

Designing for Disaster: Transitioning from House to Home

By

Jennifer Hallick

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Abstract

Natural disasters are increasing in both number and severity, causing the number of people being displaced by disaster to rise as well. Hurricane Katrina provides a particularly poignant example of the human impact of disaster, and of inadequate disaster response, especially where housing is concerned. The Federal Emergency Management Agency's response to Hurricane Katrina in New Orleans exposed a gap in the approach to housing survivors of natural disasters, especially at the interim housing level. The FEMA trailer - which was only intended to house survivors temporarily but, in many cases, became a long term housing solution, - provided shelter for survivors, but did not account for their psychological well-being. The loss of one's home can be a traumatic experience, as people identify their sense of self with their home. Therefore, it is crucial to reinstate this sense of home, and in turn provide continuity to the sense of self, early on in the recovery process.

Rebuilding after a natural disaster is a long process. Because of this, disaster housing needs to be able to evoke a sense of home and ownership so that inhabitants can connect with their environment and reinstate their daily routines. This helps them to rebuild their lives. The proposed project attempts to do this by allowing for flexibility and choice in both the design and daily use of the house. The house transitions from temporary to permanent housing, allowing for a dialogue between inhabitant and environment to begin early on in the recovery process, and to persist. The design is informed by theories on place making, elements of home, dwelling, as well as loss and the grieving process.

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Chapter 1: Introduction

“...[A] small dwelling is not just a structure, a house, but...also a home. Being a home makes it in the location of the family relationships, of generational ties, of socialization of children and of the construction of meaning. These aspects...are more critical to restore after disasters than are broken roofs.” (Russell R. Dynes, 67)

“The easy replacement of home ignores its emotional charge for us, ignores how important familiarity is in the constitution of home. Frequent dislocation or the sudden destruction of a known environment, can be fundamentally deranging. It means the loss of personal landmarks- which embody the past- and the disintegration of a communal pattern of identity.” (Deborah Tall, 424)

1.1 Context

Climate change is having a great impact on the safety and security of communities across the world. With an increase in both number and severity of natural disasters due to climate change, the numbers of displaced people are growing to the point that "...as many as 20 million people may have been displaced by climate-induced sudden-onset natural disasters in 2008 alone." (United Nations High Commissioner for Refugees, 3). After recent devastations such as Hurricane Katrina, where the emergency preparation in place was inadequate, government agencies have begun to reassess the factors needed to respond to emergencies and to help mitigate the consequences of climate change. One of the factors being addressed is interim housing for survivors (Tierney et al., 100).

Hurricane Katrina was one of the largest natural disasters that the United States has ever experienced. When all was said and done, more than 1,800 people died, 300,000 homes were destroyed, and \$ 135 billion in property damage was incurred. Over one million people were displaced from their homes, creating one of the United States' largest mass migrations in history (Weaver, 2; United States Department of Homeland Security. Office of Inspector General, 5).

On August 29, 2005, Hurricane Katrina made landfall near Buras-Triumph in Plaquemines Parish, Louisiana (Ramroth, 214; Bostic & Molaison, 253). Although the centre of the storm missed New Orleans, the 22-foot storm surge produced from the Category 5 hurricane winds the day before toppled the levees surrounding New Orleans at 53 points throughout the city, leaving up to eighty percent of New Orleans flooded up to twenty feet deep (Lee & Willardson, 58-60; Bostic & Molaison, 253-56; Weaver, 8) .

Over 200,000 structures within the city of New Orleans were damaged (Bostic & Molaison, 254-56). Many parts of the city remained flooded in several feet of water for forty-three days after Katrina hit land and people were not allowed to return to their homes (Bostic & Molaison, 254; Ramroth, 217). The housing sector accounts for more than half of these damaged structures, with 66,609 owner-occupied units and 67,735 rental units being damaged (Bostic & Molaison, 254). The Department of Housing and Urban Development (HUD) estimated that “71.5 percent of the 188 251 occupied housing units in Orleans Parish were damaged, including 78 810 that were severely damaged or destroyed.” (258). Most of the damage that resulted from Hurricane Katrina was due to flooding rather than wind, and, because of proximity to the section of failed levee systems, most of the damaged structures reside in the lower-lying neighbourhoods like the Lower Ninth Ward (258).

In events like Hurricane Katrina, where a majority of the housing stock is damaged or destroyed, the Federal Emergency Management Agency (FEMA) provides interim housing assistance as the beginning stage of helping survivors rebuild their lives, with the end goal being their ability to be self-sufficient and to return to a permanent home. FEMA generally provides temporary housing for up to eighteen months after the event. Hurricane Katrina challenged that number, however, and many extensions for assistance were granted (Rose & Tuggle, 8; Federal Emergency Management Agency, 2009 Disaster Housing 1). As it stood, as of June 2010, there were still 860 families living in FEMA trailers, a reduction from over 70,000 in August 2006 (Plyer, News Release 2).

1.2 Purpose

In the wake of a natural disaster, homes are destroyed and people are left displaced. When housing is made available for them, it is often substandard in nature and inadequate in comfort (Gerrity and Steinglass, 240). People who have endured a disaster need a place that they can make feel like home and that gives them a sense of stability and safety while they and their community recover (224).

In designing new homes for a disaster-stricken community, it is necessary to design a space that is meant to be lived in and not just a space in which to survive. But, more often than not, the urgency and need for housing creates a race to design the most affordable and efficient choice. Because of this, the importance of the relationship between dwelling and inhabitant is often overlooked and the focus is solely on the provision of shelter, as was the case with the use of FEMA trailers in the mitigation of Hurricane Katrina (Gerrity and Steinglass, 240). We must recognize that, although the provision of shelter is an important step, it is not the only step in providing a home for someone. In order to create a space that can be inhabited, it is necessary to try to make tangible the very things that often are forgotten when designing housing for survivors of disasters (GRAFT, *Design in Times* 118; Israel, 58).

Ideal homes, by incorporating elements of technology, aesthetics, environmental psychology and familiar cultural symbols, are able to speak to all of our human needs and to allow us to harness our imagination (Israel, 161; GRAFT, *Design in Times* 118).

We must remember that as designers, we are creating a home to be inhabited, not merely a house that has aesthetic qualities that may resonate with us. Kimberly Dovey

criticizes designers for thinking more about the image of the place than the place as a lived-in entity where "...the experience of home is dynamic and action based-it is an experience of 'living in' rather than 'looking at' buildings." (Dovey, 58). Peter Zumthor argues this same point. He feels that thinking about the future of how the space will be used to house things that have nothing to do with the design is crucial to allowing the inhabitant to modify the space to create a sense of home (Zumthor, 35-39).

The mitigation of a natural disaster is a very complex problem with many stakeholders who must work together collaboratively to come up with an effective response plan (O'Donnell et al., 12). As designers, we can contribute to this collaboration by offering a variety of options for interim housing that consider the humanistic qualities of a building; addressing not just the form but how people really use the space. We, as designers, also have the knowledge of and ability to choose materials and manufacturing methods that combat climate change and thus the intensity and frequency of natural disasters. We must design with both prevention and response in mind. Designers have the knowledge and ability to push the design further, so that survivors are given the ingredients to create a home instead of just temporary housing.

The purpose of this practicum is to explore one alternative approach to temporarily housing survivors of natural disasters. I will look at how FEMA travel trailers failed to meet the psychological and social needs of the survivors of Hurricane Katrina in New Orleans. I will address not only issues of safety and comfort, but will also address social and psychological issues of 'being home'. I will do this by reviewing theories on the concept of 'home as place,' what it means to 'dwell,' and how to create 'home' through design. I will also look at literature that deals specifically with the social

and psychological needs of a survivor of natural disaster and the process of mitigating a natural disaster.

The main design questions of this practicum are:

1. How is a sense of home created in a house?
2. In what ways can the elements of home, as understood in North America, be applied in the design of a prefabricated, mass-produced house for survivors of natural disasters?

The learning objectives of this project are to learn about: (1) prefabrication; (2) the theoretical ideas and psychology of the notion of 'home'; (3) the semiotics of objects, their surroundings and how people read space; (4) how a sense of place is created in one's mind; and (5) how responses to natural disasters can be improved through design.

Interior Design can aid in the design of interim housing that is sensitive to the situation and needs of survivors of natural disasters. By using theories that address the idea of home, attachment, place-making and the semiotics of objects, designers can help make a difficult, traumatic situation easier for survivors by giving them a safe and secure haven to mourn their loss with dignity, as well as a place to start over.

1.3 Project

Hurricane Katrina's devastating effects on New Orleans showed us that the short-term solutions currently in place are inadequate to address the long-term recovery people face after a disaster of that magnitude. Therefore, I propose that a modular prefabricated unit be placed on a damaged home site that can subsequently be integrated into the

construction of permanent housing. This way, the dialogue between users and their interim housing is not disrupted, causing further stress. An interim housing solution that transitions into the permanent avoids the problem of future displacement. Further, it is my assertion that an occupant's knowledge that the interim house will eventually become part of their permanent home will aid in their healing since the sense of ownership and attachment can begin earlier in the process.

The design project will consist of two phases: an interim house and a permanent house. The design will allow a certain level of flexibility and choice on the part of the inhabitant in both the planning and the selection of interior elements so that it can accommodate a range of people as well as personal preferences since “[t]he perception of personal choice [is] an essential element to what home means...if an environment is not chosen, it is not home...” (Gerrity and Steinglass, 224). As well, displaced peoples’ “...exclusion from the decisions that affect their lives can heighten the sense of helplessness inflicted by a natural disaster...” (United Nations High Commissioner for Human Rights, 20-21).

In order to keep the scope of the project manageable, I chose one specific site in New Orleans that was affected by Hurricane Katrina. This is because since Hurricane Katrina devastated New Orleans, there has been an ample amount of research compiled on disaster response and rebuilding efforts in that community.

More specifically, I will focus on the community of the Lower Ninth Ward because it had one of the highest rates of home ownership in New Orleans, was one of the most damaged neighbourhoods, and the majority of the population in the Lower Ninth Ward were low income families living in single dwelling houses (Knowles-Yanez, 392).

Groups “...who live at the margins of society, whose only equity was their homes...are largely closed out of the options to return.” (Hack, 238). As a result of policies and politics, the Lower Ninth Ward is still largely undeveloped. The residents want to return home, but feel they have nothing to come back to (Small et al., *The Axe in the Attic*). The Lower Ninth Ward is a prime example of how a poor disaster recovery plan can inhibit the regeneration of a once thriving community.

I would like to hypothetically place my design into the rebuilding of New Orleans as if these modules were used instead of FEMA trailers. Therefore, the proposed hypothetical client for this project is FEMA.

1.4 Rationale

Hurricane Katrina shed light on the fact that the United States did not have an acceptable model for housing people displaced by a disaster of the magnitude of Hurricane Katrina in their own country (Hack, 230).

Delays in rebuilding affect both the economy and peoples’ ability to recover and move forward. A disaster stricken community’s recovery relies heavily on the “ability to re-attract residents who have been relocated off-site to help rebuild the communities’ job and property tax bases.” (Lubell, 168). In turn, the human impact of a delay in recovery is that “[s]o long as their ability to return home, and the term of any such return, are unclear, it will be difficult for displaced families to move forward with their lives and start planning for the future.” (Lubell, 168). Therefore, it is imperative that housing policies, plans, and options be developed and in place before another large scale disaster

strikes. This is so they can be employed efficiently and rapidly in order to meet the housing needs of the displaced families, as well as to attract them back to rebuild both the community and the local economy (Lubell, 168, 171-172).

Rebuilding the Lower Ninth Ward is a question of social justice. Despite its high rate of home ownership (59%), more than one third of the Lower Ninth Ward was comprised of residents who lived below the poverty line (Logan, 280; Zdenek, 169; McMichael Reese, 45; U.S. Census Bureau).

Being below the poverty line places residents at a higher risk of being unable to return and rebuild, and of being pushed deeper into poverty (United Nations International Strategy for Disaster Reduction Secretariat, Global Assessment Report 10). Therefore, it is up to the group in charge of mitigation - in this instance FEMA - to facilitate as easy and equitable a return for the impoverished residents as for the displaced residents with higher means. To deny them the right to rebuild and recoup their losses from a disaster would be a social and moral injustice.

It is also important in a lower income community to reinstate its social fabric as soon as possible. This is achieved by having people return and rebuild. The external stability that interpersonal relationships and daily routines of a neighbourhood offer is crucial in maintaining peoples' sense of identity (Fried, 157). As well, a sense of being at home and being connected to a specific location, including a house and its contents, all play a part in the creation of one's sense of self. In order to help survivors of a natural disaster heal, the groups in charge of mitigating disasters must try to rebuild not only the survivors' houses, but also the aforementioned connections so that survivors can re-establish a sense of self and rebuild their lives (Fried, 157; Belk, 140; Akhtar, 165;

Marcus, 9-10). In the case of the Lower Ninth Ward, many of the homes had been passed down from generation to generation and because of this, they held memories and provided a sense of identity for the inhabitants (GRAFT, Design in Times 118).

Finally, rebuilding will reinstate a sense of empowerment into a community that was made to feel helpless following a natural disaster, displacement, and the lack of effective help from the government afterwards. Allowing residents to return and have a say in the redesign of their houses re-instils a sense of control over their lives by allowing them to express their individuality and differences. If the user is involved in the design, the design positively reinforces and empowers them. This is a key factor for turning a house into a home (GRAFT, Design in Times 119).

1.5 Limitations

The main limitation in this study is its focus on North American housing only. This was necessary to limit the scope of the project. It is my hope, however, that this will allow for a refined analysis of the fundamental theories and applications of the concept of ‘home’ in housing natural disaster survivors. The results of this inquiry can then be applied in a different context and used as a starting point for future designs.

1.6 Overview of Document

Chapter 2 is the literature review. I explore different theories of home, place-making and what it means to dwell. I also give an overview of the different steps in

responding to and mitigating future disasters. As well, I explore the psychological effects of natural disasters, and the loss of home, on individuals and communities.

Chapter 3 is the precedent analysis. I analyse the FEMA trailer and its downfalls as an interim housing choice. In the 1997 LIFE Magazine Dream House analysis, I explore the ten key elements of 'home' that Max Jacobson, Murray Silverstein and Barbara Winslow have distilled from their years of practice. In the final precedent analysis, The CUBE, I focus on prefabrication and what is involved in the manufacturing, shipping and erecting of a prefabricated house.

Chapter 4 is the design programme. It includes information relevant to the site as well as information on the proposed client and occupant.

Chapter 5 documents the proposed design. It includes my explanation of the design concept as well as drawings and three-dimensional renderings that elaborate the design in detail.

Chapter 6 is the conclusion. It includes my reflections on the design, and articulates suggestions for possible further studies.

Chapter 2: Literature Review

2.1 Natural Disasters

The number and intensity of natural disasters is increasing with the rise of global temperatures, giving rise to the displaced population. The groups charged with mitigating natural disasters, such as government and international agencies like FEMA and the United Nations, are now working together to create efficient and effective disaster preparation plans.

This section begins with an examination of natural disasters in context and details the issues of climate change, displaced persons, disaster preparation and response, and finally the effect of disasters on housing and the housing recovery process. This discussion shows that housing strategies are a crucial factor in addressing a human challenge that is in future likely only to increase in magnitude and scope.

The second part of this section examines the social and psychological effects of natural disasters. Housing is central to both understanding and managing these effects. The loss of home can have negative psychological and economic ramifications on individuals and the community as a whole. The psychological ramifications can be further exacerbated if survivors' temporary housing is not provided in a dignified manner that takes into account their physical, psychological and social needs. The discussion shows that the home is intimately tied to self-identity, and severe psychological consequences can follow when the continuity of self-identity is challenged. The social and economic implications for a disaster-affected community are also greatly influenced by chosen approaches to disaster housing.

The third part of this section focuses on rebuilding. Rebuilding after a disaster can be a lengthy process. If it is not handled correctly, it can lead to delays or even prevent residents from returning home. The amount of control homeowners are given over the rebuilding process correlates with the overall success of rebuilding efforts. Whether or not to rebuild on site is often a difficult choice for individuals, communities and public authorities. There is strong evidence that, where it is possible, rebuilding homes and communities on their original sites should be done.

The final portion of this section examines some lessons learned from the Hurricane Katrina experience. Inadequacies in planning and the susceptibility of existing homes to flood damage were the reasons for the development of new housing plan criteria and the search for innovative alternatives to the measures employed in New Orleans. A new national disaster housing strategy was formulated. Particularly relevant to the proposed design is the decision to require all permanent housing in New Orleans to be raised to a minimum height above grade in order to mitigate damage from future flooding.

2.1.1 Natural Disasters in Context

2.1.1.1 Natural Disasters and Climate Change

Global climate change has a direct effect on the increased intensity and frequency of natural disasters. With an increase in heat-trapping gas emissions such as carbon dioxide, which increased by 80% between 1970 and 2004, the surface temperature of the

sea is rising (Intergovernmental Panel on Climate Change, 5). The increase of the temperature of the sea causes an imbalance in the climate system. This results in an increase in the frequency and severity of climatic disasters such as drought, flooding, heat waves, tornados and hurricanes; all of which negatively influence every aspect of peoples' lives. According to the U.S. Global Change Research Program, millions of people are projected to be displaced by disasters and resources will be increasingly short due to global warming (Global Climate Change Impacts in the United States, 9-10).

Human activities are largely responsible for the rise in the emission of green house gases and, in turn, climate change. The Intergovernmental Panel on Climate Change states that, “[g]lobal [green house gas] emissions due to human activities have grown since pre-industrial times, with an increase of 70% between 1970 and 2004.” (Intergovernmental Panel on Climate Change, 5). As well, humans changing the natural environment by, among other things, cutting down forests and building cities that act as “heat islands” of concrete and asphalt, have influenced climate change (UN-HABITAT, 3). However, our ability to negatively influence climate change indicates hope that we can also impact climate change positively; mainly through means of mitigation and adaptation such as using alternative fuel sources (Global Climate Change Impacts in the United States, 10). Climate change is not completely reversible, however, due to the long life span of some of the gases that have already been released into the atmosphere, as well as the increase in ocean temperature that elevates the overall global temperature. Therefore, it is necessary to adapt to the effects of climate change that are already occurring and prepare for what is yet to come.

These adaptations will come in many forms including, but not limited to, “....altering...zoning and building codes to place fewer structures in harm’s way and making buildings less vulnerable to damage from floods, fires, and other extreme events.” (11). Through mitigation and adaptation in facing climate change, we can attempt to lessen the frequency and severity of natural disasters and the impact they have on peoples’ lives. This will become increasingly important as the number of people displaced by natural disasters increases.

2.1.1.2 Natural Disasters and Internally Displaced People

Climate change will influence the increase in both “temporary displacement and longer-term migration” (Kirsch-Wood et al, 41). This will be largely due to the increase and intensity of natural disasters, as well as the effects on agriculture of droughts, flooding and the salination of soil and water supplies by the rising sea (41). Already, 243 million people per year are affected by climate-related natural disasters and it is forecast that that number will rise to 375 million by 2015 (Ganeshan and Diamond, 1). It is estimated that 26 million of those 243 million people currently affected have been displaced (Global Humanitarian Forum, 48). Norman Myer of Oxford University predicts that by the year 2050 an estimated 200 million people will be displaced due to climate disruptions (Brown, 8).

In general, there are two categories of natural disasters by which people are displaced: (i) sudden-onset natural disasters such as floods and hurricanes, and (ii) slow-onset disasters due to long-term environmental changes. Examples of the latter are

changes in weather patterns that lead to an inability to sustain livelihoods, and conflicts that arise over increasingly scarce resources (Ferris, 4).

The United Nations defines “Internally Displaced People” as “[p]ersons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border.” (United Nations, Guiding Principles 1). It has been suggested that, to better protect the rights of those displaced by climate change, a more precise definition ought to be articulated. This is because some of those forced to move by economic factors, or choosing to move pre-emptively, do not fall clearly within the ambit of the current definition (Koser, 17).

In many instances, people displaced by natural disasters are allowed to return to their homes to begin to rebuild; but that is not always the case (Leckie, 18). Under international human rights law, everyone has the right to adequate, safe housing on the land of their choice as well as the peaceful enjoyment of their possessions and the right to privacy and respect for their home (18). Under the same body of law, all people have the right to freedom of movement. The United Nations’ Inter-Agency Standing Committee (IASC) has elucidated this right in their “Operational Guidelines and Field Manual on Human Rights Protection in Situations of Natural Disaster” as: “persons displaced by natural disaster should be provided with the information necessary to exercise their right to decide freely where they want to live — whether they want to return to their homes, to

integrate where they are staying during their displacement or to resettle to another part of the country.” (United Nations Inter-Agency Standing Committee, 53).

