

# The Trinity-Charleston Hybrid; Creating Affordable, Sustainable, Urban Infill Housing

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**Keywords:** Passive, Affordable, Modular, Infill Housing

## INTRODUCTION

The numbers defining our current housing crisis are daunting. In 2020, 30% of all households had “unaffordable” rent or mortgage payments, defined as exceeding 30% of monthly household income... and more than 1 in 7 households paid over half of their income on housing.<sup>1</sup> There is a national shortage of 7.3 million affordable and available rental homes for extremely low-income renters.<sup>2</sup> And on top of this, population demographics are changing with greater demand by the Missing Middle sector of people, who do not fit the typical family structure and make a decent income, yet can still not find affordable housing.<sup>3</sup> While this presents a high hurdle to clear, there is still an abundance of vacant land in our cities with enormous potential to address this problem.



Figure 1. Lower North District Vacant Lots. Philadelphia 2035.

Rather than refilling this vacant land with the same cramped, dark row homes, this project proposes a new typology of sustainable and affordable smaller homes reoriented on the site to provide greater access to sunlight, fresh air, and green space. This new typology springs from previous design research for the Side Yard House (SYH) in which a long thin home, similar to

the Charleston House typology, is repositioned along the north border of the lot with abundant south-facing windows looking into a communal green space on the south side. This southern orientation ensures all units have abundant sunlight for passive

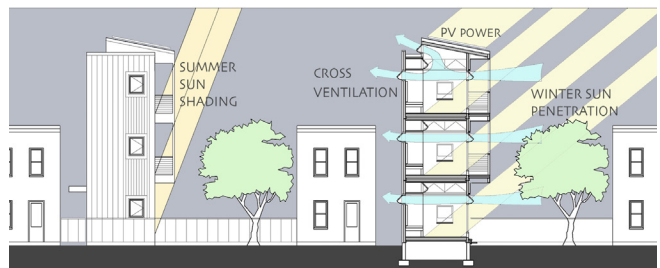


Figure 2. Passive Energy Strategies. By Author.

solar heating, daylighting, and PV power. Operable windows for cross ventilation and passive shading from the overhanging balconies also reinforce the resilient design strategies. While this design approach worked well for sites where an entire large *block* was vacant, (as in the test city of Detroit) it was less successful with smaller, more affordable homes on blocks composed of small pockets of infill sites, thereby limiting the

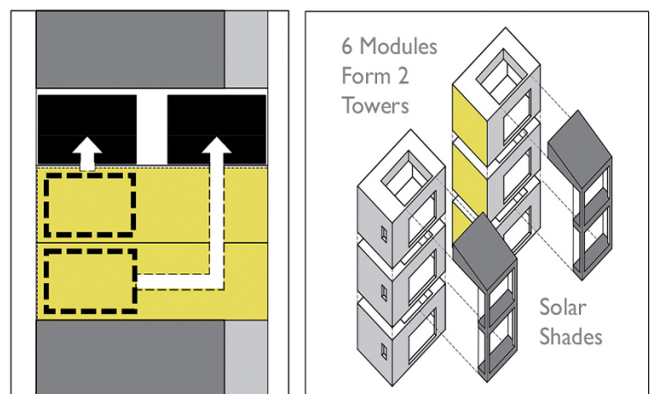


Figure 3. Concept Diagrams. By Author.

potential application opportunities. This new phase of design research focuses specifically on how the concept can be revised and applied to smaller homes on smaller infill lots within an existing block of row homes.

### THE CHARLESTON-TRINITY HOUSE TYPE

The concept for this new infill design combines the Charleston typology with the regional Philadelphia Trinity House typology, in which 3 single rooms are stacked vertically to create a house with a very small footprint. Like the SYH, units are still located along the northern lot line, but because of the smaller urban sites, 3 adjacent lots are required to create the side yards. However, the Trinity's smaller size and vertical orientation allows for 3-7 units per site (depending on lot depth) instead of 1 single larger detached home.

