

Sustainable Homes

“The works of the past always influence us, whether or not we care to admit it, or to structure an understanding of how that influence occurs. The past is not just that which we know, it is that which we use, in a variety of ways, in the making of new work.... The typology argument today asserts that despite the diversity of our culture there are still roots of this kind which allow us to speak of the idea of a library, a museum, a city hall or a house. The continuity of these ideas of type, such as they are, and the esteemed examples which have established their identity and assured their continued cultural resonance, constitute an established line of inquiry in which new work may be effectively grounded.”

- John E. Hancock

The typical building unit of North American housing, is the single-family detached home. From its humble beginnings around the 1920s, to its endless reproduction around the globe, this building type has taken the world by storm. Its uncontrolled reproduction, and its affinity for mass production, have effectively created the phenomenon of sub-urbia.

The sub-urban home has become a symbol of urban sprawl, destitute squandering, and the failed promise of an American Dream. Sub-urban culture is a passive and dependent culture; it is not sustainable. Yet paradoxically, its foundations were based on the promise of independence. And this innate yearning for freedom via independence, still drives its continued production today.

The 2012 ACSA Sustainable Homes Competition requires a single-family dwelling, to be built on an existing city-sized lot in Cambridge. Thus this proposal must work in the context of what sub-urbia has become, using its basic typological building block (the single-family home). Yet, given its aspirations of sustainability, this competition entry seeks to put a positive spin on the single-family home building type, through its conception and design strategies.

The Sub-urban Problem

The “American dream” as it has come to be known, underpins the conception of the single-family dwelling. The symbol of this house, has a dual reading; both as that of a democratic lifestyle and more recently, as an instrument of “the system” of a commodity culture.¹

In relating the “dream” to dwellings and sub-urbia, three underlying themes emerge; escape, status and fulfillment. Escape is associated with escape from the associated pressure, congestion, and corruption of urban life. Status, signifies pursuit in elevated or social advancement. And fulfillment deals with the desire for personal achievement.²

It is important to note that, whether the single-family home’s design is accepted as a radical upward change in status, or as the symbol of autonomy through possession of property, these efforts are, in the end, centered in on the individual. Thus, the sense of individuality is at the core of this type’s design; it permeates it on the level of the plan, on the level of the street, and on the level of the personal life.

Yet from observing our modern sub-urban sprawl conditions (i.e. a car culture) it is obvious that an over-emphasis on individuality is just as unhealthy as not having any individuality at all. In such a frame of mind, losing sight of the world beyond our personal selves is easy. That is one of the main reasons for which we are finding the transition to a more sustainable lifestyle hard. The over-emphasis on the self also deteriorates conditions that allow communities, and thereby, the individuals which constitute them, to thrive.

¹ Archer, *Architecture and Suburbia*, 249

² *Ibid.*, 253

This competition involves a family in Cambridge who is trying to get back on their feet. Thus the question of the individual and of the individual's social progress as posed by the typical sub-urban home becomes important. Their situation implies both a level of autonomy and a level of dependence on the community, to allow for the progressive development of their envisioned lifestyle. In addition to this societal level of interaction between individuals and the Cambridge community, this design also seeks to recognize that the family as a collectivity of people which should firstly act as its own support system as well. Thus, the house seeks to emphasize this aspect of family life, in the hopes that it will emphasize the development of strong familial ties to serve as a strong foundation to build ones life upon.

Most single-family dwellings are two-storey houses, where the common areas are removed from the private areas. Because the two are often separated by level, and since the house usually does not consist of an open plan, there is very little overlap between the two spaces. Consequently, public and private space are explicitly isolated, separated off from one another, such that in a sense, the house becomes a series of public and private rooms solely linked by hallways. In such a plan, these two types of rooms end up without an engaging relationship among each other, with hallways reduced to a functional service. The private areas are traditionally the sleeping

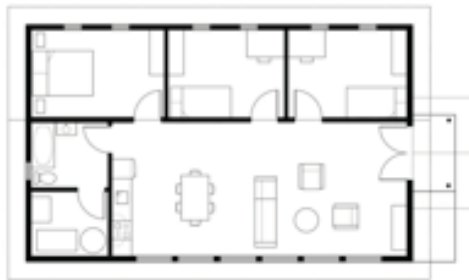


Fig. 1 - Author.

quarters, however they also contain desks which allow kids for example, to spend a large portion of their time in their own rooms. As a result, the bulk of most family's time will be spent apart.

