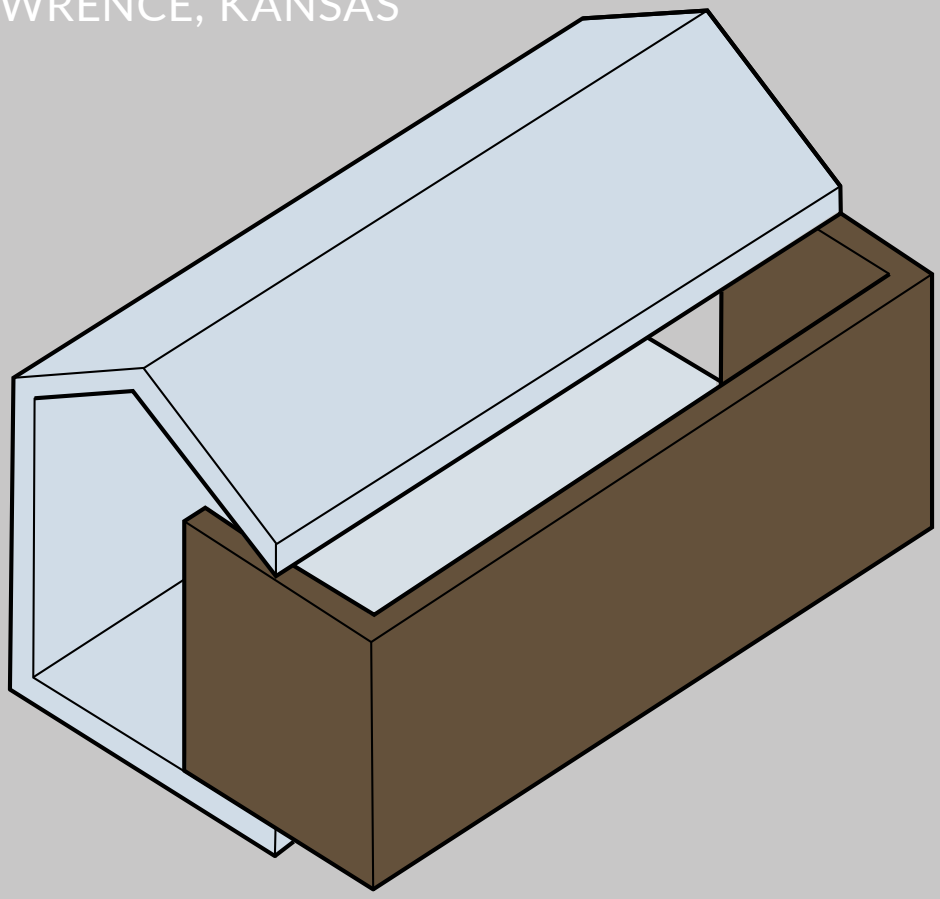
KU SCHOOL OF ARCHITECTURE & DESIGN
The University of Kansas

MARKET ANALYSIS
JURY DOCUMENTATION

Dirt Works Studio

HAVEN STUDIO

LAWRENCE, KANSAS



MARKET ANALYSIS

Haven Studio, rendering of the southeast corner showing the main entrance

Approach

Haven Studio was designed with accessibility in mind. The team chose to prioritize adoptability over innovating simply for innovation's sake. This translates into promoting best practices for construction that are achievable in near future projects over something that will not be market-ready for several more years. The design was kept simple to keep it accessible to the target market.

Target Market

Lawrence, Kansas is currently experiencing a housing crisis. Families are becoming priced out of the area and can no longer afford a typically sized house. In the last few years, Accessory Dwelling Units have been approved for certain areas of the city. As a result, there is a huge and quickly growing demand for 500 square foot homes. The design is not just a scaled-down version of a traditional home, however, but a scaled-right solution that meets the specific needs of our community. The overall concept for the design focused on right-sizing all elements for their needs. This typically translated into keeping things to a minimum size necessary to achieve the intended purpose, which reduces the resources required to achieve the project's goals and creates a more efficient final product. The narrow footprint of the home provides comfortable, multipurpose rooms while avoiding unnecessary energy loads and embodied energy resources.