According to the IASC, the parties charged with mitigating a natural disaster should make every attempt to reintegrate displaced persons with their community and home as soon as possible, provided that is what the displaced party wants and it is safe to do so. This is done through creating the conditions that allow for a safe return, including providing an environment where access to services such as livelihoods, markets, hospitals, schools and adequately constructed homes are available (53).

From a socio-economic stance, in respect of resilience to natural disasters, “[p]oor households tend to be far less resilient to loss than wealthier households, are pushed deeper into poverty, and have more difficulty recovering.” (United Nations International Strategy for Disaster Reduction Secretariat, Global Assessment Report 10). Natural disasters affect not only short-term outcomes like mortality rates and direct economic loss but also long-term impacts such as health, productivity and development. This can feed and reinforce a cycle of chronic poverty (10). From a socio-economic perspective, four billion people - sixty percent of the world’s population - are currently considered vulnerable to climate change (Global Humanitarian Forum, 58).

When devising action plans to mitigate climate change and its many symptoms, therefore, it is crucial to take into account not only the immediate, short-term impacts of natural disasters, but also the long-term impacts. A holistic response to climate change will help increase resilience, mitigate loss and reduce the extent to which vulnerable populations are displaced by disaster (O’Donnell et al., 26).

2.1.1.3 Natural Disaster Preparation and Response

Being prepared to respond to sudden-onset natural disasters is, and should be, a focus in the present context of climate change. Along with early warning strategies, preparedness is a key priority of the 2005 Hyogo Framework for Action (Kirsch-Wood, et al, 43). It is not surprising then that with the increase of recorded natural disasters, there has also been a correlating increase in disaster resilience due largely to research in, and the practice of, improved preparedness measures (40). As Kirsch-Wood, Korreborg and Linde note, “[w]hen communities are prepared, they are less likely to be permanently displaced in the face of a hazard event.” (40).

The key goal in improved preparation for natural disasters is to produce sustainable communities through “poverty reduction, good governance and disaster risk reduction” (United Nations, Report of the World Conference 7). This, in turn, increases communities’ chances of being resilient in the face of a natural disaster (Global Humanitarian Forum, 70-78).

The Hyogo Framework attempts to shift the focus away from traditional disaster response to identify and address the root causes of disaster risk, with a view to reducing both human and economic loss (Basher, 36). Those drafting the Framework believe this can be done by the parties involved in disaster risk reduction by adopting five priorities: “1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation. 2. Identify, assess and monitor disaster risks and enhance early warning. 3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels. 4. Reduce the underlying risk factors. 5. Strengthen

disaster preparedness for effective response at all levels.” (United Nations, Report of the World Conference, 11). While there are many facets to the document, recognizing risk reduction as an essential element of overall adaptation is key theme of the Framework. The action plan has been adopted by many organisations and inter-governmental initiatives, and incorporated into their own strategies for risk-management and adaptation (Basher, 36).

Disaster preparedness is part of adapting to a changing climate. Adaptation has become a key concept both in international climate policy, as well as in practical implementation of disaster response (Heine and Petersen, 48). The concept of adaptation entails both long-term strategies and immediate disaster risk management. There is recognition that, in combination, these immediate and long-term responses will reduce vulnerability to the effects of climate change, especially in impoverished, at-risk populations (48). Such populations, primarily in developing nations, have generally a lower capacity to undertake risk-reduction and preparation measures. This correlates to the high economic loss these populations tend to sustain in the wake of disaster (Basher, 35).

Impoverishment and vulnerability, however, are not reserved to developing nations. Notably, it is reported that Hurricanes Katrina, Rita and Wilma caused over \$166 billion in loss in 2005. According to Basher, while it is “tempting” to blame climate change for this loss, the true culprit is vulnerability coupled with increased exposure to disaster (35). Thus, the need for increased preparation in order to mitigate loss is clear. Unfortunately, agencies and ministries tasked with addressing climate change are often separate and apart from those responsible for disaster response and risk

management, creating a division in the understanding and cooperation necessary to appreciate risks and craft responses (35-36).

The response to Katrina was fraught with inadequacies at all levels. Of particular relevance to this project was the inadequate provision of temporary housing and the still-ongoing transition to permanent housing. While, from an academic perspective, this process remains significantly understudied and little is known about how households fare at this stage, it is doubtless that an improved disaster response in this transitional area would net positive rewards for evacuees (Tierney et al, 100-02).

2.1.1.4 Natural Disaster and the Home

Housing comprises sixty to seventy percent of all buildings in a built environment. Thus, its destruction is the largest physical, financial and social loss for a community (Comerio, 15, 17, 176).

In the wake of a natural disaster, displaced residents of the affected area and the agencies that assist in housing recovery are faced with both challenges and choices. While the ultimate goal will be to secure permanent housing, the initial step must be emergency or temporary shelter, followed by temporary housing. The challenges involved are both financial and logistical, and permanent housing can take significant time to secure or rebuild (Phillips, 221).

Even where such is possible, the return home can be slow and involves great effort on the behalf of individuals, local and federal governments, and NGOs (188). This slow return is due largely to many challenges that survivors face such as the availability

and affordability of rental units, increased family units per dwelling, escalated post-disaster prices of housing, the cost of rebuilding, as well as a lack of accessible options in temporary housing (194-195).

The housing recovery process must progress in stages that eventually culminate in permanent housing. These stages of housing reflect the immediacy of the disaster and the relative permanence of the shelter. They are described by E.L. Quarantelli as: (i) emergency shelter; (ii) temporary shelter; (iii) temporary housing; and (iv) permanent housing (Quarantelli, 75-78).

Emergency shelter is typically improvised (a car, tent, or overpass), or a surviving structure (a school, the New Orleans Convention Center) which offers few amenities and is generally occupied for less than 24 hours. Temporary shelters are usually pre-planned facilities organised by communities or national agencies that offer amenities and security. These shelters can operate from days to months and provide respite to large numbers of evacuees. It is estimated, however, that only 20% of all displaced residents go to temporary shelters, many preferring other options (Phillips, 200-01).

Temporary housing, which phase one of this proposed design illustrates, engages the longer-term recovery period and is characterised by the reestablishment of a household routine, with the understanding that permanent housing will be the eventual outcome (Quarantelli, 76). Such housing may consist of rental units, mobile homes or trailers, or larger facilities for congregate populations. As Phillips notes, “[f]or a catastrophic event like Hurricane Katrina, the task of offering temporary housing requires months of creative planning, financing, and implementation, with significant expenditures from the federal, state, and local governments.” (Phillips, 202). The FEMA

response to temporary housing in New Orleans was the mobile trailer. Significant difficulties typical to urban areas were encountered in the process - chief among them was the lack of adequate space and utilities (204). Given these challenges, it is unsurprising that trailers are considered a “last resort” in terms of temporary housing.

Permanent housing is that from which the displaced persons will not have to move again as a result of the disaster (206). Low-income families may have a longer waiting period to gain access to this phase than other groups depending on the availability of affordable housing. To find permanent housing after a disaster, displaced persons generally have three options: to rent, to rebuild or purchase a new home, or to move away permanently (207). While initially following a disaster there is often a strong will among residents to rebuild what was lost, this can quickly fade in light of the various challenges described (188).

The return to dignified, safe housing after a natural disaster is a human right. In the UN Inter-Agency Standing Committee’s “Operational Guidelines and Field Manual on Human Rights Protection in Situations of Natural Disaster,” criteria for shelter and housing programs during and after the emergency phase are laid out as goals to be attained for the agencies mitigating a natural disaster. Some key criteria that pertain to housing are described below.

Temporary housing camps should be used as a last resort, and if they are used it is important that overcrowding is avoided. Also, temporary camps and housing, as well as permanent re-housing, should be located close to employment opportunities. Housing provided should be accessible, safe and dignified (United Nations Inter-Agency Standing Committee, 35-36). As well, people displaced from their property and possessions by a

natural disaster should be returned to them as soon as possible. People should also be transitioned from temporary to adequate permanent housing in a fast, non-discriminatory way (43-48). “Adequate” encompasses “accessibility, affordability, habitability, security of tenure, cultural adequacy, suitability of location, and access to essential services such as health and education [as well as] [r]espect for safety standards aimed at reducing damage in cases of future disasters.” (48).

It is obvious that the road to permanent housing in a post-disaster community is long and arduous, for some more than others. For others still, permanent housing in the original community may be an impossibility. The challenges faced and the choices made in the housing recovery process will be particular to a given disaster, geographic location and economic climate. What is clear, however, is that in any post-disaster recovery situation, better choices in temporary housing will help expedite the process toward permanent housing and the re-establishment of a pre-disaster lifestyle.

In order to fully appreciate the need for adequate disaster responses, it is necessary to understand that a disaster’s effect on individuals and communities is more than physical. The social and psychological impacts from natural disasters are dealt with in the section below.

2.1.2 Social and Psychological Effects of Natural Disasters

2.1.2.1 Loss of Home and Identity

Homes have a psychosocial and practical significance in a family's life and, because of this, the loss of home can cause disruptions that affect the very constitution of the family's life, social networks, work routines, financial income, community ties, and physical health (221).

The sudden onset of a disaster can produce negative consequences for the family by forcing changes on them, their personal family routines and interactions. This can cause stress as they deal with the long-term repercussions of the loss of their home. And, sadly, not all families survive the process of rebuilding their homes and lives because they are not equipped to deal with these forced changes (223).

Marc Fried concludes in his chapter "Grieving for a Lost Home" that the majority of people that lose their home experience what can only be considered grief. This is made apparent by

...the feelings of painful loss, the continued longing, the general depressive tone, frequent symptoms of psychological or social or somatic distress, the active work required in adapting to the altered situation, the sense of helplessness, the occasional expressions of both direct and displaced anger, and tendencies to idealize the lost place (Fried, 151).

The home is one component in a person's sense of continuity (how they understand the world) that allows them to function in the temporal, spatial, and social dimensions of the world. When there is a disruption in an individual's sense of continuity, it can lead to a disintegration of their routines, relationships, their understanding of the past, and their outlook on their present and future (153). The depth of disruption caused by the loss of home becomes even more obvious when the elements that comprise a person's sense of "home" are examined.

Two of the main factors in a person's satisfaction with their home are the set of social networks available to them and a basic sense of belonging. These two factors are what strongly bond a person to their home and the area in which it is situated (154). The sense of belonging to a specific area, or feeling at 'home,' can have just as much to do with the interpersonal relationships someone has as with the familiarity of a place. Its expectable streets and houses instill and reinforce a sense of belonging to a specific region or 'home' (154). And just as familiar streets and houses enforce a sense of home, the familiar objects and personal belongings in one's home define a sense of belonging and being at home with oneself (Marcus, 9). Clare Cooper Marcus argues that just as certain people enter or leave our lives, impacting our inner psychological self and helping us develop over time a greater understanding and sense of one's self, so too do objects and places (8). At different stages of our lives we introduce different objects and places like theatrical sets and props. We reflect on them and our environment as a gestalt in an "unconscious process of individuation;" in other words, coming to an understanding of who we are (8). Our home and its contents represent symbols of our ego-selves - our

conscious understanding of who we are - as it is through our manipulation of our environment that we learn about and express ourselves (9-10).

Data from interviews taken pre- and post-relocation confirm that the more committed to an area a person is, the more likely they are to react to relocation with grief (Fried, 154). In fact, most people who lose their house and treasured possessions unexpectedly due to natural disaster experience grief that is comparable to losing a loved one (Marcus, 239). This loss is often understood as a loss of a part of one's self, given the role the home and its contents plays in our self-identity (9). The home is one of the most intimate places where we can let our guard down and allow ourselves to explore our sense of self through self-expression within the interior (2, 10).

The longer a person lives in one place, as well as whether satisfying relationships are formed during the time there, has a direct correlation to their amount of attachment to that place. Moving to another place from a cherished home can be a positive experience if a person perceives that they are moving to "something better" (242). However, being forced to leave can be a "highly emotional experience" (242). The same can also be said for objects a displaced person must leave behind. Salman Akhtar observes that people who leave their home by choice feel remorse over having to leave familiar objects behind. However, the anguish felt by people forced to leave their familiar objects behind is far greater than that of the former (Akhtar, 166).

Fried uses Erik Erikson's theory of the ego identity to argue that a sense of spatial identity, or "spatial conceptions as determinants of behaviour," is essential in human performance. Spatial identity is a process of assimilating the sensory elements of important experiences. These are experiences that deal with how one understands one's

body in space with reference to the composition of one's environment (Fried, 156). He states that our spatial identity "...is based on spatial memories, spatial imagery, the spatial framework of current activity, and the implicit spatial components of ideals and aspirations." (156). He goes on to argue that spatial patterns reinforce feelings of commitment to one's home, and determines that the grief response felt with the loss of one's home is not influenced by factors like an increase or decrease in the size of the new dwelling, but by the "subjective significance of different spatial and physical arrangements" (156, 168).

Feelings of being at home and belonging attributed to a specific place are most prevalent among the working class. There is a correlation between status and the amount of grief felt with the loss of home. The difference is marked. The higher the status the less grief felt. The working class depend on the "external stability" offered through the localization of socialization patterns, interpersonal relationships, and daily routines of a specific place more so than the middle-class. This is why "dislocation from a familiar residential area has so great an effect on fragmenting [their] sense of spatial identity." (157).

Choice is another factor that contributes to a sense of home and absence or limiting of choice is implicated in the loss of home. Ellen T. Gerrity and Peter Steinglass discuss Rapaport's finding that in order for an environment to be "home" it must be chosen by the user. They state that a crisis like the sudden onset of a natural disaster limits the choices available to an individual and that there is an imbalance in the amount of choices available due to, among other reasons, financial status. They argue that a new housing environment can become "home" to someone, but that it "may in fact depend

upon how much it is like the old environment.” (Gerrity and Steinglass, 224). They indicate that the very elements that differentiate a house from a home, including “...order (spatial, temporal, and sociocultural), identity (spatial and temporal), and connectedness (with people, place, past, and future),” can be destroyed in the sudden onset of a disaster, and that one of the reasons people choose to rebuild on the original site is to try to recapture some of those elements to lend to a sense of familiarity to the new home (224).

Objects, like a person’s home and possessions, are viewed as an extension of one’s perception of self (Belk, 140). Salman Akhtar suggests that objects are containers for our memories and that they anchor us to our identity (Akhtar, 165). Similarly, Russell W. Belk states that objects that we feel we possess remind us of who we are and confirm our identity. He suggests that the more we feel we possess an object, the more we feel it is part of our extended self, and that the feeling of having control over that object is critical to the extent that we feel we possess it (Belk, 141). It makes sense then that our sense of safety would be threatened by a sudden change in our environment, like the destruction a natural disaster can cause, as not only are our possessions destroyed but, along with them, part of what we perceive as our self. And this experience of loss of self can be more severe if it is due to something completely out of our control like a natural disaster. This is because it challenges the perception of control we believed we had over the objects. Therefore, experiencing feelings of lessening or diminishing of self is normal after such a loss of possessions (Belk, 140-43; Akhtar, 164-65). Belk expands further and states that not only objects contribute to a sense of self but also our attachment to our homes and neighbourhoods and, for the same reasons mentioned above, the loss of one’s home and neighbourhood can also lead to a diminishment in one’s sense of self (Belk, 143).

The loss that we feel when we lose an object involuntarily is not the same as if we voluntarily dispose of an item. This is because we choose to give objects away when we no longer find them consistent with our sense of self. Once again it relates to the perception of control or choice (143). As Mooli Lahad suggests, loss of a psychological resource like the sense of being in control can increase the psychological stress, and affect the mental health, of the trauma survivor (Lahad, 36).

Belk argues that a self-restoration reaction, or trying to fix the damaged object or replace it with a more ideal replacement, is imminent in the case of involuntary loss of objects that are perceived as part of our extended self. This is because the person who experienced the loss is attempting to reinstate their damaged sense of self (Belk, 143-44). This can be seen in natural disaster survivors' need and desire to rebuild and restore their damaged house and neighbourhood.

2.1.2.2 Natural Disaster's Psychological Effects on the Individual and Community

Living through a disaster involves stressors that can cause Post Traumatic Stress Disorder (PTSD), as well as many other anxiety disorders including phobias, Obsessive Compulsive Disorder (OCD) and depressive disorders (Norris & Wind, 29; McFarlane et al., 54-60; Ursano et al., Trauma and disaster 8-9; Leach, 28). Some of the stressors that can trigger these disorders in a disaster experience are: (i) loss of life and traumatic bereavement; (ii) threat to life, injury, and fear; (iii) witnessing and horror; (iv) property damage and financial loss; (v) resource loss; (vi) housing and rebuilding issues; (vii) post-disaster life events and chronic stress; and (viii) displacement and relocation (Norris

& Wind, 29-36). Of these stressors, the most disruptive with lasting consequences in the form of anxiety and depression is the total loss of one's home and personal belongings, which is "among the strongest predictors of PTSD", as well as displacement and forced relocation that can cause post-disaster psychopathologies to increase over time. This was the case after Hurricane Katrina. The above two factors, combined with other unresolved hurricane-related stresses, resulted in rates of PTSD rising to 21% with other mental illnesses increasing to 14% among the survivors (33-36).

The symptomatology of PTSD involves re-experiencing a trauma through flashbacks, avoidant symptoms like avoiding feelings and thoughts associated with the trauma, and arousal symptoms such as difficulty falling asleep and concentrating (Phillips, 294; Ursano et al., Trauma and disaster 9; Leach, 178; Davidson & Baum, 361). Incidents of PTSD in a disaster context vary based on certain conditions like the severity of the event (Ursano et al., Trauma and disaster 9; Phillips, 294). Someone may not develop PTSD just because they went through a disaster. There are other aggravating factors pre-disaster that increase a person's chances of developing PTSD post-disaster: pre-existing trauma, gender, race, ethnicity, education, and the severity of exposure (Ursano et al., Trauma and disaster 12; Phillips, 295). However, all studies clearly find that survivors that have a prolonged exposure to, or who experience the most severe, disasters have higher rates of PTSD (Ursano et al., Trauma and disaster 9; Phillips 308; Lahad, 36).

Depression and anxiety are also common symptoms of survivors of disasters. Anxiety disorders include PTSD, phobias and panic attacks. Symptoms of anxiety include difficulty concentrating and sleeping, chest pains, dizziness, and it is

characterized by excessive worry and fear. Depression is a mood disorder with symptoms that include sadness, sleeplessness, lack of energy, difficulty concentrating, and feelings of guilt. It is characterized by a sense of helplessness and hopelessness (Phillips, 295; Leach, 28).

Health problems, especially trouble sleeping, are reported as being higher in disaster survivors. However, the increase that one might expect in the abuse of substances such as alcohol, drugs, and smoking is absent, except for in survivors already predisposed to these habits pre-disaster (Phillips, 295). Stress due to new family problems, difficulty in personal relationships, and an increase in domestic violence are reported as being higher after a disaster.

Many theorists state that personal and social resources play an important role in peoples' ability to cope with the stress they experience after surviving a disaster (Bonanno & Gupta, 152; Buckle, 96). Survivors report a loss in the social resources needed to recover after a disaster such as "social support, feelings of connections to others, belief that you can control what happens around you, optimism, perceived control, and a feeling that you can do something about the situation." (Phillips, 295). In fact, studies have shown that in disasters with a larger impact, loss of social resources like the ones mentioned above has a direct correlation with an increase in the symptoms of mental duress like depression, anxiety, stress and PTSD (Phillips, 295, 308; Ursano, Trauma and disaster 18; Lahad, 36).

The "collective loss" that is experienced when a community is destroyed due to a disaster can be devastating to the surviving members of that community (Phillips, 304). The loss of community can challenge a survivor's ability to cope with such a trauma

because it is the lost community itself that contains the social resources needed to enable a survivor to cope and recover. These include friends, family, neighbours, places of worship, and jobs (Phillips, 304; Lahad, 36).

In the recovery phase, temporary homes are often provided in trailer camps, housing strangers next to each other, denying them the ability to take comfort and solace in the social support network provided by the neighbours they knew, pre-disaster. Such was the case in New Orleans, where “[t]hree years later, residents of the Gulf Coast still lived in cities far away from the friends, family, clergy, social services, health care, familiar routines, culture, music, and food that makes a place truly home.” (Phillips, 304). Because of this prolonged displacement of the New Orleans community, particularly the Lower Ninth Ward that lags far behind in rebuilding and returning, stress is high and rates of mental illness have reportedly increased as well as the amount of domestic violence, suicides, and homicides. The collective loss of the New Orleans community suggests the possibility for a continuation of the trauma for the displaced (304-5).

