early spatial design to detailed lighting. Because of the important early research in client sociology and user stories, the building design was able to not only accommodate the varying different needs of users, but also encourage potential clients to feel secure, building community, a greater sense of self, and independence along their path of healing at Pivot Community Center. Through this design process, this design could truly act as an appropriate space to convey Pivot's mission to advocate, educate, intervene, and counsel youth and families to make a positive difference in their lives.

References

Mission. (n.d.). Retrieved from https://www.pivotok.org/mission