The housing solution proposed by Haven Studio can meet the needs of individuals who are looking to become homeowners in an increasingly expensive market. The previous iteration of the design, the two-bedroom Haven, demonstrates scalability of the design principles to meet diverse needs of different families. This project has already become a catalyst for a new partnership to design and build several homes over the next few years with Tenants to Homeowners, a local organization that provides affordable housing for our local community. The non-profit plans to build over one hundred homes in total. These houses will support the most difficult members of our community to house; the gable form creates a familiar image of home to help ease the stresses and disorientation often associated with homelessness. These homes will address the housing crisis by providing urgently needed transitional housing.

Affordability and Cost-Effectiveness

The upfront cost of construction for this home is $196,875.74. With labor included, this would have cost $301,023.01 which was calculated as 39% of the total cost of construction and a 10% design fee. With state-of-the art equipment, quality materials, and additional components such as the EV charger and solar system, the cost of this home is projected to be more expensive than some variations of this model, but it was important that we demonstrated a range of possibilities.

Highly insulated envelope assemblies are one of the most cost-effective ways to create an energy efficient building, as it takes little time to get a sizeable return-on-investment. This, combined with passive heating creates a cost-effective and sustainable design strategy for the local region.

The solar system for the home is comprised of twelve solar panels located on the south-facing portion of the gabled roof. The slope of the roof was carefully designed to be the optimal angle for fixed solar panels. The solar system was intentionally oversized for the needs of the house since the house is tied to the electrical system of the KU Designbuild Center, the excess energy will all be used to offset the existing building. In future projects, it is likely that the quantity of solar panels could be reduced while still maintaining a net-zero energy performance. In either case, the home's energy load will be reduced by thoughtful passive strategies and carefully selected active systems and offset by a robust solar energy collection system. The reduced energy loads will minimize the required size and cost of the energy generation systems to ensure a net-zero energy home, especially in future iterations where the solar system might not be tied to an existing building. The strategies implemented will help the home to achieve a low HERS rating score, provide for occupant comfort, and lower the home's carbon footprint.

The house was designed to be easy to maintain. The design philosophy was to create a smart design, but a simple home that does not utilize many moving parts that often require substantial upkeep. The fully tiled bathroom is a durable surface that will withstand wear and tear as well as be easy to clean. The whole north wall is made of cabinetry or clad with Richlite, and 2/3 of the south wall is glass, so there is very little exposed drywall that would need to eventually be repainted. The mechanical systems are controlled from a single panel that connects to both the ERV and the air handler to easily adjust for occupant comfort. The MEP equipment in the loft is all easily accessible through an access panel, where each piece of equipment is within an arm's reach. The occupant and daylight sensors will keep the LED lights functional for an exceptionally long time, as they will only be on when needed.

On the exterior, the thermally modified ash rainscreen will be protected from the elements without the use of chemicals and will not need to be refinished over time. Additionally, the thermal modification will protect the wood from pests. The

Aerial Photo, Downtown Lawrence with the University of Kansas campus in the background

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Tenants to Homeowners celebrates 30 years of affordable housing

Carolyn Popper | @PopperKU Oct 5, 2022

Tenants to Homeowners, annual event Battle of the Builders

standing seam roofing will hold up for years without needing to be replaced. The landscaping will utilize low-maintenance natives that will not require as much water or upkeep as a typical lawn.

Due to the low-maintenance materials and net-zero nature of the home, the cost of operation and maintenance will be kept exceptionally low, with future tenants likely only needing to pay for water, sewage, and internet bills. Future iterations of this project will be funded through a non-profit organization who will manage the homes. The net-zero homes will significantly reduce the cost of operating these homes at scale. Additionally, as this project will be continued through a non-profit, it is likely that they will be able to secure donations of both labor and materials to repeat these homes for reduced cost.

Livability

By creating a smartly designed building, the day-to-day operations for occupants will be incredibly minimal while still allowing the house to perform to its greatest potential. In a transitional housing situation, occupants are likely to have plenty of other things in their lives to worry about managing and keeping their house running smoothly does not need to be one of them. Even if the houses are run by the non-profit, maintaining the houses at scale should not be something the organization needs to worry about all the time.

