

## Micro-community: A Design Build Catalyst

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**Keywords:** architectural education, design process, housing, participatory design + community engagement, pre-fabrication + modular construction

**The recent design-build project by the UTA School of Architecture is a prototype tiny-home micro-community in a city taking conscious, progressive approaches to housing. It demonstrates an intersection of education, research, and practice, expanding on the established design-build model through collaborative community building, evolving partnerships, and building performance, while critically exploring small-scale housing development as an effective solution within the context of the DFW metropolitan area.**

**Oak Crest Meadow in Kennedale, Texas, is envisioned as a catalyst project for both the neighborhood and city, providing a viable housing and community solution for seniors, a demographic impacted by increasing housing costs and limited availability. The project is an alternate-density collection of tiny-homes built in a transitioning neighborhood with mixed zoning and land use. The opportunity to be creative within this typology has led to the design of a walkable garden community with six 540-sf senior-living homes, arranged within external common spaces that foster interaction and belonging.**

**The school has inaugurated a new Community Design-Build Lab which strengthens its mission and curricular goals, reinforcing a pedagogy of learning-by-making and establishing community relationships. This project has allowed the design-build program to intensify its core teaching of both community service and building science. Oak Crest Meadow is prefabricated by students learning about prototyping, modular construction, mock-up testing, quality control, and budget.**

**A focus on building performance and residential assembly systems underpin the school's critical role within the discussion of climate change and energy stewardship. The ability to construct six nearly identical housing units provides a unique opportunity for comparative analysis. By slightly varying unit assemblies and equipment, a performance analysis of energy and water usage, carbon footprint, IAQ and more**

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**can be made. The metrics viewed across the entire project will create useful research and real alternatives for the local housing industry and influence future design-build work.**

### BACKGROUND

The University of Texas at Arlington School of Architecture (SoA) established its current version of the design-build program roughly six years ago, combining previous design-build projects and delivery methods with an opportunity to work with the Fort Worth-based Housing Channel. The Housing Channel is a 501(c)(3) non-profit whose mission is to “revitalize distressed neighborhoods and to increase the amount of quality, affordable housing available to low- and moderate-income families and individuals with special housing needs.”<sup>1</sup> This collaboration has led to the student design and construction of three single-family houses in Arlington and a strong working relationship between the SoA, the Housing Channel, the City of Arlington, and numerous local contractors, vendors, and other partners.

Design-build at the SoA is taught across two semesters of the fourth-year undergraduate program. The fall semester is the “design” semester, where students develop various schemes, ultimately selecting one to finalize with a set of drawings and documents ready for permitting. The spring semester is the “build” semester, spent largely on site, where students are directed in the construction. Coordination is made between SoA faculty, contractors, and students. Each of the completed three houses to date have been a learning experience in terms of process, schedule, budget, teaching, and much more. The most recent single-family build was interrupted by the pandemic lockdown in March 2020, resulting in an opportunity to rethink the design-build delivery just as the micro-community project began.

The latest design semester was afforded an opportunity to design a project in a different community and with a wider scope. As the Housing Channel negotiated with the City of Arlington, the choice to work on a slightly larger property for a different demographic group of users was found, resulting in a scheme of “tiny-houses” in neighboring Kennedale. The typical single-family project was adjusted and expanded, especially in terms of program and site design. Initially the Housing Channel proposed two possible sites: the Kennedale lot and a traditional single-family



Figure 1. Oak Crest Meadow, perspective. Image Credit: UTA School of Architecture.

site in east Fort Worth. Right away this was clearly more than just a shift from the typical Arlington options of previous years. The Kennedale site was selected because of the obvious potential in exploring a tiny house micro-community. Additional challenges included the larger social impact on the city and the immediate neighborhood, unit affordability, pre-fabrication, and the student design of activated outdoor spaces. The site included other challenges as well. It borders an active heavy rail line, with an industrial building and usage next door. Requirements for multi-unit parking were still kept following the rezoning. City water and sewer were also not available. The sewer connection required a city extension and a lift pump due to the existing slope. Still, the potential for a positive outcome in terms of senior living, an alternative housing type, and a willingness to experiment by the city and developer created a spirit that lifted the entire project. As with most design-build work, community partners are also encouraged by the energy of the student team.

Dubbed Oak Crest Meadow, the project is an alternate-density micro-community of tiny-homes located on a 1/3-acre lot in a transitioning neighborhood with historically mixed zoning and uncoordinated land use. The design matches the experimental and progressive attitude of the city, where previously, tiny-house communities had not been allowed. The encouragement to be creative within this typology has created the design for a walkable garden community with six 540-sf leasable senior-living homes, a community pavilion and central promenade (Figure 1).