For the Sustainable Home however, the design is a single storey house, where the common areas lead directly to the private areas. Although separated by a wall, the close proximity of these spaces, encourages a physically real dialogue between the types of space, as well as the ability to foster more direct and continuous contact among family members, while still retaining the individuality of each inhabitant (see Figure 1).



Fig. 2 - Archer, *Architecture and Suburbia*, 347.



Fig. 3 - Author.

The individual's integral role in the greater community is important as well. Many sub-urban homes refuse to acknowledge this, and implicitly are thereby further refusing to acknowledge the place an individual should have in a community today. If they offer a series of cookie-cutter homes, then they deny individuality, and if they are cookie-cutter homes such as an abstracted plan whose inspiration comes from a catalogue page without necessarily any adaptation to relate to immediate vicinity such as neighboring houses, or the site itself, then they deny the individual's relevant role in the greater scheme of things.

In Figure 2 above, a still from the movie *Truman Show* depicts a typical sub-urban development; large houses which do not relate to context or each other. The Sustainable Home however took into consideration the surrounding house types in its proximity; these begin as single-family bungalow homes, and continue with a material palette which includes brick and vinyl siding (see Figure 3). Keeping to the one-storey plan was convenient in achieving the goals for the proposed design intentions, and vinyl siding was used both from its sustainable and recyclable characteristic³. These strategies were also used to continue the urban character of the street, thus relating house to context, and implicitly bringing the family closer together in dialogue with their new community.

The project brief was interpreted in such a way that the individual's nuclear family provides the strong foundation for the futures of individual members, but also acknowledging that the support system further extends to the broader community by reciprocal relationship to it. Thus for example, with the creation of a focal communal space as the most important space in the house, was placed to face the street directly with a fenestrated facade which simultaneously communicates with this broader world, as well as catches the sun's rays as a South-facing wall. In this respect, a lot of the design decisions affecting the nature of the communal space also affected the interior condition in terms of some passive design strategies which enhanced the overall ambience of the house.

Particular Precedents

The 2007 Decathlon submission by Team Montreal, uses a central core for mechanical, electrical and water equipment. This saves both resources and energy, in terms of distribution of these systems (see figure 5). The North House, the 2009 Decathlon submission also packs these functional spaces into a service core. It further liberates the central living space from this essentially service space. Likewise in my design of the habitat home, the service core is centered to one area of the house, which allows for a large open space,

³ Vinyl Institute, "Environmental Considerations".

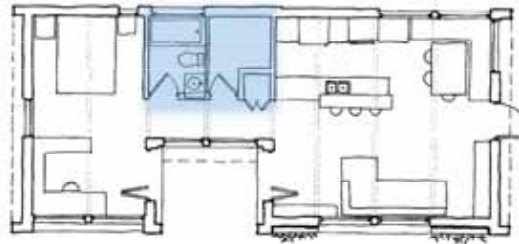
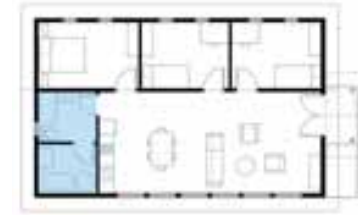
Fig. 4 - Thün et al., *North House*, 17.Fig. 5 - Zaretsky, *Precedents in Zero-Energy Design*, 53.

Fig. 6 - Author.

the communal space, to exist as an open plan. In addition to providing a pleasant space to be in, this programmatic move furthers the house's energy efficiency.