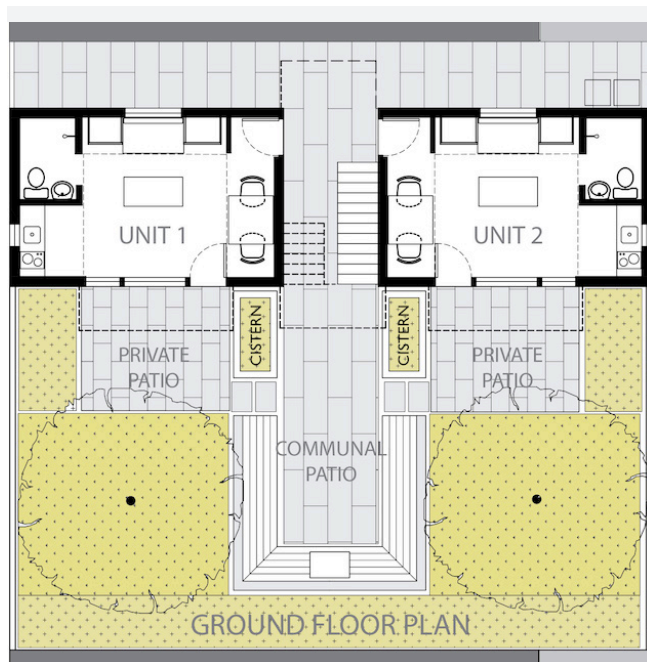


Figure 4. Microhome Ground Floor Plans. By Author.

Since this concept requires a site made up of 3 adjacent lots on north-south oriented streets, it was important to first identify a location with a sufficient number of useable sites to confirm the project's viability. The Lower North District just north of center city Philadelphia is an ideal location for several reasons. The 6-square-mile district contains approximately 34,000 row-home lots of which roughly 8,000 are vacant, almost 25%.<sup>4</sup> Of those 8,000 empty lots, there are approximately 840 that can be combined into 3 adjacent lots on north-south oriented streets. Even though the Lower North sits in a prime location next to downtown with excellent public amenities, the majority of the area has not gentrified yet (as is happening in neighboring districts) so land prices are currently low enough to make multiple



Figure 6. Three-lot sites. Google Maps edited by Author.

lot purchases financially feasible. This is important because the area's median household income is well below the city average so many who cannot afford the market rate homes currently being built around them could afford these smaller homes and not be forced out of their neighborhood. Therefore, with 840 potential sites, it would be possible to develop hundreds of homes that can affordably house thousands of people, confirming this district as a viable location for the concept.

The small size of the homes themselves translates directly to lower per-square-foot costs and so serves as the first strategy to keep the houses affordable for local residents. Costs are further reduced through the use of pre-manufactured, modular construction which costs an average of 10% to 20% less than stick built construction. All modules are a nominal 12' wide to fit on a flatbed truck but the lengths are sized in 4-foot increments of 20', 24', and 28' dimensions. While existing lot widths on the street are fairly consistent at 14'-16', the depths vary from 45' to 95' which determines how many units can fit on each 3-lot site. With this range of unit and lot sizes, a family could own a building lot comprised of three or four units of various sizes in which their siblings, parents, and/or adult children could live together to support each other. Unused units could also be rented out as