George A. Bonanno and Sumati Gupta state that resilience after disaster is the capability to “maintain relatively stable, healthy, levels of psychological and physical functioning...as well as the capacity for generative experiences and positive emotions.” (Bonanno & Gupta, 149). It is in fact “a result of normal human adaptational mechanisms” and is surprisingly common amongst survivors of trauma, as opposed to the assumption that someone must have remarkable coping skills to be resilient (149). The concepts of adaptation and returning to normal as soon as possible apply equally to both the individual and the community as a whole (Rosenfeld et al., 117).

People react differently in a disaster. That is, some cope better than others in the face of a traumatic experience (Bonanno & Gupta, 145). Studies show that gender, age, and race and/or ethnicity may be influential factors in the resilience of a person after a natural disaster. Women and some minority groups seem to be less resilient; however, studies supporting these statistics do not take into account the effects of socioeconomic status. Therefore, the outcome of resilience after disaster may have to do more with one's socioeconomic status than gender or race (Bonanno & Gupta, 152; Phillips, 310; Buckle, 91-92). Older people, especially those in their middle years, have a higher level of resilience in the event of a natural disaster than do younger people. Also, the avoidance of substance abuse and absence of pre- and post-life traumas and life stress are good indicators of resilience after a natural disaster (Bonanno & Gupta, 153; Phillips, 310).

Rebuilding, which is the subject of the section below, is both an expression of resilience, as well as an action which can promote resilience. Rebuilding efforts are most successful where owners – with financial assistance from governments and NGOs - drive the process, and are allowed choice and flexibility in the outcome. Moreover, rebuilding homes on their original site, as opposed to relocation, is a choice that has positive socio-cultural and economic implications for individuals and communities.

2.1.3 Rebuilding Housing After Natural Disasters

2.1.3.1 Natural Disaster Recovery and Rebuilding Efforts

Disaster recovery involves a series of stages that fall within two sub-phases: short-term and long-term recovery. Short-term recovery includes returning life sustaining systems to a minimum and falls somewhere between the immediate response stage (search and rescue, providing food and shelter), and the recovery stage that focuses on the transition into long-term recovery (attaining temporary housing, clearing debris and performing damage assessments) (Phillips, 22). Long-term recovery can continue for many years after the disaster and consists of activities such as debris management, critical infrastructure improvement, historical preservation, the environment, psychological recovery, and housing. This is the stage where improvements in the built environment, such as retrofitting a building to withstand seismic activities, can be used in order to mitigate future disasters. This will create a more disaster-resilient community and in turn save lives, property, and money by reducing future recovery needs (22-23). The ultimate goal of the recovery phase is to return the disaster-stricken community back to, or improve upon, its pre-disaster state (22).

When rebuilding housing post-disaster, it is important that the reconstruction policy allows for the needs of all types of households, the reconstruction helps restore the local livelihood and economy, and that displaced people have choices in the design and rebuild of their new home (Jha et al., 93; Lizarralde and Davidson). In order for the owner of the rebuilt home to have a choice, there must be “flexibility in the architectural,

technical, economical, and functional aspects of the project” early on and the ability to adapt and modify the house after they occupy it (Lizarralde and Davidson).

Reconstruction of post-disaster permanent housing can be handled in different ways that vary in how much control the owner has over the reconstruction method. However, the most effective reconstruction method is the owner-driven reconstruction (ODR) as it “has proven to be the most empowering, dignified, sustainable, and cost-effective reconstruction approach in many types of post-disaster situations.” (Jha et al., 93). In the ODR method, people are supplied by governmental agencies and NGOs with the funds to hire local contractors and labourers to rebuild their house. The owner oversees the rebuild and therefore has more control over, and can participate in, the final outcome. However, government agencies play a part as far as imposing standards for the reconstruction of the house and ensuring those standards are met (Jha et al., 95; O'Donnell et al., 25).

Some advantages to ODR are: (i) it speeds healing of psychological trauma in the displaced due to the active role they play in the reconstruction process; (ii) assistance can be attuned to the need of each individual household; (iii) it encourages the use of local and salvaged building materials; (iv) it contributes to the recovery of the local economy by engaging the local construction industry; and (v) it helps conserve the cultural identity of the community. Some disadvantages are: (i) the quality of construction could be poor if there are no standards in place; (ii) it could be more complicated to execute in relocated communities; and (iii) elderly and vulnerable people will have more difficulties supervising reconstruction (Jha et al., 96).

2.1.3.2 Rationale for Rebuilding on Disaster Site

Residents of a community hit by a natural disaster often resist relocation as a means of mitigation in both the temporary and permanent housing stages. This is due to the feeling that their community and way of life will be lost to them if they do relocate. (Phillips, 212). Relocation is “a process whereby a community’s housing, assets, and public infrastructure are rebuilt in another location.” (Jha et al., 77). Relocation is often comprehended as the best mitigation choice due to the notions that the survivors of a natural disaster are already displaced, the land they have been displaced from is uninhabitable and they will be protected from future disasters if they are relocated. Granted, sometimes it is unavoidable that a community, either in whole or in part, must be relocated for safety, but in general this is not the case. Therefore, due to its negative social implications for the community, relocation should be a last alternative and avoided if at all possible (Jha et al., 77; Leckie, 19).

Relocation is often unsuccessful due to an inadequate choice of land for the new site. This may protect the displaced from the threat of natural disaster but introduce them to new ones, such as a risk of loss of livelihood due to the distance between the new site and employment, the market and so on. A loss of social networks is also a risk related to the new site’s distance from the old site, as is the potential for “socio-culturally inappropriate settlement layout” of the new site that may not allow for families and close knit social groups to cluster together as they would have on the old site. Another risk is poor house designs that are not adaptable or flexible, and therefore do not allow for future extension and upgrades or a choice of space for different domestic activities (Jha et al.,

79-80). Therefore, “[i]n situ re-housing efforts have proven to be the most efficient and effective means of providing relief to victims in...post-disaster settings.” (Leckie, 19).

In order to rebuild and strengthen the economy of a disaster stricken community, it is important that the former inhabitants of that community be allowed to return as soon as possible as “most local development is driven by decision-making within economic spheres by households and private- and public-sector businesses.” (O’Donnell et al., 18). In order for the local economy of the community to recover, there must be residents that live and work in the community to create jobs and promote spending locally. As well, reconstruction of housing in the area can help the local economy recover as it produces jobs such as construction, production of materials, tools and transport, as well as increased property tax revenue (Skotte, 4; Lubell, 168).

The longer that people remain displaced, the greater the chances are of violations of economic, social and cultural rights becoming systemic (United Nations Inter-Agency Standing Committee, 1). The Lower Ninth Ward in post-Katrina New Orleans is a good example of how these systemic issues can take hold and slow down, if not stifle completely, the recovery of a community.

Six months after Hurricane Katrina hit New Orleans the rebuilding of houses in devastated areas of the city had not yet begun. The delay in the rebuilding of these houses meant that there was no place for the residents to come back to. And without residents there was no need to expedite the process of opening schools, markets, hospitals and so on. Without these services available there was a lack of job prospects for the people returning. Combine this with exorbitant prices for the housing and services that were available, and it was a perfect recipe for the recovery process of the community to

stall. Residents may have wanted to return but, without the proper services and supports in place, they found it easier to stay in the area they had been relocated to where there were more job opportunities and adequate housing available (Lubell, 168-69, 238-40).

As with permanent relocation, temporary relocation to a trailer camp can have many of the same negative effects on the functionality of both individual and group. In E. L Quarantelli's report *Sheltering and Housing after Major Community Disasters: Case Studies and General Observations*, he observes that "[o]n the whole, trailer camps show little collective unity or morale, and not infrequently become the source of certain kinds of social pathologies, especially when children and adolescents are part of the camp population." (Quarantelli, 77). He concludes that "displaced persons much prefer to locate a mobile home on their own property rather than in a trailer camp." (77). In fact, if given the option, most homeowners rebuild on the same site that they occupied before the disaster (Quarantelli, 78).

Whether housing is temporary, permanent, relocated or rebuilt in-situ, one thing is clear: careful consideration must be given to "maintaining existing community networks and social systems." (O'Donnell et al., 4). Although, for all the reasons discussed above, in-situ re-housing has demonstrated itself as the most successful choice for re-housing the displaced, permanent relocation is still an alternative when all other avenues have been attempted. And, unfortunately, it is likely to become a more common choice in the future due to increased flooding in coastal regions that will flow from rising sea-levels (24).

As discussed in the next section, the experience of rebuilding after Hurricane Katrina has led to a recognition of the need for improved practices. These include improving certain standards such as Base Flood Elevations – minimum heights for

buildings situated in flood-prone areas – and developing innovative disaster housing alternatives, particularly for the interim housing stage.

2.1.4 Lessons Learned from Hurricane Katrina

2.1.4.1 Base Flood Elevations

Housing stock located on a flood plain, in general, was drastically more damaged than houses not located on a flood plain. The exceptions were the Lower Ninth Ward and Village de L'Est neighbourhoods where there were equal amounts of damage to both floodplain and non-floodplain housing. Thus, being located on a floodplain was a major determinant of how much extreme damage a neighbourhood experienced (Bostic & Molaison, 261-65).

Eleven of the hardest hit Louisiana parishes had new building codes within four months of Katrina. Also, a bill was passed stating that the 2003 International Building Code (IBC) was to be enforced (Ramroth, 218-19). This included New Orleans where all new homes as well as those that incurred more than fifty percent damage must follow the IBC (Bostic & Molaison, 269).

In 1984, Base Flood Elevations (BFEs) of 1.5 to 4.5 feet had been established for New Orleans by FEMA. However, the BFEs were based on the assumption that the levees would hold and, therefore, only accounted for water from heavy rains and not breached levees. More than one-half of the houses in New Orleans are below the BFEs established in 1984. After Hurricane Katrina, FEMA decided that the BFEs were

outdated and maps with the new BFEs needed to be drawn. This slowed down the rebuild process as residents could not rebuild until they knew what height to build at. By May 2006, 40 percent of the population had still not returned. The ones that had were forced to live in the cramped quarters of their FEMA trailers (Ramroth, 219).

In April 2006, the Advisory Base Flood Elevation was established. It stated that houses situated in floodplains had to be raised to the BFE levels from 1984 or three feet above the highest existing ground elevation, whichever one is higher. As well, homes not situated in floodplains with fifty percent or more damage had to be raised up three feet. This amounted to all the existing extensively damaged homes in New Orleans having to be raised (Ramroth, 219; Bostic & Molaison, 269).

2.1.4.2 Joint Housing Solution Group

In 2006, FEMA established the Joint Housing Solution Group (JHSG) in an effort to explore disaster housing alternatives to FEMA trailers and mobile homes. They initiated their search because they recognized the need to be better prepared to house people more quickly and safely after future disasters. The members of the JHSG include FEMA, HUD as well as the National Institute of Building Sciences (NIBS) (McCarthy, 32; Federal Emergency Management Agency, FEMA evaluating non-traditional).

The JHSG is exploring options for universally-designed modular homes, factory-built contemporary housing, housing constructed out of recycled materials, various innovative designs from schools of design and architecture as well as the Gulf Coast-type cottages and other housing developed in response to Katrina through the Alternative

Housing Pilot Program (AHPP). The AHPP was an initiative created by FEMA in an attempt to find alternative temporary housing solutions that followed similar criteria as the ones listed below (McCarthy, 32; Federal Emergency Management Agency, FEMA evaluating non-traditional; U.S. Department of Housing and Urban Development, Alternative Housing Pilot Program 1-2).

One of the JHSG's main goals is "the development and documentation of a methodology to eliminate or mitigate potential indoor air quality hazards in FEMA-provided temporary housing units." It has proposed this is possible through the elimination of air pollutant sources by exclusively using non- and low-emitting building and furnishing materials, as well as using adequate ventilation and filtration measures (Federal Emergency Management Agency, FEMA evaluating non-traditional).

The JHSG developed criteria to determine whether alternative housing units are suitable for the needs of disaster housing. They are: (i) *Range of Use* or how adaptable the unit would be to various cultural, geographical and environmental conditions; (ii) *Livability* or how well the units could provide the physical and emotional needs of the user; (iii) *Timeliness* or how fast the units could be available for occupancy; (iv) *Cost* or how cost effective the units are; (v) *Footprint* or the size of the unit should be small and suitable for group and private sites; (vi) *UFAS* or a percentage of units must comply with Uniform Federal Accessibility Standards for disabled occupants; (vii) *Indoor Air Quality* or how well the unit can control the indoor air quality via a holistic approach; and (viii) *Production Lead-time* or a number of units must be available immediately or within a short time (Federal Emergency Management Agency, FEMA evaluating non-traditional).

2.1.4.3 FEMA's National Disaster Housing Plan

Before Hurricane Katrina, disaster assistance was supplied in the form of rental assistance, hotel reimbursements and financial assistance for home repair. However, FEMA was not prepared to deal with a disaster of the magnitude of Hurricane Katrina. The amount of damage caused and the time it would take to rebuild highlighted their shortcomings where preparation for temporary housing options was concerned. In 2008, FEMA released a National Disaster Housing Plan that addressed interim housing specifically, outlining different strategies for providing temporary housing in the face of a disaster (Phillips, 2005).

The National Disaster Housing Plan is as follows:

1. *Maximize Available Housing Resources.* This involves FEMA providing a Transitional Shelter Assistance (TSA), or fair market value rental allowance, for longer term displacement for survivors that are unable to return home for an extended amount of time. They will catalogue all available rental properties and make this information available to survivors in need of affordable rental housing. FEMA will install tarps on all roofs of damaged homes to prevent further damage. Also, FEMA will provide financial assistance for homeowners to repair or replace their home.

2. *Use Manufactured and Alternative Interim Housing.* If there are not enough rental properties within commuting distance to house all of the displaced, FEMA will provide other means of temporary housing including manufactured homes, park models, or other alternative means of temporary housing that will be

located either on the survivors' property, a pre-existing commercial pad, or on a new community site that would be maintained by FEMA. However, this last option is considered an absolute last resort. FEMA will produce and deliver the temporary housing units to the chosen site in a timely fashion, and will provide units for survivors with disabilities that comply with the Uniform Federal Accessibility Standards (UFAS). As well, FEMA will test all temporary housing units for an acceptable unoccupied formaldehyde level before they provide the unit to the user.

3. Employ Innovative Forms of Interim Housing. After Hurricane Katrina, it was apparent that there needed to be more alternatives for temporary housing to accommodate the needs of a variety of different users. FEMA has recognized this need and is searching for different types of interim housing. Pilot units, like the "Katrina Cottage," employ new technologies and materials that provide a larger choice of temporary housing options. FEMA is also working with HUD to authorize permanent housing construction when interim housing is not financially effective, as well as searching for alternative multifamily apartment rehabilitation projects (Federal Emergency Management Agency, 2009 Disaster Housing 2-6; Phillips, 2005-06).

2.1.5 Design Impact

Materials chosen should be sustainably sourced. Efforts to use sustainable materials may help to slow global warming and in turn decrease the severity and number

of disasters. New buildings should also be built to code to resist future disasters. In the case of New Orleans specifically, buildings should be elevated above the BFEs. Also, incorporating design elements which are disaster-specific, such as safety rooms and an escape hatch in the roof to name a few examples, are a necessity for the safety of the user in the case of future disasters.

The units should be placed on the disaster site as quickly as possible for an expedient return of the survivor. This return to the site would aid in the restoration of the survivor's sense of identity. However, the units could also be located elsewhere if the survivor did not wish, or was unable, to return. The important thing is that they receive the home as soon as possible so they can regain a sense of normalcy in their life.

Better choices in temporary housing solutions can expedite the process of returning to permanent housing and pre-disaster lifestyles. More options that consider affordability, accessibility as well as accommodate varying family arrangements and sizes are necessary.

The basic concept of the design of the transitional home must address the long-term nature of the recovery process and not just offer short-term immediate response solutions.

Finally, a survivor must feel a sense of control over the rebuild of their home. This helps to restore a sense of their identity, limit the amount of grief experienced, and limit the psychological stress experienced from the loss of home. A sense of control can be accomplished by giving survivors flexibility and choice in the overall design as well as an ability to adapt and modify the house post-occupancy. This could be translated into

choices in materials, colors, additional room selection, layout of the overall plan and so on.

2.2 Home, Place, Dwelling

Home is a construct that evolves out of how we orient ourselves in space, identify with and use that space. We adapt and modify our space to meet the needs of our daily routines. Through all of these elements we come to understand a space as place or 'home'.

The following sections present the theoretical underpinnings of my use of the concept of "a sense of home." While diverse, the theories I explore are fundamentally linked to the concept of dwelling, a multifaceted expression of the act of being in a place. First, the idea is introduced that 'home' is not just a place where a person lives, it is a mental construct that proceeds from dwelling; it is something we do as much as a place we are. Dwelling, in this sense, is then broken down into two concepts: identification and orientation.

Identification encompasses the idea of identifying with a space, understanding it as place, and becoming attached to that place. But it also involves a reflexive formation of self-identity which relates to that place. This is in part dependent on developing memories associated with a place, and 'home' is related to functions of memory. A continuum of sorts, between past and present, exists in the home. The importance of memories to the sense of continuity in both self-identity and 'home' to recovery from natural disaster is expanded upon in section 2.3 Remembering and Healing.

Orientation involves the development of an individual's 'environmental image' or spatial ordering of a place. It is how we understand the relationship between our bodies and our environment. Like identification, this is a two-way process between person and

place. In reference to this concept, the terminology that has been used by Kevin Lynch to describe how people orient themselves in cities is applied microcosmically to buildings and their interiors. This language helps articulate how the environmental image of ‘home’ is formed.

Finally, the concept of dwelling is elaborated in reference to the foundational work of Martin Heidegger. Dwelling incorporates an understanding of building which relates not only to the creation of the built environment, but to the small-scale manipulation of that environment. ‘Building’ encompasses any modification a person makes to their environment to suit their needs, regardless of at what scale it is made. Dwelling, in the context of the built environment, similarly encompasses the mutual influence of inhabitant and structure: inhabitants configure structures according to their lives, while structures in turn configure the lives of the inhabitants. The discussion on dwelling also reflects the previous concepts of identification and orientation: by dwelling, we identify by interacting with our environment and the things in it, and we orient ourselves in reference to the “fourfold,” Heidegger’s expression of the basic conditions of existence. We understand the home as the centre of our universe from which we contrast and compare the outside world in order to understand our place in it. It is through dwelling that we build a sense of home.

2.2.1 Home as Place

Robert Gifford states that a house is a structure and not necessarily a home. A home is “...the rich set of evolving cultural, demographic, and psychological meanings

people attach to that physical structure.” (Gifford, 255). He maintains there are six elements in the set of meanings that establish a residence as a home. They are: (1) haven - a home facilitates security, refuge and privacy from the outside world; (2) order - home is a central point from which we understand our place in the world both spatially and temporally, reinforcing a sense of continuity in our lives; (3) identity - home symbolizes who we are through personalization of space. It lends to a sense of our ethnicity, socioeconomic status and family; (4) connectedness - the spatial and temporal patterns in a home help promote a sensation of connectedness to individual people or a group, the place itself, a particular culture, and both the past and future; (5) warmth - a symbolic and interpersonal feeling that grows out of the previous four elements; and (6) physically suitable - whether or not the home’s form and structure fits our psychological needs (256-57).

Susan Saegert maintains that the concept of home “...is part of the experience of dwelling – something we do, a way of weaving up a life in particular geographic spaces.” (Saegert, 287). She goes on to state that the concept of dwelling is what differentiates between house and home because “...it does not assume that the physical housing unit defines the experience of home.” (287). She asserts that dwelling involves a relationship between a person and their environment on a physical, psychological and social level via symbolic and spiritual connections that help shape their social and personal identity. A person who dwells in a place depends on, and their perceptions are influenced by, their home environment. In turn, the environment is constantly shaped and changed by the person’s interaction with it (287-88).

According to Norberg-Schulz, there are two aspects to dwelling: identification and orientation. Identification means to relate to a complete environment of “things” in a meaningful way. It determines the qualities of things experienced and relates to the bodily form. Orientation comprehends the spatial interrelationship of those things experienced and relates to spatial order or an “environmental image”. These two aspects work in tandem to comprise the act of dwelling (Norberg-Schulz, *The Concept of Dwelling* 15-16; 20).