The units themselves are a single-story with offset shed roofs. The plan is roughly square, with an entry, open kitchen and living space in one half and a bed/bath/laundry in the other. A custom open shelving unit divides but doesn't separate the bedroom and living room. A small rear yard patio is provided as a private outdoor space distinct from the public promenade. The "base" tiny-home unit will have a small hot water heater and minisplit in a partial attic space (appliances and mechanical equipment variations are discussed below in more detail). The units are modest and cleanly designed. They are intended for one occupant, providing a tall, open interior with multiple outdoor connections.

### COMMUNITY IMPACT

The scheme was quickly identified as a potential catalyst for housing opportunities within the larger community and region, and also a chance to expand upon the internal SoA pedagogy of the design-build curriculum. The Housing Channel recognizes the project as a chance to expand upon their own impact by increasing the number of units and offering an alternative housing type. Kennedale also signaled its recognition that traditional use-based zoning had limited its development, and more importantly was building support for adding affordable housing to a transitional neighborhood lacking any kind of definition or real community. Simultaneously, the SoA was adjusting to the pandemic lockdown while opening its new Community Design-Build Lab. Adapting to changed teaching strategies alongside the opportunity to connect with research, prototyping, and

pre-fabrication were all identified as opportunities just as the Oak Crest Meadow project kicked off.

As with most design-build projects the students are tasked with communicating with stakeholders, partners, vendors, and the public, both to follow any required review process and to promote and build understanding across the larger community. For Oak Crest Meadow the student team held discussions with all of the adjacent property owners and conducted design presentations to the Kennedale Economic Development Committee, City Council, and city staff. Mid- and final design reviews with the Housing Channel, contractor, industry partners, SoA stakeholders and the SoA faculty were also held. The surrounding neighborhood is still largely a haphazard collection of building types and densities. Kennedale, however, views the location as needing better definition and improvement as the larger demand for housing in the metroplex closes in around it. Following the design semester and the final presentation and approval from the city council, the utility and site work was to begin. Delays however led to the full shift of student work into the SoA Community Design-Build Lab and the off-site construction of the first unit (Figures 2-3). As expected, this prototype uncovered a series of design questions all while teaching the necessities of pre-fabrication, estimating, and purchasing.

Oak Crest Meadow provides a viable housing and community solution for seniors, an underserved demographic disproportionately affected by rapidly increasing housing costs and limited availability. While the scale of the project provides only a small number of units compared to the urgency of the senior and disabled housing crisis, it has opened the conversation amongst the students, SoA and Housing Channel. It is widely recognized that both elderly/disabled housing and assisted care housing is lacking in the US. A quick look at the most recent Dallas Housing Authority PHA (Public Housing Agency) report to HUD, for example, lists only 119 of 3527 total units (3.4%) as “Elderly/Disabled.”<sup>2</sup> This is not a criticism of the DHA but rather a simple statistic that talks to the larger disconnect between senior living, public housing, and public healthcare services. The Oak Crest Meadow project reveals these conditions in a context of architecture and design that has been largely unexplored at the SoA.

Considerations for senior and disabled occupants were made in the tiny house design, not least of which is the tiny house itself as an affordable and manageable unit for a community that generally lacks housing availability. Not only do the units provide an option to seniors lacking a history of homeownership, but the project is designed to create a sense of community and inclusion that may build trust and awareness, key defining social characteristics of a micro-community. The six units are arranged within specifically programmed external common spaces that foster interaction. This “promenade” is a human scaled front yard with areas that belong to the community and also address the front porches of individual units (Figures 4-5). A mix of landscaping and hardscaping creates an informal design meant simply for the

residents. A shared community pavilion will also be constructed at the back of the site, opening onto a larger green space with west-facing views. The required off-street parking area is held to the street edge, separated with a site wall from the units and promenade.

An additional effort between the SoA and Housing Channel is to make one of the units available as a construction project for Youthbuild Fort Worth, a program for at-risk high school students. Youthbuild’s mission is to “help segments of the population who need most support: those disconnected from school or work, those returning from jail or prison, and more.”<sup>3</sup> The work with this and other regional programs, including Tarrant Community College, teaches design and construction skills, provides interaction with SoA students, and creates awareness of trade school and higher-ed programs.