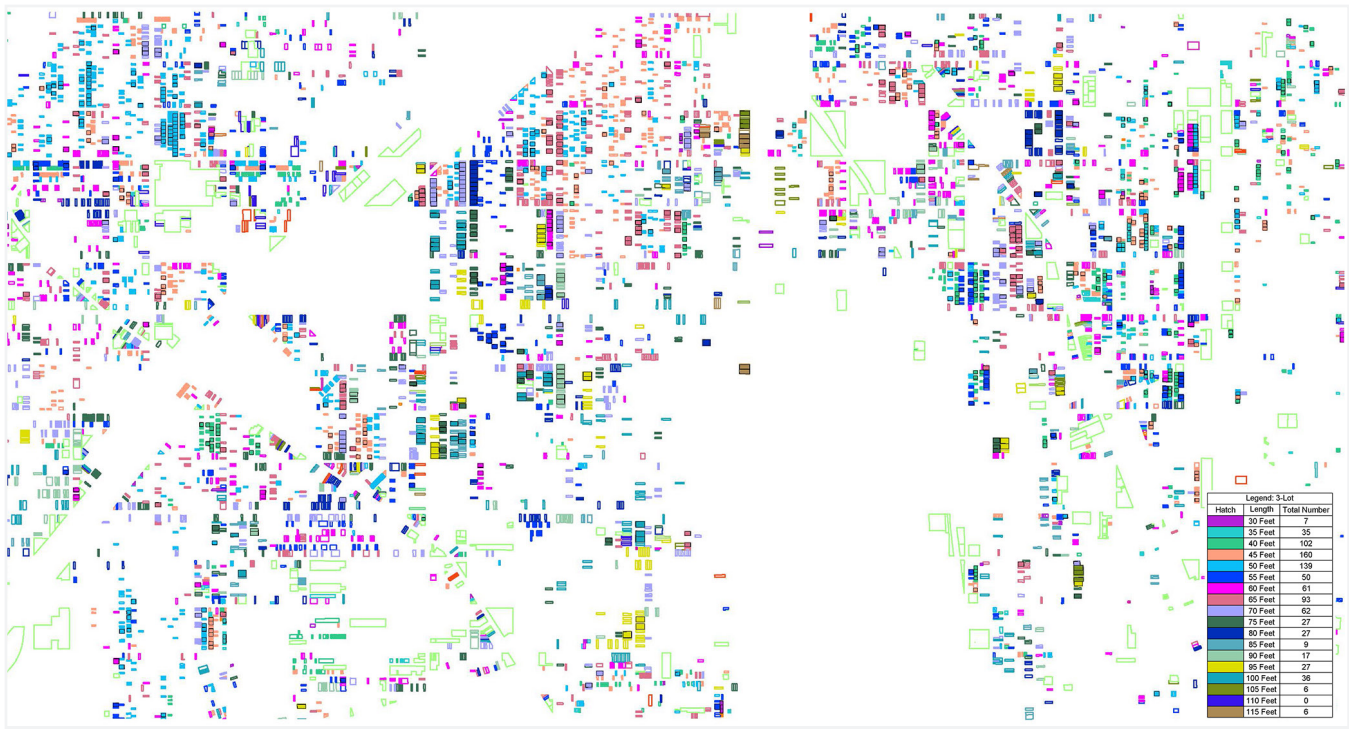


Figure 7. Vacant Lots in Lower North District. Solid infill indicates 3-lot sites. GIS Map edited by Trisha Kawa.

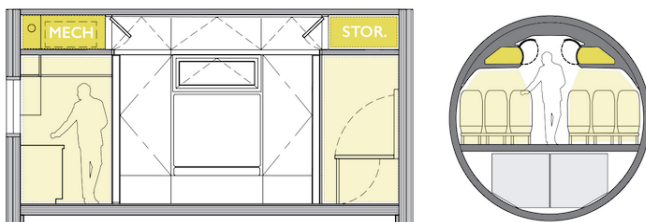


Figure 5. Microhome and Fuselage Sections. By Author.

Accessory Dwelling Units to help defray the mortgage costs. The smallest unit model (example shown here) is a tiny 250 square foot single-story microhome for single residents that can be stacked 3 units high. Because of the small floor area, a space saving strategy is applied that borrows from airline overhead storage bins. A U-shaped space of functional “wet” zones with storage bins above surrounds a taller central living space. The larger single-unit, 3-story Trinities have an internal stair connecting cooking, living, and sleeping levels. These are geared towards couples and are available in 3 sizes with floor areas of 750, 900 or the largest at 1050 square feet that includes an additional bedroom. The multiple module combinations possible per site create a wide variety of units that can accommodate the range of diverse, non-traditional family structures required for missing middle housing.



Figure 8. Microhome Interior. Rendering by Zachary Winton.



Figure 8. Exterior Perspective of Microhomes. Rendering by Zachary Winton.

#### ENDNOTES

1. *2022 State of the Nation's Housing report*, Habitat for Humanity, <https://www.habitat.org/costofhome/2022-state-nations-housing-report-lack-affordable-housing>
2. *NLIHC Releases The Gap 2023: A Shortage of Affordable Homes*, National Low Income Housing Coalition, <https://nlihc.org/news/nlihc-releases-gap-2023-shortage-affordable-homes>, Mar 16, 2023
3. Daniel Parolek, *Missing Middle Housing*, Island Press, 2020
4. *Philadelphia2035*, Philadelphia Planning Commission, March 2014