2.2.1.1 Identification

Juhani Pallasmaa believes that we are in a perpetual dialogue with our surroundings, creating a mutual effect between individual and place. In other words, when one dwells in a place, that place dwells in them (Pallasmaa, 27). The reality that we exist within is not only one with spatial and material elements but also temporal, cultural and mental. All of these elements layer together in a constant flux. Pallasmaa argues that buildings acts as a mediator between the different elements of our reality and are one of “...the most important externalization[s] of human memory. We understand and remember who we are through our constructions, both material and mental.” (17).

Kimberly Dovey asserts that identifying with the place that we dwell in is part of what constitutes a sense of home. This form of connectedness with one’s dwelling is of an emotional nature as opposed to the ordering of space, which deals more with a cognitive understanding. A person and their dwelling take from one another in the formation of their respective identities (Dovey, 40).

Two interpretations of the representation of identity through the built form are: (a) the *Social Interpretation* - the home is a "... 'statement' of identity expressed through a shared symbolic language" (40), the home portrays a desired social identity rather than who the person actually is; and (b) the *Individual Interpretation* - the relationship between the home and person is seen as having a much deeper connection than the superficial level suggested by the social interpretation. Dovey believes that a combination of the two interpretations informs the identity relationship between home and person. She believes that the way that "[t]he house is both a 'statement' and a 'mirror,' developing both socially and individually, reflecting both collective ideology and authentic personal experience." (40).

David Kopec defines place identity as "...how people incorporate a place into the larger concept of their own identities or senses of self." (Kopec, 62). He states that our self-identity and self-esteem are reinforced by the places that we identify with via the sense of continuity they provide. When we feel comfortable, safe and like we belong, a sense of place, as well as attachment to that place, is formed (62).

A person's bond with both the physical and social fabric of an environment comprises place attachment. The attachment that a person feels towards a particular place is due to the intricacy with which their identity is woven into it (62). The level of control a user feels over their household can encourage or obliterate the sense of attachment they feel toward their house. So being able to control the amount of personal privacy, both within the household as well as in relation to the neighbourhood, is important in being attached to a place.

Another important factor in feeling attached to a place is associated memories. Surrounding oneself with meaningful objects often contributes to feelings of place attachment (131). Designing a house that allows for personalization of the interior and exterior spaces is important in promoting place attachment. This is because personalization relates to self-identity and the level of personalization possible correlates to an ability to express identity. The greater this ability, the more likely a person will experience place attachment. (132).

The temporal aspects of identifying with one's home deal with how we identify with "...who we are by where we have come from." This comes through experiences that take place in that environment. Our home environment is saturated with memories that cause the environment to act as a "mnemonic anchor." (Dovey, 42). Because of this we are able to interact both with our present and past through interactions with our home. How we remember our past through our home environment shapes our experience of our present home which in turn evokes the memories of our past. This cyclical process intertwines our past and present so that within our home environment, we are constantly dwelling in both moments concurrently (43). As well, home as temporal identity can connect us with our future. This is due to the sense of autonomy and adaptability that allows for the growth of the dweller's identity, as suggested by one's home. Growth requires a connection between their experiences (present) and dreams (future), because "[k]nowing that we have the power to remain in a place and change it permits us to act upon and build our dreams." (43).

Gaston Bachelard maintains that "[a]n entire past comes to dwell in a new house." (Bachelard, 5). Our dreams are the vehicle that makes this possible. The house allows us

to daydream and experience memories of our past homes and the safe happy feelings associated with them (5-6). The interior of the house is the container of these memories. Bachelard asserts that the house's most important use is to shelter daydreaming as "...the house protects the dreamer, the house allows one to dream in peace." (6). Reliving our memories of past homes through daydreaming allows for our past homes to dwell within us always (6).

Pallasmaa affirms that buildings serve three purposes in memory: (i) they act as a material reminder of the course of time; (ii) they hold and release memories; and (iii) they help us recall and imagine. All of these aspects of memory are important as our self identity is grounded in our memory of things (Pallasmaa, 18). We are forever projecting meaning and significance onto every object and space that we come across (22). Although buildings cannot create feelings, they can reinforce and project our feelings back to us (30). The home, for example, has the capacity to contain "...feeling[s] of safety, familiarity, at-homeness, and to stimulate fantasies." (25).

2.2.1.2 Orientation

Kimberly Dovey suggests that there are three ways that we orient ourselves in space to create a sense of being at home. The first is "Spatial Order," which refers to the concrete bodily experience of space, as opposed to the conceptual or abstract understanding of space (Dovey, 35). According to Dovey, we understand the concept of home through how our body interacts with our environment. She notes that "...the human body stands vertically on a horizontal plane with certain spatial abilities and

limits... The underlying structure of home as spatial order lies in its role as a center of our spatial world with a sense of verticality and horizontal access.” (36). This central point is what grounds us within the larger space of the world. It is distinctly separate and yet exists within the world at large. It is a sacred and secure place of stability and certainty with definite physical and symbolic boundaries that allow for the dweller to control access to, and behaviour within it (36). The second is “Temporal Order.” This relates to our temporal orientation in the world. Home is an origin that we continuously return to. It is a place saturated in past experiences that we become familiar with through our body and the act of everyday living. Home as temporal order also encompasses our familiarity with certain spatial patterns from our past; our childhood home, for instance (37). The final way, “Sociocultural Order”, is the most influential in the shaping of the environmental form. Numerous possibilities are available when it comes to the form a house takes. In Dovey’s view, “[c]ultural beliefs and social practices represent the ordering system that selects from among these possibilities and shapes the broad range of formal manifestations of home within any sociocultural context.” The social norms or behaviour patterns of a particular culture solidify over time and give way to “...spatial arrangements and environmental props that support and evoke those experiences.” (38).

The actions of our daily lives, in relation to how we identify with our surroundings, are dictated by our orientation in space. Our actions involve having certain goals and paths picked out that lead to places. We understand these places because of “environmental images” that we create through our experiences and memories, in order to orient ourselves in space as well as give ourselves a sense of emotional security. Existential space, or a person’s “image of the environment,” defines the meanings of

those goals, paths, and places; architectural space is the concretization of that existential space (Norberg-Schulz, *Existence, Space* 7, *The Concept of Dwelling* 20; Pallasmaa, 26).

In his book *The Image of the City*, Kevin Lynch discusses the ‘environmental images’ that a person uses to understand and navigate through a city. He maintains that “[e]nvironmental images are the result of a two-way process between the observer and his environment. The environment suggests distinctions and relations, and the observer...selects, organizes, and endows with meaning what he sees.” (Lynch, 6). He states that once this process has occurred, the parameters of the image formed are tested against the ever-changing perception of the observer and are altered according to their understanding. Therefore, the perceived reality of the city that is experienced between different observers can be vastly different (6). This is due largely to the fact that the “...image is the product both of immediate sensation and of the memory of past experience...” (4). So, if two different people are physically experiencing the same space but have a different set of memories associated with it and objects within it, they will have two very different perceptions of that space.

Lynch found that there were five key elements that largely make up an environmental image of a city: (1) paths- the channels that the observer moves along such as sidewalks and streets; (2) edges- linear elements that are not deemed paths by the observer such as a shore. They are “breaks in continuity” or penetrable barriers such as water or a wall; (3) districts- larger areas of a city that are recognized as having similar characteristics. These common elements are identifiable from inside the district; (4) nodes- points in the city where major convergences of paths occur due to travel or a activity that occurs specific to that location such as street corners or subway stations; and

(5) landmarks- physical objects that are used as a point of reference within districts and nodes. They are usually very distinct and are singled out from their surroundings (Lynch, 46-48; Israel, 17; Kopec, 31-33).

David Kopec argues that Lynch's five elements of legibility in the creation of an environmental image not only apply to a city but also to the creation of an environmental image of individual buildings (Kopec, 31). He states that "Lynch coined his elements to describe cities, but they also apply to microcommunities such as malls, resorts, hospitals, airports and even homes." (33).

When entering an interior, paths are established through the use of common linear movement patterns through the space. There could also be vertical circulation paths when multiple stories are involved. Nodes are where those circulation patterns merge in major gathering points or destinations such as a kitchen, for example. Therefore one must carefully consider the paths and means of arrival at destinations as well as the edges that distinguish them from other rooms or districts. Edges or 'lateral references' in an interior could be established via in between spaces such as a window ledge highlighting the distinction between inside and outside, or a distinct change in materiality such as flooring suggesting a distinct change in a rooms or districts. Districts, as suggested previously, can be established per room via distinguishing elements such as flooring, wall colour, millwork, and objects to name a few. An open concept space may share these common elements suggesting a larger district. Finally, landmarks are distinct objects within rooms or between rooms that can be used as wayfinding tools to navigate through the building. They are also used to distinguish the purpose of the space. Where the landmark has a meaning in our social context, it imparts an understanding of the activities

that are to take place within a room/district. Therefore, the landmark or object establishes what type of activity is expected within that district, making a node or destination (Lynch, 46-90).

The way people orient themselves in space using Lynch's five elements, as well as how they apply meanings to those elements - particularly goals, paths and domains - defines home as place for those people (Norberg-Schulz, *The Concept of Dwelling* 20).

The concept of 'home' can be linked to 'centres'. Centres can be both “nodes” and “landmarks” as defined by Kevin Lynch. A centre acts as a vertical axis in our orientation of space that unites earth and sky and which all known paths lead to and from, implying an inside and outside or arrival and departure (Norberg-Schulz, *The Concept of Dwelling* 22-3; *Existence, Space* 19). The ‘centre’ is “...the basic constituent of existential space.” (Norberg-Schulz, *The Concept of Dwelling* 20). It translates as what is safe and known as opposed to the unknown. Because of this, it is often associated with the interior of one's home and the unknown, the world outside one's home. Norberg-Schulz notes that the notion of home as the centre of a person's world is a common theme in home as place. The notion is tied to childhood as a child's “...first points of references are tied to the home and house, and the child only becomes able to cross its borders very slowly.” (Norberg-Schulz, *The Concept of Dwelling* 22-3; *Existence, Space* 19).

In order to engage with the outside or unknown, it is necessary for one to leave their home or centre. Paths, or the horizontal movement of people, mostly propose a direction and sometimes lead to a recognized goal. These paths combine together to form a plane of “infinite extension” that branch out from the centre or home, and in turn, give

structure to the person's existential space (Norberg-Schulz, *The Concept of Dwelling* 23-24).

The centres and paths combined act as figures on an unstructured ground that, in a person's environmental image, act as domains that are differentiated by certain consistent qualities which in existential space "...fill out the network of paths and make it become 'space.'" (24). Therefore, structuring the environment into domains using centres and paths is how one orients themselves in space (24). Orientation in space grounds our understanding of the surrounding environment allowing for action and thus the act of living to occur (25).

The establishment of a home equates to a person establishing themselves in the universe. The home is at the centre and it is used to contrast, gauge and attempt to understand the 'unknown' outside. It is this act of observing the 'outside' world from a safe centre that allows a person to establish and know their place in the world. It is this act of centering oneself in the universe that is to 'linger' or 'live' in a space; to dwell (Existence, Space 19).

2.2.2 Dwelling and Being

Martin Heidegger felt that it is correct to think of building and dwelling as two separate activities. However, he also believed that we must look at them as the same to the extent that "...building is not merely a means and a way toward dwelling-to build is in itself already to dwell." (Heidegger, 144). Through exploring the origins of the words

build and dwell, Heidegger found that, at their origin, the words “build” and “dwell” were understood to be the same activity (Sharr, 39).

Heidegger traced the word *buan*, or building, to its meaning ‘to dwell’ by connecting it to the roots of other words. He made the connection between *buan* and *bin* where *ich bin* translates to ‘I am’ and its imperative form, *bis*, means ‘be.’ Therefore, he concluded that, “*ich bin, du bist* means: I dwell, you dwell. The way in which you are and I am, the manner in which we humans *are* on the earth, is *Buan*, dwelling. To be a human being means to be on the earth as a mortal. It means to dwell.” (Heidegger, 145). He then went one step further and connected the term *buan* to ‘protect,’ ‘preserve,’ ‘care for’ and ‘cultivate.’ Building had two modes: ‘to construct,’ in terms of buildings, and ‘to nurture and cultivate the land.’ He deemed both to be acts of “genuine building” or “dwelling.” Heidegger considered the act of building and dwelling combined to be a declaration of being (Sharr, 40; Heidegger, 145). So, to be on earth is to build or dwell. However, this is part of our everyday experience and, for that reason, dwelling goes unnoticed due to the habitual nature of building as dwelling or being on earth (Heidegger, 145-46).

When humans dwell they are “on the earth” and “under the sky” which means they reside under the watchful eyes of the divinities and amongst their own kind (mortals), which evokes a sense of being, belonging and connection both physically and spiritually to all things in the universe. This links the four elements of what Heidegger called the ‘fourfold’ - earth, sky, mortals and divinities - into a ‘oneness’ (Heidegger, 147).

The 'fourfold' is "...the basic conditions of existence in which humans experience things..." including buildings (Sharr, 30). To Heidegger, the elements of the fourfold are always together and surrounding us or 'staying,' and because of this act of 'staying' we are constantly connected and in communication with the fourfold and are able to orient ourselves in our environment by using them as a reference point. Through using the fourfold as references to orient ourselves in our environment, differences and commonalities become apparent. Being aware of these differences and commonalities, we can appreciate our place in the world in regards to both location and circumstances. "Such acts of appreciation...were ways to feel at home, to reach accommodation with one's surroundings. 'Dwelling' is reached in this sense of accommodation." (32).

Nearness is the connection and awareness between all things: the earth, sky, divinities and mortals. It is an ability to communicate with the world around oneself (Heidegger, 163-64, 176). Heidegger maintains that, although we cannot experience nearness directly, we try to reach it through the 'things' that surround us (Sharr, 25; Heidegger, 164). We attain nearness or understanding through things near us as we cannot perceive it on our own. Thus, we need to interact with things in our environment in order to understand nearness (the world and being) (164). For Heidegger, a thing was mainly a thing because of its ability to gather "...what was around it for reflection. And what it gathered, through its existence and its use, was the fourfold..." (Sharr, 34).

Norberg-Schulz addresses the "thing" in space and how we understand it as a crucial element in our identification of space. He states that we identify with the world through our interaction with the things that comprise that world (Norberg-Schulz, *The Concept of Dwelling* 17). Therefore it is important to understand the concept of "thing".

He discusses Merleau-Ponty's understanding of a "thing" as something that exists independently of people that retains a type of ancient knowledge that externally exposes itself to the world via its configuration in space and the language of expression (16-17). Norberg-Schulz calls attention to Heidegger's explanation of what a thing is. Heidegger's concept of a thing is that it is a gathering place of the "fourfold" of earth, sky, mortals and divinities where the four "mirror" one another. So, "...things are what they are relative to the basic structure of the world. The things make the world appear, and thereby condition man." (17). Therefore, dwelling can be understood to first and foremost be composed of our interpretation and use of the meaning that things gather (17). The nature of dwelling then first lies in the person's understanding of the thing and then in taking that understanding and communicating it through our work (built environment), so that our homes gather the fourfold of the world communicating that understanding (17). This interpretation of building and dwelling offers a deeper meaning to our connection with the world. In order for us to truly dwell or inhabit the world we must connect with the fourfold through the act of creating or building the thing. Our interpretation of the fourfold becomes our physical reality that we constructed (17). Essentially, "...the world only emerges as what it is, when it is "said" or "set into work" (Norberg-Schulz, *Architecture: Meaning and Place* 46). Therefore, the world only exists as we understand it because our perception of it influences the way we build or shape it into existence and thus experience it.

2.2.3 Dwelling and the Interior

Heidegger believed that dwelling and building were ‘intimately’ connected by peoples’ attempt to understand sense of place, and their interaction with ‘things of place’. (Sharr, 36). Adam Sharr maintains that the designer’s ability to account for human interaction in space at many different scales allows for places from which people can assess their place in the world (2-3). He asserts that Heidegger felt the practice of architecture should return to “...the making of somewhere with the activities and qualities of its inhabitation...” in mind, and that when the visual aesthetics of a building were highly emphasized in importance by architects it “devalued the all-important dimension of human inhabitation.” (3, 38).

To Heidegger, building and dwelling, or the relationship between a person and the world around them, took place over time at a variety of scales (Sharr, 42). To dwell in a place is to accommodate or adapt and allow our habits to form over time. Dwelling entails a level of continuity (Tall, 424). Heidegger believed that “...a structure was built by its inhabitants according to their needs and then configured and reconfigured through the ways in which they dwelt. The inhabitants’ lives, in turn, were configured by the building.” (9-10).

Adam Sharr uses two examples to explain Heidegger’s theory of building and dwelling in relation to time and scale. The first is a dining table that may conventionally be associated with dwelling but not building. There were perhaps some significant tables that would be deemed to have architectural importance. However, a regular domestic table would not be one of them. Heidegger felt that a table was always associated with

building and dwelling because it participated in the daily life of the inhabitants.

Heidegger believed the very use of, and interaction with, the table comprised both building and dwelling (41).

“Moving the table around the room is building, of a sort, done in response to the needs of its users. Likewise, laying out places for a meal is also a kind of building, organised around how people anticipate eating there.... In this way, dwelling (or human engagement with the table) is dependant upon building (or the arrangement of the table, both as how it’s located and how it’s organised for use). Similarly building is dependant on dwelling (the organisation of the table follows how people want to engage with it). In Heideggerian terms, here is the building of cultivation inextricably involved with dwelling in the daily micro-organisation of eating meals.” (41)

The second example Sharr gives is of a house for a growing family. Initially, when a couple has a newborn, it is consistently with an adult. However, as the child develops, some physical separation is necessary for both parent and child due to privacy issues. If the house cannot be rearranged, then building an addition may be necessary to accommodate the changing needs of the inhabitants. “The issue then becomes a matter of building; building which responds to the needs of dwelling. To the philosopher, this would be the same activity as the arrangement and rearrangement of the dining table, but on a larger scale.” (42).

2.2.4 Design Impact

Spaces that allow a person to modify and manipulate them to meet their needs and that act as stages for everyday rituals are places of dwelling. It is in these actions of ritual daily practice that dwelling occurs. To dwell is to build. To build is our attempt to understand our universe. A building, or thing, is both a by-product of that attempt to understand the universe, as well as a vehicle to interact with the world (or our interpretation of it) and understand our place in it. When we manipulate space on a smaller scale such as the example of the table above, we are in fact building. Therefore, in every interaction with our environment, when we modify and restructure that environment to our needs in our everyday routines, regardless of what scale that interaction is on, we are in fact building and, thus, dwelling.

It is from this act of dwelling that a sense of home forms. To dwell is to be at home on earth. Therefore, as designers we have the ability to design spaces that encourage a sense of home: spaces that allow for constant manipulation and modification, on a variety of scales from the planning of the space down to modular, flexible furniture details. The user's participation in the design, as well as their interaction with flexible interior details, is an act of building that in essence allows them to dwell within that environment. Through dwelling, they will experience a sense of belonging or being at home in that environment.

Memory is a fundamental element of the identification with, and orientation of, space; two key aspects that comprise dwelling. It is through our interaction with the objects that surround us that we dwell. When those things are taken from us suddenly, it

is necessary to incorporate coping mechanisms, such as nostalgia, in order to transition through the loss to return to a state of dwelling. The discussion in the section below illustrates how memory is used to facilitate the healing process.

2.3 Remembering and Healing

The recovery and restoration of cherished objects is an important stage in a person's journey to recovery from a natural disaster. These objects are the link to their pre-disaster life and can be used to help the survivor grieve, move on and look toward the future. This is done through the condition called nostalgia: where people can reflect on objects and look back to a 'better time' to lessen the pain of their current situation and give them hope for the future. Monuments are objects that we erect to reflect upon and remember when grieving a tragedy. They are therefore an important element in the process of grieving. The concepts of objects, nostalgia and monuments, and their role in the grieving process, are further elaborated below.

2.3.1 Objects

In his book *Atmospheres: Architectural Environments-Surrounding Objects*, Peter Zumthor speaks about the care and loving way that things are placed around people's living environment and how this signifies a deep relationship between people and their things. He states that when you enter a space, you get a real feel for the inhabitants from the objects or traces that they leave behind. He questions if it is in fact the architect's main role in designing a home to create a receptacle in which to house cherished objects. He talks about how it helps him to be a better designer to think of the future of the places he designs; things that have nothing to do with the design will take their rightful place in the building, creating a sense of home for the user. It is important to leave room in the

design for flux and change as the end user will modify the space according to their needs (Zumthor, 35-39).