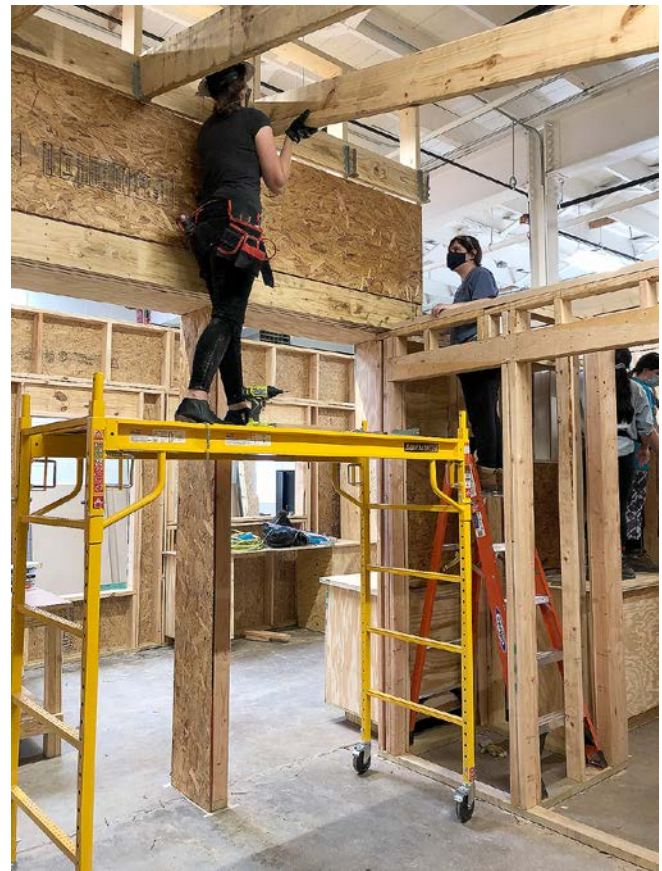


Figure 2. Build-studio: Students framing the first prototype tiny-house in the SoA Community Design-Build Lab. Image credit: Brad McCorkle.

## DESIGN EXPERIMENTATION

The SoA has inaugurated its new Community Design-Build Lab which strengthens its mission and curricular goals, reinforcing a pedagogy of learning-by-making alongside establishing local and community relationships. The UTA design-build program has existed for a generation with successes across the



Figure 3. Build-studio: the first tiny-house mock-up in the SoA Community Design-Build Lab, ready for disassembly and transport to the site. Image credit: Brad McCorkle.

Dallas-Arlington-Fort Worth metroplex. Experimentation with materials, structure, building types, teaching, project delivery and community partnerships have always been part of the program. Recently, however, UTA design-build has consciously expanded in these efforts with an increase in faculty, facilities, and greater ambition regarding project scale. More importantly, the chance to increase outreach as a means of increasing equity and engagement with underserved communities has found a new energy and focus.

The Oak Crest Meadow project, as described, is a result of a years-long partnership with the Housing Channel in Fort Worth. Early projects completed as this relationship began included case-studies and “small-builds” that maintained and reinforced a strong, studio-based tradition. As this led to the design and construction of single-family houses, the studio curriculum was arranged into the fall-design and spring-build studio sequence. Each of the three completed houses were, of course, a learning experience just as each had their requisite delays and issues due to weather, permitting, scheduling, and most recently the pandemic lockdown.

Experimentation with the Housing Channel projects is most clearly seen across each of the overall house designs themselves. The projects are kept to a strict budget based on a current relationship to market value and affordability. Another critical design factor is the narrowly defined zoning codes that have existed in the City of Arlington. These establish a *minimum* building size of 1500sf, which remains despite various challenges over the years. In the most current reboot of the Oak Crest Meadow project (as discussed below), the tiny-house zoning use and size requires a significant commitment from the city. The three single-family projects saw a range of experimentation regarding layout, siting, material cladding, and interior detailing. For example, one project was sited to save three mature live oak trees at the front edge of the property by creating a smaller footprint and garage. Another, sited on a difficult, wedge-shaped site, resulted in a detached garage with an L-shaped house that created a courtyard scheme. The houses all favor the expression of structure and a compositional massing that quietly distinguish them from their suburban neighbors.

The SoA is now taking advantage of the new Community Design-Build Lab which allows the Oak Crest Meadow project to be largely prefabricated. Students entering the recent spring

micro-community build-studio were tasked with mocking-up a full prototype tiny house. This was a shift born from the pandemic lockdown combined with a delay from within the Kennedale city council. However, student learning as it relates to prototyping, modular construction, mock-up testing, estimating, purchasing, construction coordination and quality control were all introduced. The first tiny-house is now fully framed in the Design-Build Lab, and the design for its flat-packing, transportation and final installation were also completed. Pre-fabricating and installing the additional houses will now be part of a future build-studio.