The minimal interior walls within the home keep the interiors affordable and easy to remodel when necessary, and the open plan allows for flexible furniture placement and reconfiguration. A future occupant might start their day by waking up and transforming the bed back into the sofa and raising the roller shades that provide privacy. Next, they might head into the bathroom to take a shower and get ready for their day, using low flow fixtures that save water. After that, they might make their coffee and have their breakfast at the kitchen table, enjoying the morning light filling the space through the large, glazed wall. Before getting some work done sitting at the table, they could put in a load of laundry in the Energy Star-rated appliances. When they leave to run some errands in the afternoon, the lights will turn off automatically, saving them energy. After making dinner, they might lounge in the living room and watch TV before unfolding the bed and going to sleep. Simply by accomplishing these tasks in a smaller space, the occupant will have used fewer resources than a typical homeowner, and combined with energy efficient fixtures and appliances, even more energy will have been saved.

Buildability

To improve the affordability and efficiency of these homes, the team utilized prefabricated techniques in the construction. Prefabrication allows much of the construction to take place off-site and enables faster on-site construction time, reducing the cost of labor and materials, which is essential in addressing the housing crisis.

The Build SMART envelope is a hybrid system that combines the best qualities of traditional stick-framed construction techniques with continuously insulated nailbase (non-structural equivalent of SIPs). These redundant systems pair to be greater than the sum of their parts. Contractors are typically hesitant to use SIP panels on their own, but in combination with stick frame, this is a repeatable envelope strategy that can be utilized by any contractor. The nailbase panel portion provides a layer of continuous insulation and an extra layer of sheathing, eliminating most thermal bridging and adding additional rigidity to the structure, enhancing its durability. The stick frame portion has the advantage of being familiar to all contractors, making it affordable and easy to build.

This combination assembly allows for mechanical, electrical, and plumbing to run through the stud walls and still retain continuous unbroken insulation with the exterior rigid timberboard. Prosoco's high-performance liquid-applied flashing and the prefabricated panel's precision creates an airtight fit. Because of this, low- and no-VOC finishes were selected throughout the project.

The team proved the repeatability of this envelope strategy through the roof assembly. The roof was constructed onsite, with traditional rafters framing into the panelized wall system. The rafters were then sheathed and covered with about eight inches of exterior rigid timber insulation, before being sheathed again with ZIP sheathing. Like the stick frame element of the wall panels, the rafters were infilled with cellulose batt insulation. The combination of insulation materials provides an R-62 for the roof, far exceeding the code minimum. This verifies that the envelope strategy can be repeated by any contractor, even without access to the prefabricated panels.

The prefabricated wall panels from Build SMART reduce onsite construction time, which saves in the cost of construction. As Build SMART is a local company, it is easy for future projects to utilize their system; however, similar results could be achieved with stick frame construction and nailbase panels. The small footprint is affordable for partnered organizations to build similar homes based on this project. This will improve the lives of more families by expand¬ing the number of families nonprofits can support at one time, and remaining space efficient to fit more projects on narrow lots.

Scalability

Due to the simple design and the integration of prefabrication, Haven Studio is ready to be created at scale. The prefabrication allowed the on-site construction process to take only four months from foundations to finishes, and the timeline could be significantly sped up with a team working on the construction full time. With appropriate resources, this could easily be replicated with slight refinements to get it ready to be mass produced, with teams constantly working on prefabricating the different elements. Build SMART already has the facility to prefabricate the exterior wall panels and ship them to sites, but the techniques could be replicated by any contractor.

Being able to create these homes at scale would dramatically improve the housing crisis in Lawrence. The partnership with Tenants to Homeowners, a local Lawrence, Kansas nonprofit that has helped more than 400 families become homeowners since 1992, will do just that. Students entering the studio in Fall 2023 will begin working with Professor Chad Kraus to design and build a tiny home that will directly help families in our community obtain safe, healthy, and sustainable housing. Helping to house members of our community using a housing first method will allow people to focus on rebuilding their lives by providing a sense of stability and let their mental energy be used for more productive things.

Beyond the scalability of the built project, the design concepts utilized in the studio design have been translated to a two-bedroom model. The team has already created full construction documentation for the two-bedroom version during the initial design phase of the competition before pivoting to the studio version for the build competition. This demonstrates that these sustainable principles are applicable to both transitional housing as well as more traditionally sized housing for families.

Innovation

Innovation was balanced with the desire to make accessible options for sustainable solutions that could be readily achieved. Not only could these principles be implemented in new construction, with prefabrication and highly insulated assemblies, but also sustainable choices in durable, bio-based products and energy efficient appliances, fixtures, and systems could be adopted by the general public who are updating their existing homes to be more efficient, which is even more sustainable than a new construction project.