Donald A. Norman suggests there are three levels of how we process and understand objects: visceral, behavioural and reflective (Norman, 21). The reflective level is where the “history of interaction, the associations that people have with objects, and the memories they evoke” occurs (46). The concept of self is a mechanism of the reflective level where our memories remind us of who we are, reflecting back to us our accomplishments and experiences (53).

Norman believes that it is not the aesthetic quality or utility of an object that makes a person cherish an object so much as the “history of interaction,” as well as memories that are stirred up due to their “associations,” with that object (46). Objects are important symbols that people associate memories with. Jonathan Chapman suggests that the memories a person attaches to an object are acquired over a period of time that creates a “durable narrative experience” or shared history with the object. This makes it an irreplaceable cherished object in the eye of the owner (112). Norman states that as designers we tend to create and build aesthetically beautiful things, but these aspects of design are not necessarily what guide us through our “everyday lives” (47). Norman argues that emotions and feelings, that “...reflect our personal experiences, associations, and memories,” allow us to attach ourselves to something that may conventionally be deemed ugly in the design world (47). One example he uses for this is peoples’ compulsion to collect knick knacks or kitsch to commemorate a trip (46-47).

In the book *The Meaning of Things*, Mihaly Csikszentmihalyi and Eugene Rochberg-Halton interviewed people about their material possessions and what made

them special to them (47). Their findings were that these objects related to memories and stories, and seldom had any special associations in and of themselves. Rather, the quality that made the objects meaningful was their ability to evoke feelings in the owners. This led the authors to conclude that attachment is not really to the thing, "...it is to the relationship, to the meanings and feelings the thing represents." (Norman, 48).

2.3.2 Nostalgia

Yi-fu Tuan states that all people feel the need to look back into their past to "...acquire a sense of self and of identity." (Tuan, 186). He argues that we are made up of memories that are ephemeral and are not readily accessible. This is where objects play a role because they "anchor time." (187). The past clings to personal possessions allowing us to reflect on them to regain a sense of our self at any given moment when need be. Tuan maintains that the use of nostalgia and mementos to look back on the past are most important for a person who feels they do not have control over themselves or their surroundings. People who experience rapid change typically respond by evoking an idealised past. However, when that same person again feels that they have their life under control, they no longer have a need for nostalgia. Their sense of identity will be reflected in current action, rather than nostalgia (188).

Salman Akhtar states that nostalgic objects are important as artefacts that help deepen our "self-knowledge" and are "psychologically enhancing and useful" through triggering memories, linking us to the past and lost loved ones that shared the construct of our past with us (Akhtar, 73). He argues that the nostalgic aspect of the object is due to

our longing for what is lost and that this longing makes us idealize the object, increasing the love we feel for it (57). He maintains that “[t]he more painful our separation from the things that have the most sentimental value, the more we cling to them in our reverie.... At the heart of nostalgia is the universal tendency to exalt what we have lost.” (57)

One can see how the use of mementos and nostalgia are crucial in the early phase of the recovery process for survivors of natural disasters so that they may maintain a sense of self through the turmoil in the aftermath of the disaster. As they rebuild, their need and attachment to certain objects may wane, but initially these objects are a crucial element in the recovery process. Therefore, allowing a special place for nostalgic objects in the design of disaster housing is important to maintain the user’s connection to their past.

Katy Bennett explores how nostalgia can be used to help support self-identity by maintaining a sense of continuity, when that continuity is challenged by uncontrollable events (Bennett, 189). As a case study, she uses the residents of Wheatley Hill, Durham. They use nostalgic feelings to cope with the changing landscape of their village in light of the closure of the coal mines around which the entire town’s practices and daily rituals had once been based. Nostalgia is used to regain a sense of the collective identity that they have lost since the closure of the mine (187-89). She argues that not only can nostalgia be used to regain a sense of collective identity amongst a group, but is also “...a private experience, allowing individuals to preserve a sense of self in the face of change.” (189). The act of nostalgia, through a group of people uniting around physical symbols that have “nostalgic significance” to their community, is a way for them to

identify themselves as a community through their collective memory (191). A family is also a community at a smaller scale and therefore this concept can be applied to it.

The act of story-telling is a way of engaging in nostalgia and connecting with others that share the same story (192). Jonathan Chapman states that objects can have a shared “durable narrative” with a person through their lives (Chapman, 112). This shared narrative that objects have with people can produce the same effect as story-telling amongst a group of people. These objects, as symbols, are capable of creating a sense of collective identity amongst a group of people even if they mean something different to each member of that group (Bennett, 195). Photographs are one of the best examples of this. They can contribute to a sense of personal continuity for an individual and/or a group, because even though a photograph is one image of an event, it can bring forth multiple stories or memories based on what each individual viewing the photo remembers of that particular event (Csikszentmihalyi & Rochberg-Halton, 68; Bennett, 195). Therefore, one can take from this that objects can be used as a symbol to evoke nostalgic memories and a sense of a shared past amongst a group of people.

Elements of nostalgia are important in the process of recovering from a trauma, because they allow the survivor to escape into memories that they perceive as ‘better times.’ This allows them to reflect on those times and look forward to rebuilding something similar in the future, and helps them to manage and cope with the painful reality of the present. Bennett makes this apparent in her example of Wheatley Hill’s Centenary Heritage Gala Parade where she states that in the community’s attempt “...to tell a smooth, simple story about itself, nostalgia helps people to cope with the present as they make sense of it through a journey into the past that either avoids or erases painful

experience, or recasts it in more emotionally manageable terms.” (Bennett, 192). She maintains that this ability to focus on a ‘particular version’ of the past can paint a more positive light on people’s present emotional experience and help create a stronger bond and sense of community between them (203).

2.3.3 Memorialisation

As suggested above, memories are often attached to objects and places. The ability of these things to evoke memories is what connects us to them in profound ways. Memorials are specifically designed to house memories, and therefore fulfil a special function in the disaster recovery process.

Tim Cresswell states that monuments are an example of how people place memory: the production of a place which houses memories is a fundamental way in which memories are saved from the “vagaries of mental processes.” Through monuments, memories become public (Cresswell, 85).

Kenneth J. Doka writes that “...memorials are ancient ways we cope with tragedy – both private and public.” He states that in fact they have been used by people since before the written word (Doka, 179). Memorials are spaces that are “...invested with meaning...[and] *set aside* to remember.” (186). Doka expands on this, suggesting that a memorial can be anywhere or comprised of anything such as a permanent section of ground, a memory box or quilt, or even a moment in time set aside to remember (186). Memorials, after the initial tragedy are often of a spontaneous nature such as flowers and other offerings at the site of the tragedy. The act of spontaneous memorials expresses

peoples' need to grieve and remember after a tragedy in their own personal way (186). However, in regards to a natural disaster "...there may not be a single site representing a tragedy." Therefore, allowing for a special place within one's home where they can reflect on their losses, be it loved ones, things, or even their way of life, is an important aspect in their recovery process (187).

It is important for survivors to surround themselves with familiar objects associated with 'home' as it is these objects, recovered after a disaster, that can recreate a sense of home as place. Yi-fu Tuan states that it is the components or objects contained within a home more than the shell of the home itself that evoke "enchanted images of the past" that help a survivor's memories overlap from their old home to the new one. This can create a sense of continuity in the narrative of their memories and allow the survivor to adopt the new place as 'home' (Tuan, 144). Special objects provide continuity and stability and root us to our past, while combining them with newly acquired objects blends our present and past together giving insight and meaning to our lives (Israel, 113-14). Therefore creating a special place, or memorial, to house recovered objects to continue their narrative with the user is crucial to recovering after a natural disaster.

2.3.4 Design Impact

It is imperative that the design of a home for a natural disaster survivor allows for the housing of cherished objects in some form of memorial. This is to facilitate the act of reflecting on the object, which results in the experience of nostalgic feelings. This allows the survivor to grieve and begin their healing process. This can be accomplished through

the use of shelving and furniture that incorporate cherished objects into their design. In this way, the furniture and shelving serves as a memorial.

Beyond the theoretical concepts that I have discussed in this section, there are a number of other important issues and ideas that are relevant to the design. I will present them with an analysis of design precedents in the next chapter. They include a case study of the FEMA trailer and how it was inadequate, ten essential elements used to instill a sense of home in a residence, and an exploration of the methods used to prefabricate, ship and erect modular housing.

Chapter 3: Precedent Analysis

The following section is comprised of three precedents that I used to inform different elements of my design. The first is an examination of the FEMA trailer. This was an important precedent as I needed to understand what was used and how it failed to house disaster survivors adequately following Hurricane Katrina. This was so that I could address some of the trailer's shortcomings in my design by incorporating elements that would rectify those shortcomings. Among the problems I identified are the trailer's small size, inadequate ventilation and inability to promote a connection with its inhabitants.

I used the 1997 LIFE Magazine Dream House precedent in order to explore ten key elements of design, as outlined by Jacobson, Silverstein and Winslow, that promote a sense of home in a house. This was important as one of my key objectives in the design was to create a housing option that would promote a sense of home for the inhabitants and encourage them to connect with it.

The final precedent, the CUBE, was important because it helped me understand the process of fabricating modular housing from factory to site. This was crucial to the design as it gave me guidelines to follow with respect to the possible volume of the space, based on dimensions appropriate to shipping. It also informed how the pre-planned units and room units could fit together, based on the different construction methods available for modular housing.

3.1 FEMA Trailer

3.1.1 Introduction

After their initial response to Hurricane Katrina, FEMA provided rent-free trailers for displaced households for up to 18 months as an alternative to rent assistance (Crowley, 129). FEMA purchased 300,000 trailers for a total cost of 4.9 billion dollars. This included travel trailers, mobile homes and park model trailers. However, due to a large outcry against FEMA for isolating poor families in trailer camps with little access to transportation, schools, jobs, healthcare and shopping, 100,000 of these trailers remained sitting empty in a field waiting for someone to inhabit them (Crowley, 129; Lubell, 182; Gressel & Wilder, 8; United States Department of Homeland Security. Office of Inspector General, 5). In total, as of March 6, 2006, FEMA supplied 87,824 trailers that were situated both on individual's property and grouped together in camps (Crowley, 129).

Travel trailers are typically 8 x 35 feet with a total of 280 square feet and have one bedroom. They are wheel-mounted and designed to be towed by, and are considered, a vehicle and are only meant to be lived in temporarily for recreational purposes. They are regulated by transportation authorities as opposed to housing authorities such as HUD, and for this reason they do not need to be built to the same standards as a mobile home in regards to issues like indoor air quality. Mobile homes are typically 14 x 60 feet with a total of 840 square feet and have three bedrooms. They contain all amenities and are built on a permanent chassis and placed on a group site. They are regulated by HUD

and are designed as permanent housing. Park models are typically 12 x 36 feet with a total of 432 square feet and have two bedrooms. They are exempt from HUD's formaldehyde standards and can be regulated by transportation authorities. However they can be built to HUD specifications and also are usually placed on a group site (United States Department of Homeland Security. Office of Inspector General, 6; Centers for Disease Control and Prevention, 2; McCarthy, 12; U.S. Department of Housing and Urban Development, Alternative Housing Pilot Program 1).

FEMA's regulations do not allow mobile homes to be placed in a flood plain as temporary housing unless they are raised above the base flood elevation, but do allow travel trailers to be used in flood plains since they are deemed a temporary solution (Lubell, 182; McCarthy, 12). However, trailers are not structurally suitable for hurricane-prone areas and need to be strapped down, defeating their designation as temporary housing on the flood plain (Crowley, 130; McCarthy, 12).

Manufactured temporary housing often becomes a permanent residence for occupants who lack other means to regain permanent housing (McCarthy, 12). This was the case for survivors of Hurricane Katrina, where in 2009, FEMA offered the people still residing in their temporary housing the option to buy the park models for one dollar and the mobile homes for five dollars. However, the travel trailers were not eligible for purchase because they were only designed for short term use (Federal Emergency Management Agency, Housing Transition Notice).

Since 60% of the temporary housing provided in Louisiana was in fact travel trailers placed on a person's private property, one must question what will happen to the people residing in the travel trailers who do not want to move and are trying to rebuild

their home and neighbourhood, but must vacate the trailer and have no other housing options (McCarthy, 21; Centers for Disease Control and Prevention, iii, 1). Also, after all of the health and legal issues resulting from the formaldehyde levels in the travel trailers, FEMA has chosen to not use travel trailers in any future response to disasters (McCarthy, 16, 21). Therefore new options in temporary housing are necessary to take the place of the travel trailer.

I will focus on the travel trailer in this precedent analysis. It is the model used in situ for a resident to live while they repair or rebuild their home, which is the premise of my design (Centers for Disease Control and Prevention, 2; McCarthy, 12). The model I chose is the 2006 Gulfstream Cavalier 30BH as it was the most frequently used model in housing the displaced from Hurricane Katrina (Centers for Disease Control and Prevention, 6).

3.1.2 Plans and Images

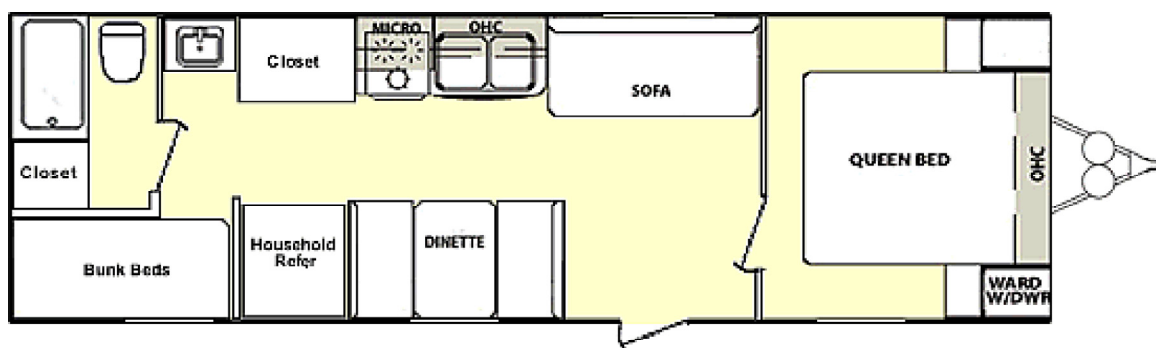


Figure 1: 2006 Gulfstream Cavalier 30BH Travel Trailer Floorplan.
Image property of Holiday World of Houston. Copyright permission obtained October 29, 2011.
Retrieved from <http://keystone-rv.hwrv.com/details.asp?base=2&id=UTF06213&desc=2006-GULF%2006>



Figure 2: Exterior Front of 2006 Gulfstream.
 Photograph property of Holiday World of Houston. Copyright permission obtained October 29, 2011.
 Retrieved from <http://keystone-rv.hwhrv.com/details.asp?base=2&id=UTF06213&desc=2006-GULF%2006>



Figure 3: Exterior Back of 2006 Gulfstream Cavalier.
 Photograph property of Holiday World of Houston. Copyright permission obtained October 29, 2011.
 Retrieved from <http://keystone-rv.hwhrv.com/details.asp?base=2&id=UTF06213&desc=2006-GULF%2006>



Figure 4: The kitchen and dining area of a standard FEMA travel trailer.
 FEMA/<Mark Wolfe> http://www.photolibrary.fema.gov/photolibrary/photo_details.do?id=28407
 Accessed January 11, 2011. Public domain image.



Figure 5: The living space and main bedroom in a standard FEMA travel trailer.
FEMA/<Mark Wolfe> http://www.photolibrary.fema.gov/photolibrary/photo_details.do?id=28408
Accessed January 11, 2011. Public domain image.



Figure 6: Bathroom.
Photograph property of Holiday World of Houston. Copyright permission obtained October 29, 2011.
Retrieved from <http://keystone-rv.hwhrv.com/details.asp?base=2&id=UTF06213&desc=2006-GULF%2006>



Figure 7: Bathroom Sink (separate from bathroom).
Photograph property of Holiday World of Houston. Copyright permission obtained October 29, 2011.
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Figures 8 & 9: Master Bedroom.

Photographs property of Holiday World of Houston. Copyright permission obtained October 29, 2011.

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Figures 10 & 11: Bunk Beds.

Photographs property of Holiday World of Houston. Copyright permission obtained October 29, 2011.

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Figures 12 & 13: Couch/ Bed.

Photographs property of Holiday World of Houston. Copyright permission obtained October 29, 2011.

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Figures 14 & 15: Dining Area.

Photographs property of Holiday World of Houston. Copyright permission obtained October 29, 2011.

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Figures 16 & 17: Kitchen.

Photographs property of Holiday World of Houston. Copyright permission obtained October 29, 2011.

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3.1.3 Why Travel Trailers were Insufficient and How They Failed

FEMA's choice of using trailers as their interim housing was fraught with difficulties. The travel trailers were only meant for temporary residency; however, there are currently still families living in them (Plyer, News Release 2). The extended period of living in the travel trailers led to all manner of health and psychological problems. This is due largely to long-term exposure to formaldehyde, the cramped trailers and densely populated camps (Kromm & Sturgis, 15-16; Phillips, 204).

Along with the increased respiratory problems from formaldehyde exposure, other health and safety issues have arisen. The rate of depression in occupants has been found to be seven times the national average and suicide attempts increased to 79 times higher than before the disaster among the trailer park residents (Kromm & Sturgis, 15). Domestic violence incidences were found to be triple the yearly baseline rates before the disaster and the number of reported rapes was 54 times the national yearly average (Kromm & Sturgis, 16; Phillips, 204).

Families with a disabled member faced increased hardship at the temporary housing stage as there were an insufficient number of accessible temporary trailers. This is still a problem today (Phillips, 195; Crowley, 130). Also, because trailer locations were far from work, schools and established social networks, the stress was exacerbated and re-establishing family routines became further complicated (Phillips, 204).

FEMA did not have a stock pile of trailers ready and thus they were slow to provide them to the displaced people. They had to be manufactured and FEMA was unable to keep up with the demand for trailers. With a waiting list of over 40,000, FEMA was only able to install 500 trailers a day (Hack, 234; Lubell, 182).

There were disagreements between officials involved on how the trailers should be distributed and sited which caused further delays in getting trailers to the people that needed them (Hack, 234; Phillips, 203-204). There were three options for siting the trailers: (1) create temporary large settlements with infrastructure and facilities; (2) use smaller sites within the city like commercial pads, school grounds and so on; or (3) place trailers on the displaced person's property. All three options were met with opposition from local officials for one reason or another. There was a fear that the temporary

communities would become permanent ones. People were worried that trailers left in front yards and driveways would be left there indefinitely, taking away from their street's appearance. There was also concern that school yards and the likes in the city would be impossible to reclaim once temporary communities were erected on them (Hack, 234).

Temporary housing sites usually consisted of rows of trailers that were angled along a roadway to provide easy delivery and removal as well as easy installation of waterlines and sewers. However, the plans of the sites did not take making them liveable communities into consideration: they suffered from a lack of facilities, playgrounds for children, and had issues of security both for and from residents (Hack, 235; Phillips, 203-204).

Some of the travel trailers used were tow-behind recreational vehicles purchased off-the-lot from RV dealers. Others were built to FEMA's specifications, specifically to house the population displaced by Hurricane Katrina. The travel trailers that were built to specification had limited amenities and were meant for temporary use only (Gressel & Wilder, 8). There was also no opportunity for the user to personalize or arrange the interior according to their needs and use of the space (Brinckerhoff Jackson, 399).

In the spring of 2006, concerns arose about the indoor air quality of the FEMA travel trailers due to numerous reports of upper respiratory conditions in children that were residing in the trailers. Fourteen units were tested and the results concluded that the formaldehyde levels in the travel trailers had become highly concentrated (8). It was projected that one-third of the trailers provided for survivors of Hurricane Katrina had the potential of being problematic for the user in terms of formaldehyde issues (United States Department of Homeland Security. Office of Inspector General, 1).

The Centers for Disease Control and Prevention (CDC) took a larger sample of 519 occupied trailers in December of 2007 and January of 2008, to once again measure the formaldehyde levels in the trailers. Their goal was to determine what characteristics of the trailers were affecting the formaldehyde levels and to aid FEMA in the decision of whether or not they should relocate residents in FEMA-supplied trailers. Formaldehyde levels in many of the trailers were found to be higher than the acceptable U.S. indoor levels. Travel trailers were found to disproportionately have much higher levels of formaldehyde than park models and mobile homes. Because of their findings, the CDC made the recommendation that FEMA relocate residents displaced by Hurricane Katrina that were still living in trailers (Centers for Disease Control and Prevention, iii-iv).