Fig. 7 - Thün et al., *North House*, 10.Fig. 8 - Benítez et al., *Small ECO Houses*, 313.

Fig. 9 - Author.

The house also relies on daylight and natural ventilation strategies. As figure 7 and 8 show, the ample natural lighting reduces artificial light and by extension, the power required for lamps. Originally I intended to provide the inhabitants of the house with such pleasant detailing as exposed rafters shown in figure 8. However the cost would have greatly increased, and the feasibility would not have been as appropriate for a Habitat home, thus the cathedral ceiling concept is retained without exposed structure. By using structurally

insulated panels (SIPs) this effect is efficiently created, allowing for a sense of a greater space in the room, as well as more light (which should reflect off the ceilings and walls, preferably painted a light, non-VOC paint finish).

The communal space not only manages light, but heat as well. Through its fenestration and roof overhang which are designed to keep the summer sun out, and the winter sun in, a pleasant room temperature can be achieved through the concrete slab floor which acts as



Fig. 10 - Author.



Fig. 11 - Author.

thermal mass. During the day, it will be heat up sufficiently, to subsequently re-radiate heat at night, and into the adjacent private rooms on the other side of the partition wall. Likewise, the cathedral ceiling in combination with opposing windows creates a stack effect and natural ventilation to distribute air and heat around the house (see figures 10 and 11).

Technical Precedents

Design for disassembly, known as “DfD” is an important philosophy that should begin to take precedence in modern construction, particularly modular construction, such as the sub-urban single-family typology and its mode of mass production and construction. The main premise of this design philosophy is in creating buildings which reduce new materials consumption, both for construction and demolition. This helps maintain a sustainable and responsible view on future generational needs as old buildings become stocks

for the material needs of future ones; or even renovations to the existing buildings.⁴ The design of the Sustainable Home aimed to adhere to the principles established by design for disassembly guidelines (i.e. simplicity of structure and form, interchangeability of materials, design reducing labour intensity etc...).⁵ Because the philosophy is about disassembly, a lot of these principles focussed on building materials, and their fastenings and were most actively pursued in the technical (building construction) features of the Sustainable Home design.



Fig. 12 - Thermapan, "SIP Solutions".

As seen in figure 12, Structural Insulated Panels (SIPs) have a long history with Habitat for humanity, and the largely volunteer labour it uses to complete work. In fact their use has been so successful that companies such as Thermapan Structural Insulated Panels have actually been involved in the production of many Habitat for humanity homes, by providing local chapters with SIPs at a cost or on a

⁴ Guy and Ciarimboli, "Design for Disassembly", 3.

⁵ Ibid, 6.

donated basis.⁶ This building construction type presented advantages from both a performance and a construction/Dfd point of view, thus it is proposed for the Sustainable Home design.

Structural Insulated Panels (SIPs) are easily erected and dismantled, and likewise are designed according to this philosophy. They represent an integral envelope for the building, both serving as structural system and building skin, rather than compartmental and layered traditional skin design, which would pose more problems at attempts of reuse following disassembly. SIPs can easily be removed from the building and re-used in their entirety, rather than thrown into the landfill. As the roof sheathing, insulation, and structure is all combined into one efficient panel (as is wall sheathing, insulation and structure), both connections, and assembly in general are simplified. Most SIP connections involve large screws, which can easily be removed and re-used as whole components.⁷

SIP building construction, is a type of modular construction because it is essentially using a series of pre-fabricated panels directly and efficiently erected on site. This is very advantageous for the nature of the volunteer labour of Habitat houses, as SIPs require very little skilled labour, and they exhibit a much quicker learning curve than other construction skills. Since SIPs are all ready made in the factory prior to shipment on site, the bulk of the material arrives with the same order, efficiently beginning the process of home construction. This further reduces construction waste generated on site, while the waste can be directly re-used in the very factory in which it was produced. This pre-fabrication also increases the life-span of the materials, as they are produced in a dry and controlled condition. The nature of the SIP panel both increases energy efficiency in performance and by its service life. These factors are directly influenced due to the solid nature of its construction. The SIP panel system eliminates air circulation and moisture, thus preventing growth of mould, and allergens. This reduces the amount of heat that can escape the house through air leakage, but also

⁶ Thermapan, "SIP Solutions".