The potential for design and material experimentation has been expanded within the school thanks to the addition of this new facility. Equally important is the expanding mission and embrace of design-build within the curriculum. As the teaching of design and construction improves and expands, so does the recognition of community outreach and the building of local partnerships. The Design-Build Lab is still only in its first year of operation and now must find a way into the everyday consciousness of SoA culture. The delay and ongoing saga of the Oak Crest Meadow project is an example of one of the fundamental difficulties of design-build projects: the frequent misalignment of a semester schedule vs. the real-world unpredictability of construction and development.

### BUILDING SCIENCE & CLIMATE ADVOCACY

Oak Crest Meadow provides an ideal scenario for comparative research, building multiple, nearly identical tiny homes all gathered into a single micro-community. From the earliest moment in defining the project scope, the opportunity to measure differences in energy, performance, cost, and more has been apparent. Collecting, documenting, and applying this research to the classroom and beyond represents the building science and technological teaching goals that balance the design-build program alongside its success in community engagement and hands-on learning. The expectation for six tiny houses to be constructed has led to modeling studies that aim at least four certification levels: passive house (PHIUS+), zero energy ready (DOE ZERH), EnergyStar, and local minimum code (IECC). The research team has also expanded to include UTA engineering faculty specializing in both building control systems and post-occupancy data analysis. A series of energy, carbon, and 3D models are being developed so that the tiny houses can hit specific certification standards, energy and water usage limits, energy generation goals, and indoor air quality (IAQ) metrics that include CO<sub>2</sub>, temperature and humidity levels.

Post-occupancy monitoring always comes with a few assumptions that need to be even more carefully considered in the case of tiny homes. Individual use of the building, its appliances and equipment, and the occupant's personal lifestyle can skew results when there isn't a larger data set. However, the monitoring

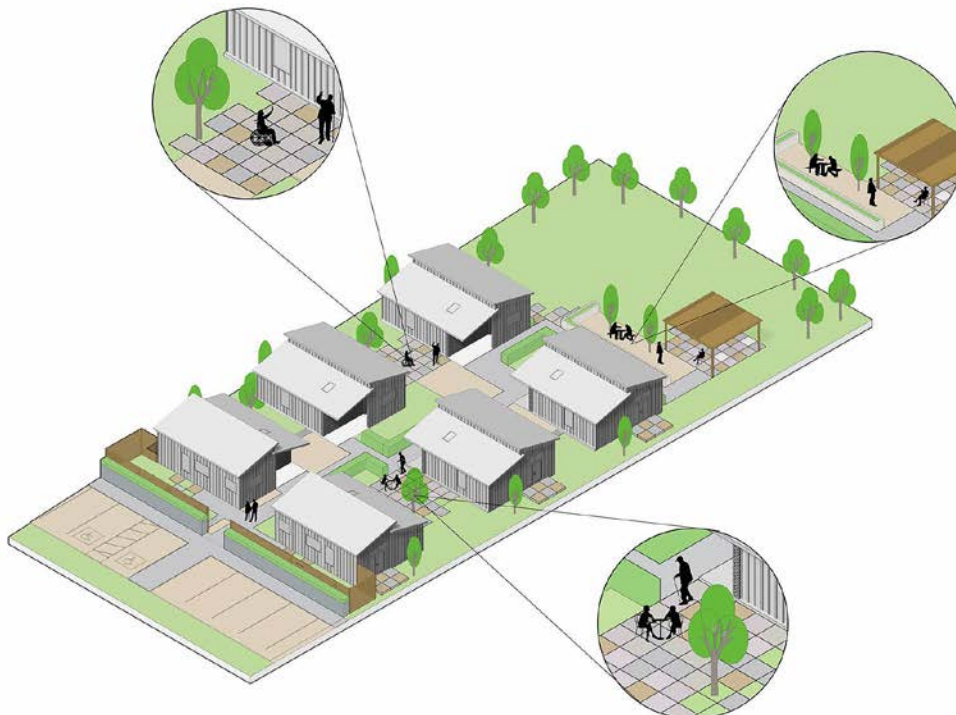


Figure 4. The Oak Crest Meadow promenade, connecting six tiny house units. Image credit: UTA School of Architecture.



Figure 5. Oak Crest Meadow site plan. Image credit: UTA School of Architecture.

of certain electrical usages, such as appliances or DHW, can be compared across all units without regard to differing certification levels. Energy usage tied to heating or cooling, of course, is expected to vary based on insulation and air-tightness levels, amongst other factors. Varying envelope assemblies are expected, but energy demand differences may be subtle, with slight changes in insulation levels as one example. The increase in air-tightness expectations and full, continuous insulation needed to achieve passive house certification will certainly mean an increase in window and door costs, the addition of roof and below-slab insulation, and the introduction of a PV array. An array for the entire community may be a solution considering the inefficiency of providing PV for some but not all of these small units.