3.1.4 Better Housing Options, Better Natural Disaster Mitigation

Hurricane Katrina taught us that the damage from a storm of that magnitude, and the bureaucracy associated with reclaiming, cleaning, and rebuilding can take a lot longer than expected. As a result, temporary living quarters can turn into long term ones. Therefore, an alternative to the FEMA trailer is necessary for use in future disasters: one that can feel more like home, and have elements that create a sense of comfort and hominess for long-term use. As designers, we must recognize that we are not only providing a shelter but in fact are providing a home for the survivors of natural disasters (GRAFT, Design in Times 118). Also, a temporary shelter that can transition into, and eventually become part of, the permanent structure is favourable. One reason this would be positive for FEMA is that there would be no concern for the cost of returning a trailer

park site to its original state once permanent housing was secured, as well as the necessity of returning and storing the trailers, both of which were issues during the recovery from Hurricane Katrina (Phillips, 204).

Gary Hack suggests that the downfall in the plan of the traditional trailer site is its inability to connect temporary housing and permanent settlement. He argues that a better choice than using travel trailers, the unit cost of which can be that of a moderate-sized manufactured home, is to use componentized housing that could be designed as a starter home and have rooms added on to it as the resident can afford more (Hack, 237). A prefabricated unit would lessen the rebuild cost for the homeowner and benefit FEMA, because instead of supplying the homeowner with money to rebuild they could give them a 'starter kit' of sorts: the housing unit. FEMA would not have the extra costs of the removal and decommissioning of the units after the fact. This is a better alternative to selling the users a trailer which is potentially dangerous.

Also, the travel trailers are meant to sleep eight people, but not long-term. If smaller modular units could be used instead and families could combine their units to make larger ones, they could stay together and avoid being separated. This could avoid the psychological issues created by crowding that became apparent in the group sites during Hurricane Katrina recovery (Kromm & Sturgis, 15-16).

The interiors of the FEMA trailers are stark and do not have much in the way of subtle details that make the difference between a shelter and a home. There is no allowance for personalization in the space. This is an important aspect in the connection with a space, creating a narrative between dweller and space which culminates in a sense of home on the dweller's part. There is little connection between the interior and exterior

both physically and visually and, as well, the trailer has a general sense of just being dropped onto the site, as opposed to being planned and integrated into the site. This lends to the sense of the temporary nature of the FEMA trailer, disallowing the resident to feel settled in the space and from beginning to connect and build a narrative. What is the point of connecting with an environment that eventually will be taken away from them, just like their home?

The lack of, and size of, the windows is problematic in that it does not take advantage of the propensity of an abundance of natural light to make a small space feel larger and more inhabitable, which would avoid issues of psychological discomfort with the space. Also, the lack of windows leads to issues in ventilation, which is important in such a hot humid climate, leading to problems with physical discomfort in the space.

The small footprint of the space, as well as the layout, does not allow for an adequate amount of private and shared communal spaces, which is another factor that can lead to psychological issues from crowding and a lack of personal space or territory. This was especially an issue with FEMA's use of the trailer after Hurricane Katrina, as some trailers were used to house up to eight people.

3.2 The 1997 LIFE Magazine Dream House

3.2.1 Introduction

The 1997 LIFE Dream House was designed by the Taliesen architect John Rattenbury for LIFE magazine (Allen & Stanton, 106). Rattenbury preferred to refer to it as ‘a house for life’ as “[t]he goal was to create a moderate-cost home that responds to the needs of the average American family.” (Rattenbury, A House For Life 61). The 2,100 square-foot home’s design was published in LIFE magazine and the plans could be bought at an affordable price. The plan is flexible so that modifications could be made according to the needs of the individual users: married, unmarried, with or without children, mixed generations, and retired people. Most of the rooms are able to be expanded and the house can be built with two to four bedrooms depending on the number of occupants and the stage of life the particular family is in (Rattenbury, A Living Architecture 251-53; Rattenbury, A House For Life 61-62). It is adaptable to different climate and site conditions, has different roof configurations and exterior overhangs that extend the interior space outside (Rattenbury, A Living Architecture 252; Rattenbury, A House For Life 62).

Some of the guiding principles of the design of the home are:

- Humanize the house – keep it in human scale, use natural materials, warm colors.

- Nurture the family – with beauty, comfort and excitement.
- Give the house a spiritual quality – this is what we find in Nature.
- Create a timeless design – don't follow a "style" that will soon be out of style.
- Make it flexible – spaces may need to be expanded, contracted or used differently.

(Rattenbury, *A House For Life* 61).

3.2.2 Elements of Home

Toby Israel states that the best homes are able to fulfill our needs for shelter, beauty, social and psychological growth through the use of familiar cultural signs and symbols, principles of technology and aesthetics as well as design psychology; they speak to all of our human needs (Israel, 161). Jacobson, Silverstein and Winslow believe that the way to create a home that is "memorable, satisfying, and enduring" is to apply the concepts or patterns "that focus on the experience of being in a home." (8). Patterns do not pigeon-hole the outcome of the design. In fact, they guide designers through the process by providing a language to work with where "an infinite variety of solutions based on the specific conditions" is attainable through the use of patterns (8). The authors assert that "...good houses are made of deep, traditional patterns, grounded in human experience." There are a few crucial patterns that are essential to the design of a good home, and they are each interrelated, working together to produce a sense of home (4-5).

The following ten patterns that Jacobson, Silverstein and Winslow deem crucial can all be found within the 1997 LIFE Dream House. These are elements that I wish to analyse and use in the design of the transitional house to instil a sense of home within it. It should be mentioned, however, that these patterns are based on the analysis of patterns found in the housing stock of North America specifically, and because of this all of the elements may not apply to housing in other countries.

Pattern One: Inhabiting the Site

The house is part of a larger whole. This must be taken into consideration when designing a home. “In some sense, the house must participate in the larger whole: a whole that includes views; the path of the sun; the presence of neighbors, sound, sidewalks, and roads...” (Jacobson et. al., 10). John Rattenbury considers this in the design of the 1997 LIFE Dream House, where he did not want the house to “...loom or put on airs...”. He wanted it to blend into the land and executed his intentions with wide low lines that draw the eye outward as opposed to upward. Also, the long overhangs, a recessed entrance, and well placed windows create a welcoming sense to people on the street and yet create a sense of privacy for the person on the inside (Allen & Stanton, 114).



Figures 18 & 19: Exterior Forms Low Lines and Covered Spaces
 Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.
 Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Two: Creating Rooms, Outside and In

When designing a house, one must not only think of shaping the interior but also how the building gives shape to the exterior. If consideration is not taken for both interior and exterior spaces in the planning of a home, the outdoor space will be deemed as leftover space, and the interior spaces “will lack the coherence of design and feel detached from the site”. The interior and exterior spaces should “make an interlocking quilt of the site.” (Jacobson et. al., 11). As mentioned previously, the long overhangs of the roof creates a recessed entrance, but also creates covered private porches off of the master bedroom and living room (Allen & Stanton, 110, 114). This emphasizes a blurring of interior and exterior and expands the livable interior space while bringing the outdoors indoors. There is a connection between this particular pattern and Heidegger’s theory of dwelling: the connection to the outside world is encouraged and one’s place in the world is better understood via this connection to the outdoors.



Figures 20 & 21: Covered Exterior Spaces

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Pattern Three: Sheltering Roof

The form of the roof depicts the shelter of home. The roof must not just be “tacked onto” the house but should depict how the house is inhabited through how it shapes both the interior and exterior space around it. “The most powerful houses are those in which, in some form, the whole building is conceived as a sheltering roof.” (Jacobson et. al., 12).

John Rattenbury felt that the exterior of the house should express the life that is taking place within. Therefore, there is no extra ornament added onto the roof. On the exterior, the clerestory windows imply the natural light filtering into living areas and the chimney suggests the large hearth inside the house. Inside, the varied ceiling heights create a visual texture while the ledge that runs the perimeter of the central open living space creates a sense of human scale in response to the twelve foot ceilings. The ceilings in the entranceway and dining area are slightly lower than eight feet, again to create a more human scale (Allen & Stanton, 107, 114).



Figures 22-24: Roof Line, Stone Hearth, Ceiling Heights
 Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.
 Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Four: Capturing Light

In designing a home, one must arrange the interior spaces in a way that captures or gathers light. Balanced light from a minimum of two sides of an important room is a must. As well, it is important to create moments of surprise with light; for example, a wash of light on a wall. The most important use of natural light in a home is to “reinforce the order of the plan: The important centers, edges, paths, and goals...” (Jacobson et. al., 12).

In the 1997 LIFE Dream House, clerestory windows line the front and back of the house, illuminating the central multi-purpose space - comprised of the living, dining and kitchen areas - with even natural light. In the lowered ceilings there is recessed lighting to establish those areas and give enough light for the intended use of those areas (Allen & Stanton, 107).



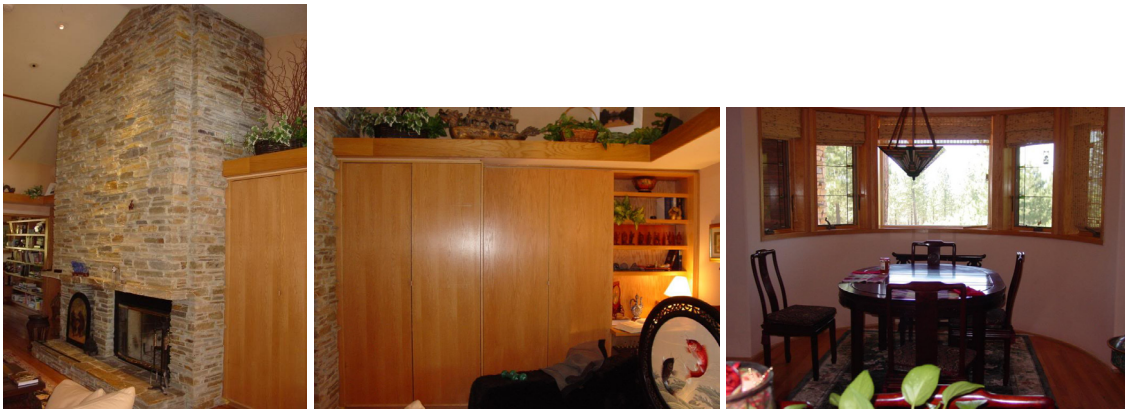
Figure 25: Clearstory Windows Gather Light
 Photograph property of Michael Shuck. Copyright permission obtained March 23, 2012.
 Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Five: Parts in Proportion

A home is made up of a multitude of parts that “must add up to an orderly and sensible whole”. One must decide what the major and minor parts will be and how they will interplay, balance and support one another. “A home is a hierarchy of Parts in Proportion and will feel comfortable only when all its parts are in good proportion to each other and make up a balanced whole.” (Jacobson et. al., 13).

In the 1997 LIFE Dream House, importance is given to the central multi-use space. This is made apparent through the high ceilings, ample natural light being brought into the space via the clerestory windows and the stone hearth which is a main feature and gathering point. The symbolism of the hearth represents warmth and home. All other rooms are subordinate to the central space in that they are connected off the central area that acts as a major hub or node. Rattenbury also uses built-in storage solutions throughout the house: in the bedroom, a daybed converts to a table; in the main area, storage that houses and hides an entertainment system so it does not distract from the main feature of the hearth. These built-in storage solutions are subordinate to the

individual rooms themselves as they function so as to make the rooms function better. Therefore, on a smaller scale, they tie into the overall proportional relationship in the house (Allen & Stanton, 107, 110).



Figures 26-28: Hearth, Built-in Storage, Dining Room
Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.
Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Six: The Flow Through Rooms

How a person arrives and the sequences of moves they take through a house has an immense impact on creating a sense of home. The way the space is planned to allow for movement through it can impact whether someone feels welcome or not; whether they are encouraged to move through the space or stay in the threshold. The very movement through a room itself can determine whether it is comfortable or not (Jacobson et. al., 14).

The low deep overhang of the roof over the entrance welcomes people to take shelter under it and draws them further toward the interior. On arrival in the entranceway, the difference between ceiling elevations - moving from an eight foot height into the central area with twelve foot ceilings - and all the natural light draws occupants further indoors and the hearth gives a sense of warmth and welcoming. The

bedrooms are located off of either side of the central area and give a level of privacy to family members. As well, the kitchen is conveniently located close to the garage door for the ease of transporting groceries from car to kitchen (Allen & Stanton, 107, 110, 114).



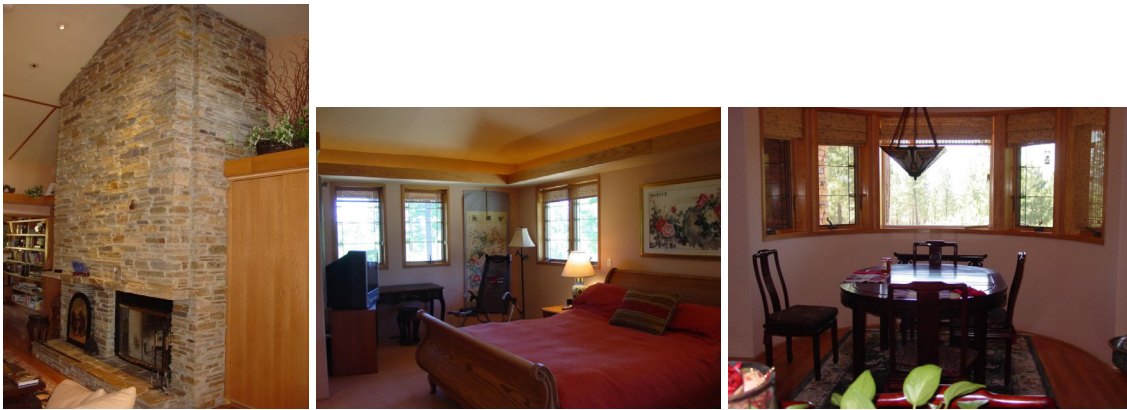
Figures 29-33: Progression through House from Entrance to Private Areas
Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.
Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Seven: Private Edges, Common Core

A well designed room gathers and holds human activity in it. There should be a good balance of communal and private spaces within a home. There should be both exclusively private spaces and shared spaces. However, a good room usually has a mixture of the two. The common spaces “...offer magnetic and lively centers, reinforced by light and ceiling shape, with circulation at the edges; and it provides claimable private areas for everyone, even if the spaces are tiny (private niches, desks, window seats, and alcoves).” (Jacobson et. al., 14). It is important to find the right balance of private and common spaces (14).

The 1997 LIFE Dream House is a good example of this pattern. The central multi-purpose area encourages gathering of family members with its high ceilings, generous amount of natural light and feature hearth. Off of this central area there is a study with pocket doors that can be closed, the kitchen and dining room have a half wall with a pass-through separating them from the central living area, and finally the

bedrooms. Therefore, there is a blend of shared communal space, and auxiliary spaces off of that shared space which offer different levels of privacy and connection to the central shared space (Allen & Stanton, 107, 110).



Figures 34-36: Central Common Area & Private Edge Spaces
Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.
Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Eight: Refuge and Outlook

An important feature in a home is that the occupant can feel the protected shelter of its structure while having the ability to peer into and view the world outside. This principle can be applied even on a smaller scale where being able to view a room from another room can help create a cozy feeling. This experience of observing the outside world from a secure location can be achieved through the use of design elements such as window seats, alcoves, inglenooks open to larger spaces, solid backs and open fronts. The refuge is normally dark, enclosed and at a higher position than outlook which is open, light and at a lower position (Jacobson et. al., 16).

The 1997 LIFE Dream House offers many points of refuge and outlook. The covered porches off the living room and master bedroom, as well as the recessed

entrance, allow for a private place of refuge where one can watch the outside world while maintaining some sense of protection. There are also window seats in the bedroom where a person can watch the outside, as well as strategically placed windows - in the study, for example - that face the front of the house but are placed high enough that occupants can view the outside while not being seen from the outside. The auxiliary rooms off of the main central space also act as refuges where a person can escape for some privacy and yet maintain some visual connection to the shared central space (Allen & Stanton, 107, 110, 114).



Figures 37 & 38: Areas of Refuge

Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.
Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Nine: Places in Between

Many spaces that exist in a home such as a front porch, bay window seats, gazebos, balconies, summer rooms and breezeways exist somewhere between inside and outside. This is their appeal to inhabitants. These spaces allow for inhabitation of ‘the edge’ and are important because they “...offer enough exposure to make you aware of your surroundings, and...provide just enough protection to make that awareness comfortable.” (Jacobson et. al., 16).

The 1997 LIFE Dream House has many of these in between spaces. The same places noted above that are used for refuge and outlook (covered porches, recessed entrance, strategically placed windows, and window seat in bedroom), can be deemed as places in between, and it is the ability to observe the world without being seen that makes these in between places so appealing (Allen & Stanton, 107, 110, 114).



Figures 39 & 40: In-between Places

Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.
Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

Pattern Ten: Composing with Materials

Composing a home is like composing a piece of music. The selection of materials and how their interplay creates the sense of home one is trying to achieve. “Compose materials as a melody-those that support and underscore; those that offer counterpoint, slow the progression-all with a view to letting the building sing.” (Jacobson et. al., 17). Working with materials so that when combined, their “individual qualities, longevity, and visibility” are made apparent is the key to composing with materials. Some important questions to ask when composing with materials are “What are the major materials? How are they expressed and experienced? What materials will establish the fundamental

themes? What kinds of rhythms, repetition, variation will be played out around and within the home?” (17).

Rattenbury uses many natural elements in his material choices. He believes that “[t]he house’s elegance comes through its simplicity.” (Allen & Stanton, 126). He uses wood on the exterior as well as the interior. This creates a sense of warmth and welcoming. As well, the stone on the exterior hints at the stone hearth on the interior, expressing a connection between exterior and interior. In the central multi-use space much of the wood is directed in horizontal lines leading to the stone hearth indicating it as the main focal point. There is a consistent rhythm in the placement of clerestory and other windows alike, and this once again connects the outside with the inside: natural light is being treated as a material that is shared between both outside and inside. The rectilinear pattern on the windows acts as a counterpoint to the rest of the house and emulates the rectilinear lines of the wood throughout the space on a smaller scale. This creates visual texture and variation, and thus interest, in an understated and elegant way. All of the lines of the material indoors and outdoors have a horizontal directionality to them that adds to Rattenbury’s overall concept of the house coming from, and being part of, the land. In this aspect, a parallel can be drawn with Heidegger’s concept of what it means to dwell. The house has a sense of being really grounded in its site, like it has grown out of the site. And yet the hearth at the centre of the home makes one aware of the vertical dimension of space. Therefore, the house makes one aware of dwelling under the sky and on top of the land. Rattenbury uses materials in this way to compose an overall picture of a warm welcoming home.



Figures 41-45: Materials

Photographs property of Michael Shuck. Copyright permission obtained March 23, 2012.

Retrieved from <http://s245.photobucket.com/albums/gg41/MichaelShuck/>

The way the patterns work together is the key to the success of a well designed home. The patterns all work together to create an overall whole, and therefore should be considered in concert with one another when designing a space. Working with one pattern brings forth questions regarding the other patterns and thus “...one pattern works to reinforce and augment another” (Jacobson et. al., 18-19). As one can see, the 1997 LIFE Dream House has implemented all of these patterns successfully to create an overall sense of home.

3.3 The CUBE by Challenger

3.3.1 Introduction

The CUBE was conceived by graphic artist Greg Woloszyn and designed by architect Ed Calnitsky from Calnitsky Associates Architects. It is part of Conquest Manufacturing Challenger series of environmentally-friendly houses. The concept of the house is to question what the minimal space requirements are that one can develop into a living space that has no extras, is affordable and energy-efficient. The house measures 20' by 20' by 20' (four individual modules measuring 20' by 10' by 10') and is 1056 square feet (not including basement). The dimensions of the CUBE allow for additions, such as a garage, additional bedrooms, and a family room to be added on as the family grows or the needs of the user change. Calnitsky's use of plentiful natural light is what makes the minimal footprint a livable space.

The houses are built in Conquest's 40,000 square foot climate controlled facilities in Altona, Manitoba and shipped all over North America. They can be moved, built on a poured foundation, and ready to be moved into within one week. They are shipped on two flatbed trucks in four parts and are placed on the site with a crane where the wiring and plumbing are then hooked up. The CUBE has a geothermal heat pump, heat recovery ventilators, solar panels to provide solar thermal hot water, grey water recycling and grey water heat recovery. It has been built and designed to LEED Residential Gold standards using eco-friendly techniques and materials. Some of these include water-repellent and fire-resistant mineral wool insulation, low VOC paints, countertops made from

completely recycled materials, formaldehyde-free wood veneer products made from recycled hardwood for the cabinetry, LED recessed lights, draft proof windows and doors as well as a dual-flush toilet, low-flow faucets and showerheads to preserve clean water, polyurethane foam core with the highest R-value for the building components, and energy-efficient appliances (Ready Event Marketing, 2-11).