⁷ USEPA, "Design for Disassembly", 39.

provides a healthy and longer lasting structure.⁸ The Interior wall panels in the house use light-gauge metal framing, allowing for eventual re-use and re-combination, or recycling.



Fig. 13 - USEPA, “Design for Disassembly”.

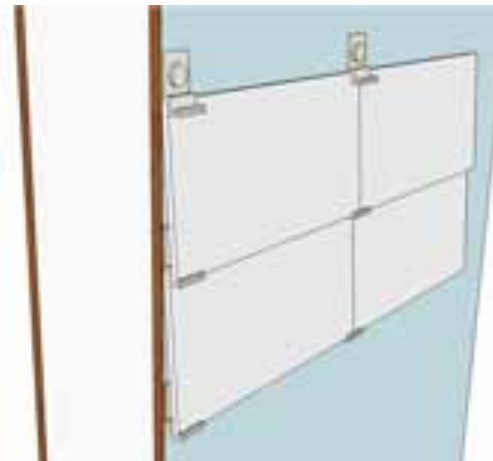


Fig. 14 - Author.

Design for disassembly considerations were used in the detailing of the vinyl facade as well. In an effort to increase the life span, and effectively consider the life cycle of the vinyl siding, a snapping binding system was considered in place of screws on the material itself. This modification of traditional panel siding was first developed as a case study for the Chartwell School in California.

Although it was developed on a prototype which consisted of salvaged wood panels, the design concept can be implemented to vinyl siding as well. The clip has a double bend, the top of which holds the top of a vinyl siding board in place, and the bottom of which secures the bottom of the siding board (see figures 13 and 14). A hex head screw keeps the clips in place, while the thickness of the

⁸ Thermapan, “SIP Solutions”.

clip allows for ventilation and drying of the siding. The clip system therefore increases the ease of manual construction, and deconstruction because of the nature of the connection, and it increases capabilities of siding re-use because of no wear and tear involved in the assembly and disassembly of the vinyl facade panels.⁹

“It may be futile, then, to represent suburbia itself as the problem. Rather, the suburban landscape, its dwellings, its furnishings, and not least its conventions are best regarded as a datum- a base-plane of understood circumstances- that people have voluntarily, even eagerly, taken on as they moved to suburbia. Once arrived at, this base-plane also functions as a datum of opportunity: a site from which people then are able to engage, in various possible ways, in processes of social formation, individuation, and self-realization. To arrive in suburbia, in other words, is to establish a point of reference- certain baseline conventions, conditions, and opportunities. Then, in countless decisions on how to select from, assemble, shape, and reconfigure the resources at hand, people undertake a process of constantly maintaining- or modifying- their material circumstances and life practices to keep them aligned with their own history, their current social milieus, their expectations, and their dreams.”¹⁰

Just so, the Sustainable Home seeks to begin with the typology of the single-family suburban home, to build off of and improve its initial model; to change its essential negatives while retaining all that remains attractive about this lifestyle. In creating a proto-typical sustainable single family dwelling for the ACSA Sustainable Homes competition, this design proposal seeks to engage in a discussion which will reconfigure the sub-urban model, into a truly autonomous and self-sustaining home, and lifestyle. By using the typology of what we have come to accept as a sub-urban home, it hopes to engage in a discussion which will reconfigure the typical sub-urban building block, through its use of precedents and design solutions which touch on questions of program, passive solar design and technical building construction.

⁹ USEPA, “Design for Disassembly”. 43.

¹⁰ Archer, *Architecture and Suburbia*, 351.

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