Another critical comparative analysis is the difference in construction costs between the various certification standards. There have been previous projects that compare Passive House level to ZERH (Zero Energy Ready Homes) certification standards, including the recent completion of two Auburn Rural Studio 20k houses.<sup>4</sup> Often the results point to a dramatic increase in cost to achieve PHIUS+ Certification but without a dramatic change in energy savings. Building scale has a lot to do with this and we expect the smaller project size to reinforce this assumption. Scaling up to multi-family is especially important in closing the passive house gap between cost and performance, as the efficiencies of increased occupancy and reduced envelope become visible.

Finally, this research is expected to be brought back to the design studio as part of a continuing effort of coordination between studio and non-studio teaching. Shifting the teaching of undergraduate building science material to better suit the hands-on experience of design-build is one of the goals of the evolving SoA curriculum. The ability to utilize the Oak Crest Meadow project as a teaching tool is expected to go beyond its initial design and construction, such that its continuing monitoring and comparative assembly strategies become tangible evidence for future design and construction decisions.

### SPECULATION & MOVING FORWARD

Oak Crest Meadow is a prototype tiny-home micro-community in a city that, until very recently, was taking conscious, progressive approaches to rethinking housing, its engagement with not-for-profit development, its relationship with UTA and other local stakeholders. The project demonstrates an intersection of education, research, and practice, expanding on the established design-build model through collaborative community building, continuously evolving partnerships, and attention to building performance.

However, since the initial draft of this paper and the successful construction of a mock-up tiny house in the new SoA Community Design-Build Lab, the City of Kennedale has had an almost complete turnover of its city council. The new council, unfortunately, has made a complete reversal in its attitude and support of the Oak Crest Meadow project, along with other low- to mid-priced

housing development projects. The Housing Channel and the SoA have been shut out of discussions and the approvals and permits granted have now been rescinded. A period of negotiation was cut short, and the project has now been officially killed.

The lessons from the sudden political reversal in Kennedale are still being unpacked. The progressive and supportive attitudes of the previous city council membership have been replaced by officials with beliefs and interests that are almost entirely opposite. The legalities of the steps that have (and have not) been made since the new council was installed are being questioned widely across the area, but it is unknown if any action will come from it. Certainly, organizations like the non-profit Housing Channel do not have the means or current investment to challenge the city's non-action further. The speculation is that the council is removing support for low-income housing in favor of higher-end, large lot single-family development. No indication of any balance between high-end and affordable housing has been made.

Currently the Oak Crest Meadow project awaits a new home. The Housing Channel and SoA have started to discuss sites in the City of Arlington, which (as described above), has always been a location difficult to accept alternative housing types. Much of the potential of the new Arlington site can be directly credited to the efforts and past successes of the SoA and Housing Channel. All the previous single-family houses constructed as part of the design-build program have required expediting and additional attention from the city building department. The ongoing participation and connection to the Arlington planning, zoning and building officials have built a significant level of trust which is now being evidenced in the (likely) acceptance of the SoA tiny-house micro-community. The original site in Kennedale was an alert of sorts to Arlington; it is clear that the city values the town-and-gown successes of the SoA and hopes to maintain it. The feeling is mutual. With the eventual construction of a revised Oak Crest Meadow project, the school will be making further impact on loosening a still restrictive zoning code. A successful completion within Arlington also suggests that the city would be more inclined to offer additional future sites for tiny or micro-development going forward.

Future implementation of this typology signals a new level of cooperation and partnership that may provide real alternatives in an otherwise limiting and prohibitive housing market. An important, local example of a tiny-house community serving the recently homeless was built by bcWorkshop, one of the school's most important partners. The project, called the Cottages at Hickory Crossing, was completed in Dallas in 2016.<sup>5</sup> It has become well known in the metroplex and is regarded as both an architectural and social model.

The Oak Crest Meadow project is still being optimistically studied and developed as a micro-community prototype and for academic research focused on design, delivery, and performance. As an ongoing research project and emerging precedent for

student design-build, this offers the potential to further develop social, curricular, quantitative, and architectural prototypes. The SoA design-build program continues to expand alongside our faculty and student enrollment. None of this will speed up the process of completing individual projects, however. The commitment from faculty and project stakeholders beyond the typical studio or development continues to be a labor of love for any design-build work. All else considered, that commitment is perhaps the most valuable student lesson.

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#### ENDNOTES

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