3.3.2 Images



Figures 46-48: Process of Shipping and Installing the CUBE House
Photographs property of Conquest Manufacturing. Copyright permission obtained March 22, 2012.
Retrieved from <http://challengerliving.com/the-latest/challenger-launch—a-resounding-success/>



Figures 49: Exterior Front
Photograph property of Conquest Manufacturing. Copyright permission obtained March 22, 2012.
Retrieved from <http://challengerliving.com/the-latest/challenger-launch—a-resounding-success/>



Figure 50: Exterior Back

Photograph property of Lloyd Alter. Copyright permission obtained March 20, 2012.

Retrieved from <http://www.treehugger.com/modular-design/modern-modular-done-right-from-challenger-living.html>

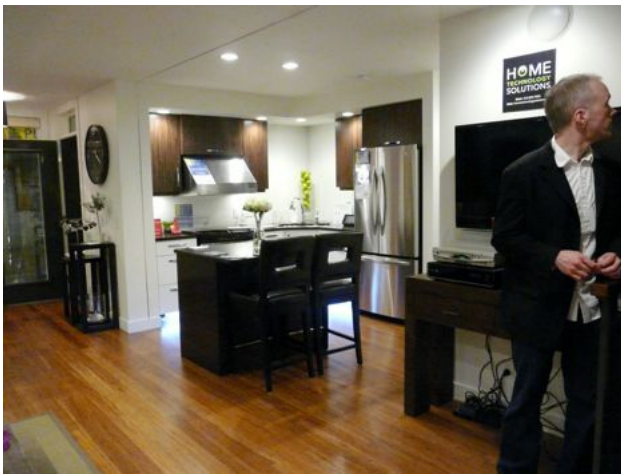


Figure 51: Kitchen and Front Entrance

Photograph property of Lloyd Alter. Copyright permission obtained March 20, 2012.

Retrieved from <http://www.treehugger.com/modular-design/modern-modular-done-right-from-challenger-living.html>



Figure 52: Living and Dining Area

Photograph property of Lloyd Alter. Copyright permission obtained March 20, 2012.

Retrieved from <http://www.treehugger.com/modular-design/modern-modular-done-right-from-challenger-living.html>

3.3.3 Build Your Own Home

I chose the CUBE as a precedent for my project as it employs modularity as a building fabrication method, as well as for the delivery and on-site erection processes that I am suggesting for my design of the transitional houses. It also uses many sustainable design elements that I would like to use in the design such as grey water capture, solar panels, sustainably sourced materials and so on. What follows are the steps taken to fabricate and site modular housing.

Modular housing systems are three-dimensional factory-produced box modules that are ninety to ninety-five percent complete, including interior and exterior finishes, pre-wiring and pre-plumbing, upon arrival to the site. They are fabricated and assembled at a factory and then shipped to the site where they are connected together to create a structurally complete system. They can be used as a single entity or combined/stacked to create a larger building envelope. They are reputed to be the most structurally sound of all types of system-built housing. They are generally comprised of a combination of wood, steel, aluminum and concrete (Carper, 5; Reidelbach, 15). Some advantages in using modular housing systems are that they offer a fast and cost-effective approach to building homes with high quality materials. As well, a variety of standard and custom plans are available to suit the needs and tastes of a wide range of users (Carper, 15-18).

Sectional houses (the combination of two or more modules) are the most popular of modular structures. They are designed and fabricated to meet or exceed local building code requirements for conventionally built houses. Each individual section typically measures 10 to 14 feet in width, 12 feet being the average width, and 38 to 56 feet long,

although they may be as long as 70 feet if the regulations for the particular state highways on which they are transported allow. Once on the site, they are erected on a previously poured foundation either by placing them side by side, stacking them, or a combination of both. The individual sections typically leave the factory completely finished with carpeting, flooring, paint, electrical and mechanical systems and other accessories such as window coverings in place. The most common shape for a sectional house is a rectangle, however, different configurations are attainable due to different sized sectionals units, such as the three-dimensional sectional systems discussed below, which allows for carports, garages, false gables and so on (Reidelbach, 17-23).

Three-dimensional sectional systems follow the same principle as sectional houses but are smaller in size. They are fully finished, pre-wired, pre-plumbed boxes that, when combined with other boxes and components, form the finished structure. They can be as small as a wall panel and as large as a complete room. In this way, a complete structure can be put together from many smaller modules (Reidelbach, 25).

There are two choices for roof systems:

- 1) Factory built roof systems where the roof is built onto the box in the factory. A low slope roof (3 in 12 or less) is necessary in this case so that the building will meet the maximum shipping height limitations. The typical ceiling height in a sectional with a factory built roof system is 7 foot 6 inches because of the use of the low slope roof. However, a folding type of truss rafter roof system can be used to acquire a 4:12 roof pitch; or

- 2) The on-site variety where the sectional boxes are shipped as boxes along with factory fabricated trussed rafters or conventional pre-cut rafters and joists and the roof is built on site, allowing for a roof with a steeper pitch than 4:12. The steeper pitched roof allows for the ceiling heights to be the more conventional 8'-0" (Reidelbach, 19-21, 151-55).

The sectional units are most commonly shipped via flatbed trucks due to economical reasons, however railway flatcars or ships and barges can be used. All states permit shipment of housing units twelve feet in width on flatbed trucks, and most allow a maximum height of 13 feet and 6 inches (Reidelbach, 121-29).

There are two main ways to erect a modular unit on site:

- 1) The track or roller method is most popular for single story dwellings. It involves using specially designed tracks or roller tracks that extend from the side of the top of the foundation to the side of the transport. The unit is slid into position on the foundation. However, the building site must be relatively level with no obstacles on the long side of the foundation in order to execute this method; and
- 2) The crane method is the most prevalent method. It is mostly used when site conditions are unfavourable for the previous method. The crane method also needs to be used if the units are being stacked (Carper, 19;Reidelbach, 131).

In one day, a modular house can be unloaded from the transport trucks, placed on the foundation and the sections or modules connected, at which point the builder need

only come back to hook up the plumbing and other utilities and install the finishing touches such as sidewalks, porches and so on (Carper, 19).

Chapter 4: Design Programme

4.1 Site Analysis

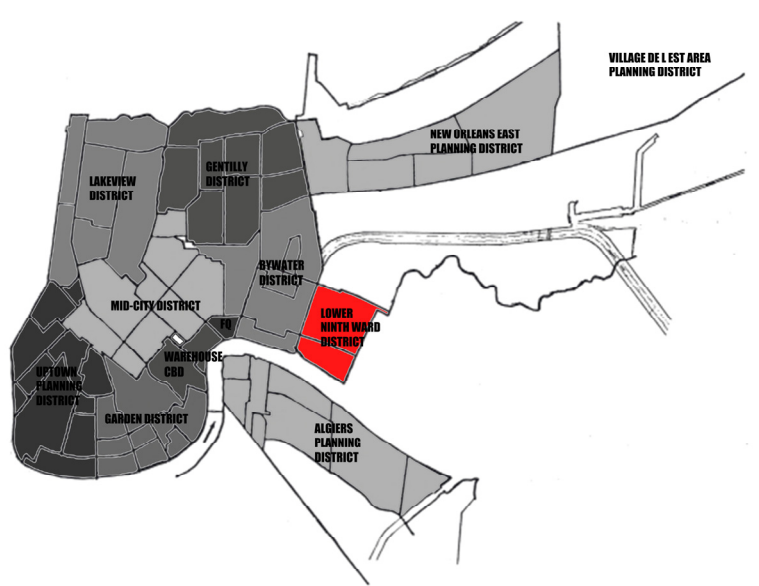


Figure 53: Author Adaptation of New Orleans Neighborhood map blank.png
http://en.wikipedia.org/wiki/File:New_Orleans_Neighborhood_map_blank.png
Accessed March 20, 2012. Public Domain Image.
Planning District Information Retrieved from https://gnocdc.s3.amazonaws.com/maps/PDFs/NOLA_planning_districts.pdf
(Greater New Orleans Community Data Center, New Orleans Planning Districts)

4.1.1 History

4.1.1.1 New Orleans

The city of New Orleans was established by Jean-Baptiste le Moyne, Sieur de Bienville in 1718. It was a strategic location for a city as it was located at an outlet of networked rivers that comprise the Mississippi River drainage basin. New Orleans is surrounded by Lake Borgne to the east, Lake Pontchartrain to the north, and Lakes Salvador and Cataouatche to the south. It was an ideal location for trading and it became an important port in southern Louisiana for shipping of Midwest agricultural products (Lee & Willardson, 53-54; Giegengack & Foster, 21; Ramroth, 202).

The city was situated one hundred miles from the mouth of the Mississippi River and sat on a group of natural levees raised eight to fifteen feet above sea level and surrounded by swamp and marshland (Waite et al., 21; Giegengack & Foster, 21). This area includes the current French Quarter, the Garden District, and the Central Business District (Bostic & Molaison, 255; Ramroth, 203). There was no appropriate site near the mouth of the Mississippi River to expand the city and its commercial capabilities via the port, however, due to seasonal flooding. In 1812, levees were constructed along the river channel to deter flooding in the lowlands beyond the river and by 1858 the levees were over a thousand miles long and up to thirty-eight feet high.

In 1878, the United States Army Corps of Engineers were placed in charge of maintaining the levees, proposing needed changes and upgrading the levees if need be (Waite et al., 23; Lee & Willardson, 53-54). It was recommended by private engineers that outlets, reservoirs, and jetties be used to diminish the pressure on the existing levees and check the water levels. However, a levee-only policy to control flooding was decided on due to the costly nature of the recommended changes. In 1926, the United States Army Corps stated that the levees would be sufficient (Waite et al., 23).

The lower-lying areas that include the current Mid-City, Lakeview, and Gentilly districts were not largely built until 1920, when the land was finally drained (Bostic & Molaison, 255). In April of 1927, the levees near Greenville, Mississippi failed and started the Great Mississippi Flood. Combined with a heavy rainfall, the water level rose and breached the levees in over one hundred different locations. When the flood waters neared New Orleans the decision was made to dynamite the Poydras levee and flood a residential area in order to save the commercial district. It turned out the destruction of

the levee was unnecessary: the storm cleared up the day after the levee was blasted. By then it was too late. Over half a million people had lost their homes and livelihoods through the intentional flooding of the residential district (Waite et al., 23).

During the 1960s and 1970s, New Orleans East was drained and developed (Bostic & Molaison, 255). On September 9, 1965, Hurricane Betsy struck Louisiana. The levees failed and water from Lake Pontchartrain flooded the Lower and Upper Ninth Wards, Gentilly, and St. Bernard Parish. The Army Corps engineers rebuilt the New Orleans levees, but only to withstand similar magnitude (Category 3) hurricanes, and, in 2005, they did not survive Hurricane Katrina. Most of the same neighbourhoods that flooded during Hurricane Betsy also flooded during Hurricane Katrina (Waite et al., 23-24; Giegengack & Foster, 27-29; Lee & Willardson, 55).

4.1.1.2 The Lower Ninth Ward

The Lower Ninth Ward District is made up of two neighborhoods: The Holy Cross, which is the older of the two neighborhoods, and the Lower Ninth Ward. The Holy Cross was developed in the late nineteenth century and it was not until the 1950's that the Lower Ninth Ward was developed from agricultural land into residential. In 1918, the Lower Ninth Ward District was distinguished from the Upper Ninth Ward, which was comprised of the Bywater and St. Claude neighborhoods, when the Industrial Canal was built to act as a deepwater passage from Lake Pontchartrain to the Mississippi River (McMichael Reese, 40).

In the 1800's, the Lower Ninth Ward was largely used for agriculture and had plantations where sugar was the dominant crop. The farms were a major source of income for poor African Americans and immigrant workers from Ireland, Germany and Italy who mainly settled in the Holy Cross neighborhood. Only half of the Lower Ninth Ward was developed by 1950. It wasn't until a second bridge between the Lower Ninth Ward and the city was built in the late 1950's that the South section of the Lower Ninth Ward was developed (Greater New Orleans Community Data Center, Lower Ninth Ward Neighborhood Snapshot). This was due largely to the demand for housing for the people that were working in the now industrialized surrounding areas of the Ninth Ward. Because of this, the Lower Ninth Ward was largely a working-class neighborhood. The land was cheap, because the industrialized nature of the area and it tended to flood due to its dip in elevation. It was therefore relatively easy to buy a home lot and build. Drainage canals were installed to accommodate the Industrial Canal which helped with the flooding and allowed for heavier development of the area; however, they did not eradicate the flooding in the area and hence property remained of a lower value. This was attractive to people of lesser means when buying or renting property (McMichael Reese, 41-43).

Another thing that kept the property levels down in the Lower Ninth Ward was that New Orleans was a highly segregated city and the Lower Ninth Ward was a dominantly black neighborhood. This was due largely to colonial racial residential dispersion patterns (people of similar races clustering together), the low value of the property, and also a decision the municipal government made in the 1940's to develop two distinct residential areas for the black community in the Lower Ninth Ward that were

completed in the 1960's. During the Civil Rights era, the white population that did live in the Lower Ninth Ward moved due to tension between the races (41-43).

Through the second half of the twentieth century, the social effects of population shifts due to affordable housing issues created a dense, low-income population in the Lower Ninth Ward that was overwhelmed with drug use and crime and was further segregated. However, the Lower Ninth Ward also became known for its strong community support ethics that were reflected through all of the shared organizations and clubs and strong social networks. This is one of the main reasons for the residents of the Lower Ninth Ward wanting to return to their neighborhood post-Katrina.

4.1.2 Site Images



Figure 54: Aerial photograph of the Lower 9th Ward. Undated pre-Katrina U.S. Army Corps of Engineers photo.<http://commons.wikimedia.org/wiki/File:Ihnc-05.jpg> Accessed November 29, 2010. Public domain image.



Figure 55: Aerial photograph of the break in the levee in the 9th ward. New Orleans, LA, August 30, 2005.
 FEMA/< Jocelyn Augustino> http://www.photolibrary.fema.gov/photolibrary/photo_details.do?id=18177
 Accessed January 14, 2011. Public domain image.



Figure 56: Ninth Ward, New Orleans, LA, 9-16-05.
 FEMA/< Marvin Nauman> http://www.photolibrary.fema.gov/photolibrary/photo_details.do?id=15826
 Accessed January 14, 2011. Public domain image.



Figure 57: Ninth Ward, New Orleans, LA, 9-16-05.
 FEMA/< Marvin Nauman> http://www.photolibrary.fema.gov/photolibrary/photo_details.do?id=15827
 Accessed January 14, 2011. Public domain image.



Figure 58: Houses in the Ninth Ward. New Orleans, September 20, 2005.
FEMA/<Win Henderson> http://www.photolibrary.fema.gov/photolibrary/photo_details.do?id=16076
Accessed January 14, 2011. Public domain image.



Figure 59: The Ninth Ward. New Orleans, September 20, 2005.
FEMA/<Win Henderson> http://www.photolibrary.fema.gov/photolibrary/photo_details.do?id=16079
Accessed January 14, 2011. Public domain image.

4.1.3 Access to Site and Circulation Patterns

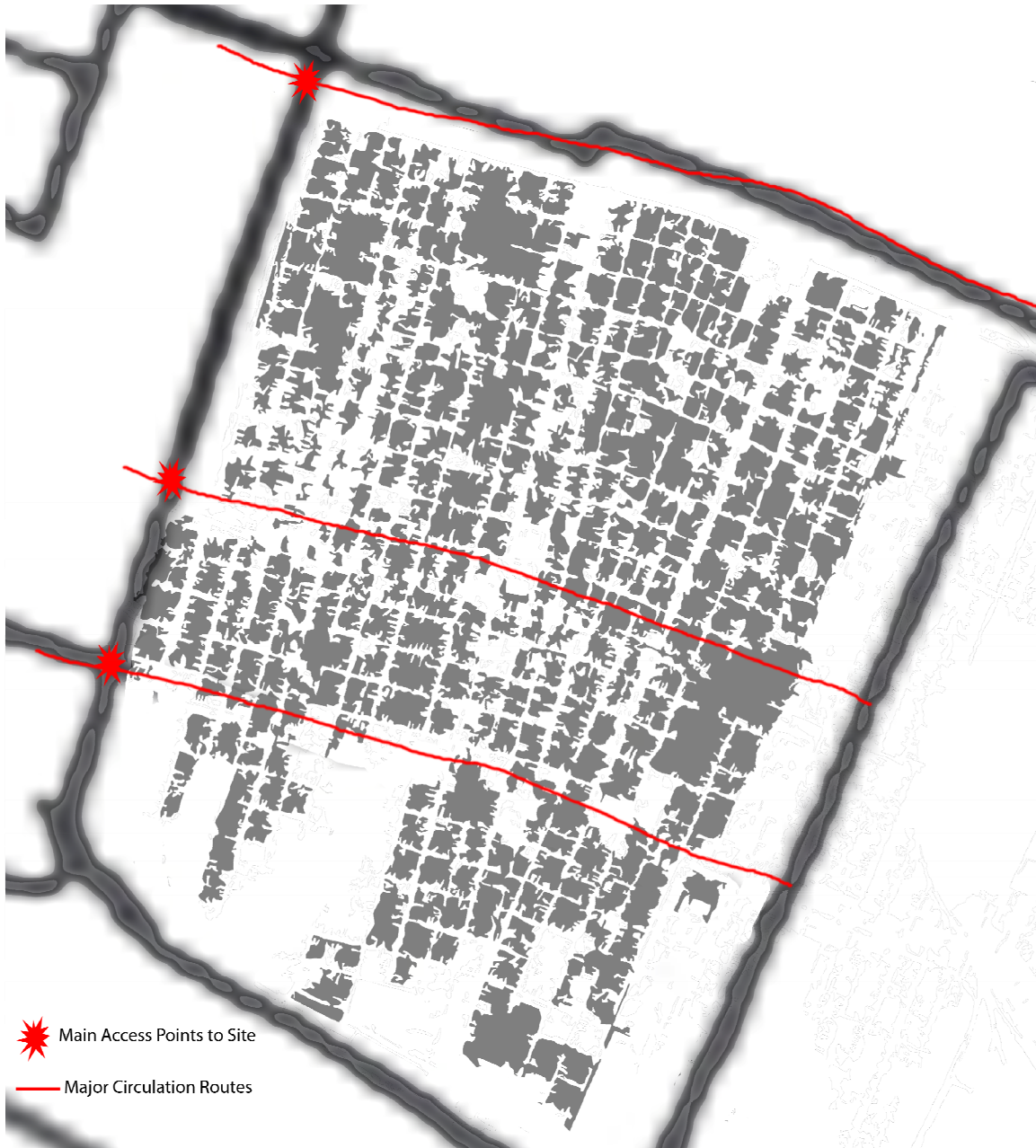


Figure 60: Main Access Points and Circulation Routes to Site.
Author Adaptation of New Orleans Neighborhood map blank.png
http://en.wikipedia.org/wiki/File:New_Orleans_Neighborhood_map_blank.png
Accessed March 20, 2012. Public Domain Image.

4.1.4 Opportunities and Constraints of Site

A typical New Orleans residential block is 300 feet square where “[e]ach block is divided into long, narrow lots that are typically 30 by 120 feet but can range from 20 to 65 feet wide by 80 to 150 feet deep. Blocks are often divided into ten 30-by-120-foot lots per opposing side and two 30-by-150-foot key lots on each of the remaining sides.”

(Bernhard, 101-02).

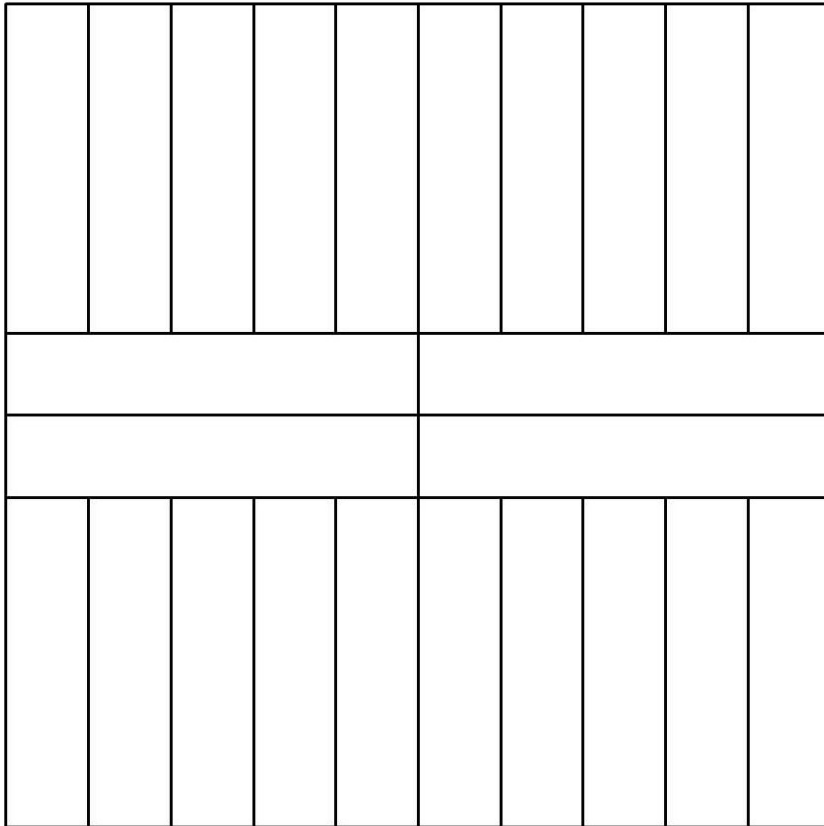


Figure 61: Interpretation of Bernhard’s description of a typical New Orleans residential block (Bernhard, 101-02).

Image by Author.

There are 3 foot setbacks on either side of the house as well as 20 feet in the front and 20 feet in the back that are required by the building code (GRAFT, Design

Guidelines 124). Because of this, as well as the typical lot size being 30 feet by 120 feet, the footprint of the house can be no larger than 24 feet by 80 feet. This includes porches and any other exterior addition. The steps leading up to the porch can be situated in the required 20 feet at the front of the house (126).

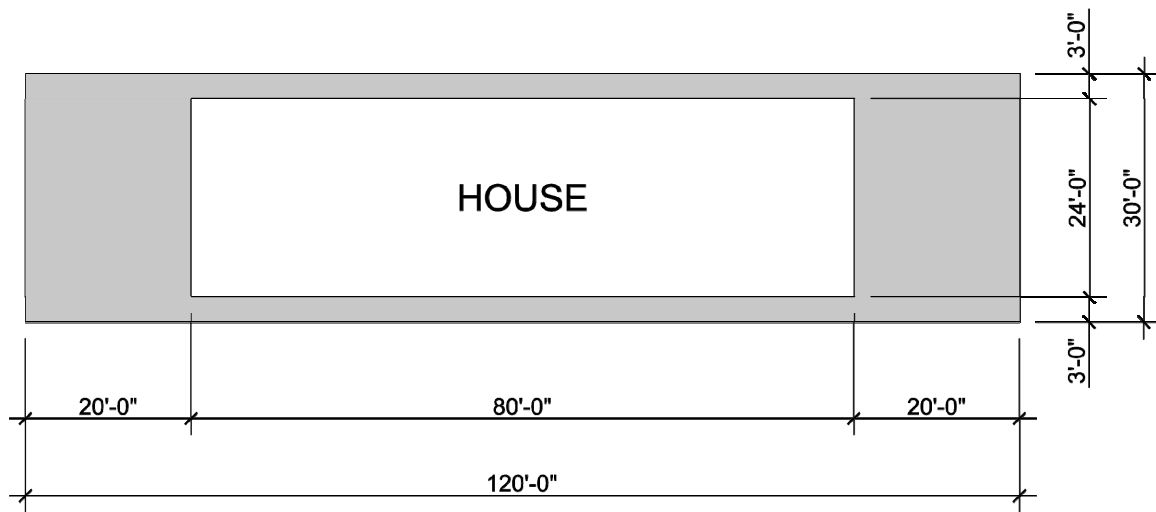


Figure 62: Interpretation of Bernhard's description of a typical New Orleans lot size with setbacks and house footprint (Bernhard, 126). Image by Author.

The damages to a disaster-stricken site can vary in degrees depending on the magnitude of the particular disaster. In the case of Hurricane Katrina, the infrastructure incurred major damages from flood waters, chemicals, pesticides, oils and other contaminants that were released in the storm surge (Phillips, 194). This would pose challenges in the timeline of erecting the transitional home, as rubble would need to be removed from the site as well as any potentially hazardous contaminants. Also, consideration of design elements that would allow the house to be a completely self-sustainable entity (relying on alternative means of power, sewage removal and water supplies, until the time when the infrastructure could be repaired and the house connected to it) are necessary.

4.1.5 Views from Site

4.1.5.1 Architectural Character and Lot Spacing of Houses in New Orleans



Figure 63: Uptown New Orleans row of houses with roofs damaged by Hurricane Katrina. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:LowerlineBlockBack.jpg> under the Creative Commons Attribution-Share Alike 2.5 Generic <http://creativecommons.org/licenses/by-sa/2.5/deed.en>. Accessed February 13, 2012.



Figure 64: House with Christmas decorations, Uptown New Orleans. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:UptownOctaviaAnnunciationXmas.jpg> under the Creative Commons Attribution 2.5 Generic <http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 65: neworleans1 243. Photo by jasminedelilah.
Available at <http://www.flickr.com/photos/79534376@N00/1457153086>
under the Creative Commons Attribution 2.0 Generic
http://creativecommons.org/licenses/by/2.0/deed.en_CA. Accessed March 27, 2012.



Figure 66: GENERAL VIEW OF ROW OF SHOTGUN HOUSES, FROM SOUTH.
Library of Congress, Prints & Photographs Division, HABS KY,56-LOUVI,13--7 (CT).
Retrieved from <http://www.loc.gov/pictures/item/ky0015.color.572146c/>
Accessed February 13, 2012. Public Domain Image.



Figure 67: Houses in Uptown New Orleans. Photo by Infrogmation.
Available at <http://commons.wikimedia.org/wiki/File:UptownFeb07CarnivalMaskHouse.jpg>
under the Creative Commons Attribution 2.5 Generic
<http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 68: New Orleans after Hurricane Katrina: Houses in formerly flooded New Marigny neighborhood along St. Bernard Avenue. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:MarignyBlueDoubleWhiteShotgun8May.jpg>
under the Creative Commons Attribution 2.5 Generic
<http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 69: New Orleans after Hurricane Katrina: "Shotgun" style house in formerly flooded Mid City neighborhood. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:MidCity10May06Shotgun7.jpg> under the Creative Commons Attribution 2.5 Generic <http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 70: New Orleans: row of small "shotgun" style houses Uptown. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:412ShotgunRowUptown.jpg> under the Creative Commons Attribution 2.5 Generic <http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 71: New Orleans : A classic "Shotgun" style house in Marigny neighborhood. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:MarignyShotgun8May2.jpg> under the Creative Commons Attribution 2.5 Generic <http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 72: Residential architecture, Old Jefferson, Louisiana. Photo by Infrogmation. Available at http://commons.wikimedia.org/wiki/File:Old_Jefferson_Louisiana_shotgun_house.JPG under the Creative Commons Attribution-Share Alike 2.0 Generic <http://creativecommons.org/licenses/bysa/2.0/deed.en>. Accessed February 13, 2012.



Figure 73: Pair of shotgun houses.

Photo by Censusdata. http://commons.wikimedia.org/wiki/File:Pair_of_shotgun_houses,_Old_Louisville.jpg
 Accessed February 13, 2012. Public Domain Image.

4.1.5.2 Lower Ninth Ward: One Year After Hurricane Katrina



Figure 74: Collage of Lower 9th Ward New Orleans, LA. 2006 First Year Anniversary Aftermath.

Photos by M. T. Harmon; Office of Public Affairs. Corporation for National and Community Service.

http://photos.nationalservice.gov/Newsroom/Katrina/0806-Aftermath/10008631_f7NQj#684813604_cZNjq
 Accessed March 18, 2010. Public Domain Images.

4.1.6 Housing Typologies of the Lower Ninth Ward

4.1.6.1 Introduction

The housing in New Orleans has a deep and rich history. The building typologies were imported by the different cultures, including French, Spanish and African, that settled in New Orleans. They were modified over time to accommodate the climate and site conditions, creating an eclectic mixture of housing stock specific to New Orleans. Some modifications, including the use of porches, deep overhanging eaves, houses encroaching on the street and placed close together, were used in response to the hot and humid climate. The porches and deep overhanging eaves of the Shotgun and Creole Cottage styles also served to transform the sidewalk into domestic space, however, and rear porches that wrapped around the house expanded the interior space into the yard. The front porch itself is of African origin, where such additions were derived due to the experience of tropical heat and humidity. American builders were quick to adopt the custom of porch building. The Creole Cottage, Creole Townhouse, and the Shotgun House are the resulting predominant housing types in New Orleans. Within these three house types there are a selection of variations that usually differ based on how many openings, or bays, are along the front façade of the house (Upton, 284; Vlach, 45; Verderber, 258; Bernhard, 100-02).

Houses in New Orleans share many similar characteristics. They are as follows:

Exterior:

- They are narrow due to the long narrow lot sizes.
- They are usually flush with, or set back somewhat from, the sidewalk.
- They are between 40 to 70 feet in length.
- They usually have a rear yard or courtyard with a service building.
- Most are party-walled or a 2 to 4 feet distance from one another.
- Most are one to two stories tall and are typically never taller than three and a half stories.
- Most of them are raised six to thirty-six inches due to the occasional flooding after a heavy rain as well as for ventilation.

Interior:

- They are usually 11 to 14 feet high so that heat can rise outside of the lived in space. This achieved through the attics, because the presence of windows dormers and vents promote heat to exit the house via the stack ventilation.
- Maximized living space is achieved by arranging rooms of the same size en suite so that corridors are minimized by the room to room circulation patterns.
- To achieve cross ventilation, openings in the rooms are placed across from one another.
- The same size rooms allow for flexibility in the plan where rooms' uses can be reassigned when needed (Bernhard, 102).

4.1.6.2 Creole Cottage

The Creole Cottage houses of New Orleans originated from the Caribbean basin where the style was brought over with French- and Spanish-speaking migrants between the late 1700s and the mid 1800s. They are comprised of primary spaces that open directly off of the street and lead into secondary spaces behind the primary ones. They are usually 40 to 50 feet deep, vary in width, and are one and a half stories high where a half story room or extra storage is possible. The roof is a steep gable-sided roof that pitches toward the front and rear of the house and hangs two to three feet over the sidewalk to protect residents from rain and sun. They can either be free-standing or share one or both walls with other buildings (Upton, 281; Foster, 188-89; Bernhard, 103-04).

The interior of the Creole Cottage is one room wide by one room deep, as is the case in a Two-Bay Creole Cottage, or two rooms wide by two rooms deep, as is the case in a Four-Bay Creole Cottage. The primary rooms are the same size and are usually 12 by 14 feet. Secondary spaces that come off of these primary ones usually include one or two small rooms called cabinets that often house a kitchen and bathroom and an open covered porch. The remaining seventy to eighty feet of the lot is allotted for a courtyard, rear yard, or additional service buildings (Bernhard, 103-04).

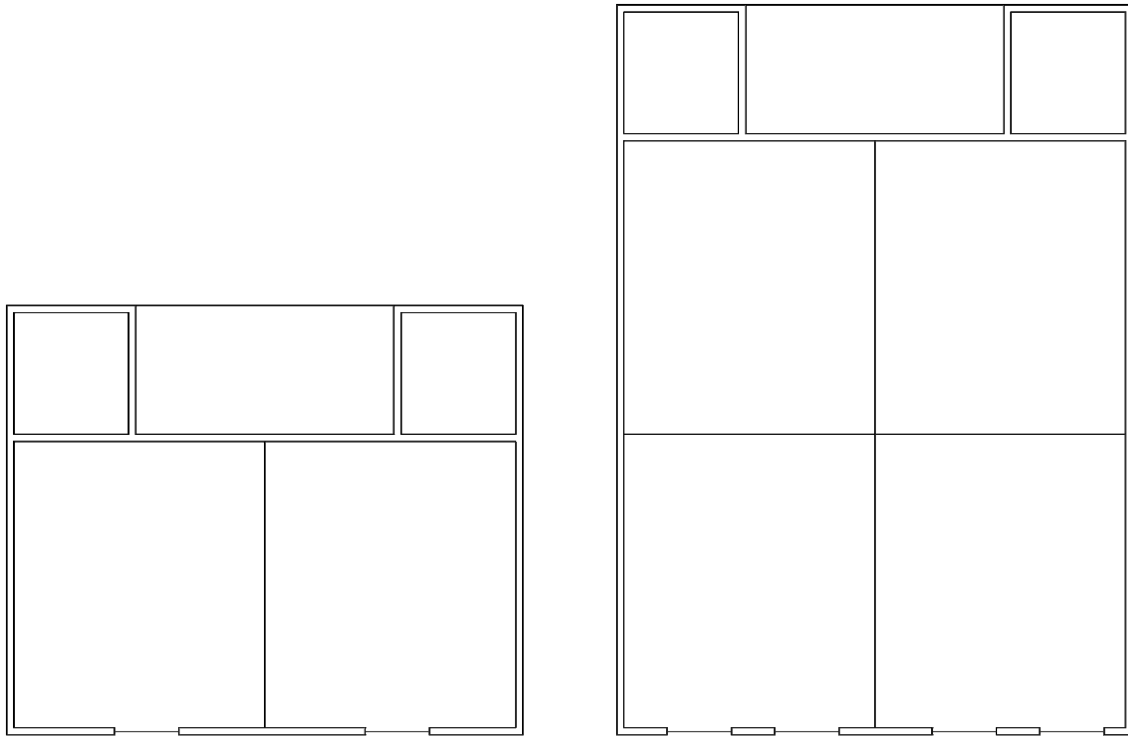


Figure 75: Interpretation of Bernhard's description of Two- and Four-Bay Creole Cottages (Bernhard, 103-04). Image by Author.



Figure 76: Two-Bay Creole Cottage
 New Orleans: Residential architecture on Grand Route St. John, Esplanade Ridge section. Photo by Infrogmation.
 Available at <http://commons.wikimedia.org/w/index.php?title=File:GrandRouteStJDoubleCreoleCottage.JPG&oldid=33438747>
 under the Creative Commons Attribution-Share Alike 3.0 Unported
<http://creativecommons.org/licenses/by-sa/3.0/deed.en>. Accessed February 13, 2012.



Figure 77: Four-Bay Creole Cottage
 New Orleans: Old house in Bywater section. "Creole cottage" style architecture. Photo by Infrogmation.
 Available at <http://commons.wikimedia.org/wiki/File:Bywater7Jul08HouseBlue.jpg>
 under the Creative Commons Attribution-Share Alike 3.0 Unported
<http://creativecommons.org/licenses/by-sa/3.0/deed.en>. Accessed February 13, 2012.

4.1.6.3 Creole Townhouse

The Creole Townhouses were built throughout the 1800s. The style that influenced their characteristics is a mixture of the Creole Cottage type, Spanish Colonial type, and the general Townhouse type the Americans imported. The layout of the Creole Townhouse consists of a series of linear primary spaces with vertical circulation patterns. They range from two to three and a half stories in height, have a gable-sided roof which leans to the front and back, and are usually sixty feet deep. They can be freestanding but usually share one or both walls with other buildings. Like the Creole Cottage, the half story can be developed as living space or storage. There are usually secondary rooms located in a two-story service building that is attached to the back of the building and accessed via a balcony on the second floor. The front façade of the main building, as well as the facades of the back and service building, are flanked with balconies and

galleries. The first floor is often used for commercial space and the remaining floors for residential purposes (Foster, 190-91; Bernhard, 105-06).



Figure 78: Three-Bay Creole Townhouse

New Orleans: Governor Nicholls Street, the French Quarter. Photo by Infrogmation. Available at <http://commons.wikimedia.org/w/index.php?title=File:GovNicholls14Jan2008VictorianAndTownhouse.jpg> under the Creative Commons Attribution-Share Alike 3.0 Unported <http://creativecommons.org/licenses/by-sa/3.0/deed.en>. Accessed February 13, 2012.



Figure 79: Four-Bay Creole Townhouse

New Orleans: Old house in Bywater section. "Creole cottage" style architecture. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:FQJan07EarlyLateColonial.jpg> under the Creative Commons Attribution 2.5 Generic <http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.

4.1.6.4 Shotgun House

The Shotgun House is rooted in African building traditions; gable-entry houses are common in parts of central Africa. Having its gable end entry perpendicular to the main thoroughfare, as opposed to the Euro-American tendency for the entry to be on the long side and gables on the side, distinguishes it from the rest of the building types in the South. Shotgun Houses are New World hybrids that were developed in the West Indies and brought over by Haitian immigrants to the United States through New Orleans, where they were built between the late 1800s and early 1900s. The American Shotgun House mixes the architectural elements of a Caribbean Indian building shape, African-inspired proxemic codes, and European colonial framing techniques. They are the most prevalent housing type in New Orleans and were most popular amongst the working-class residents of New Orleans (Foster, 192; Upton, 281; Vlach, 43; Bernhard, 108).

Shotgun Houses are typically situated on a 30 by 120 foot lot, 40 to 70 feet long, and 2 to 4 feet from the side property lines. They have a gabled roof that slants to the sides and are usually one or two stories high. They are usually flush with or set back from the sidewalk, with a rear yard that contains a service building situated at the rear property line. They usually have front and back porches as well, and some have galleries and balconies along different facades lending to alternate entry points on the side of the house (Foster 194; Bernhard, 107-108).

The interior consists of a linear progression of rooms that are usually 12 to 14 feet in width and square in shape. Movement through the interior happens room to room via connecting doors, along an exterior gallery or along an interior hallway. Cross

ventilation is attained through placement of openings across from one another along the length of the house as well as the placement of doors lined up from the front to the back of the house. The attic of the Shotgun House is usually used for storage (Foster, 194; Vlach, 43; Bernhard, 107-08).

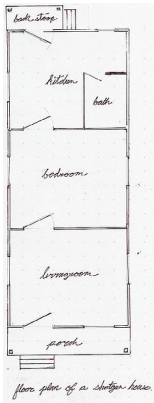


Figure 80: Floor plan of a typical shotgun-style house. Photo by Susan Murray. Available at http://commons.wikimedia.org/wiki/File:Shotgun_house_plan.jpg under the Creative Commons Attribution-Share Alike 3.0 Unported http://commons.wikimedia.org/wiki/File:Shotgun_house_plan.jpg. Accessed Feb 13, 2012.



Figure 81: Two-Bay Shotgun "Shotgun" style house in Uptown New Orleans. Photo by Infrogmation. Available at <http://commons.wikimedia.org/wiki/File:UptownFeb07LightBlueShotgun.jpg> under the Creative Commons Attribution 2.5 Generic <http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 82: Four-Bay Shotgun
Houses in Uptown New Orleans; a "shotgun" and a "shotgun double". Photo by Infrogmation.
Available at <http://commons.wikimedia.org/wiki/File:UptownFeb07ShotgunStgnDouble.jpg>
under the Creative Commons Attribution 2.5 Generic
<http://creativecommons.org/licenses/by/2.5/deed.en>. Accessed February 13, 2012.



Figure 83: Camelback Shotgun
Photograph property of Marty Pearl. Copyright permission obtained March 21, 2012.
Retrieved from http://www.martypearl.com/Portfolio/Published-Images-2008-2010/Images-Published/7045355_JQLj pz/70

4.2 Human Factor Analysis

4.2.1 Client Profile

The proposed clients are the Federal Emergency Management Agency and the United States Department of Housing and Urban Development. What follows are brief descriptions of their evolution and roles in disaster mitigation.

4.2.1.1 Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency (FEMA) was established in 1979 by President Carter after years of ineffectual, fragmented disaster management by various federal agencies. The creation of FEMA was an attempt to amalgamate many of these different agencies into one centralized agency that could respond to the full gamut of disaster mitigation. In 2001, FEMA co-ordinated with the then newly-formed Office of Homeland Security on the September 11 terrorist attacks, and in 2003 FEMA joined the Department of Homeland Security. (Federal Emergency Management Agency, FEMA History; McCarthy, 1) In 2006, the Post-Katrina Emergency Reform Act was passed. It reorganized FEMA, giving FEMA more authority to fix gaps that were made apparent in their response to Hurricane Katrina. This included a more thorough preparedness plan (Federal Emergency Management Agency, FEMA History, FEMA 3).

FEMA's responsibilities are to provide assistance to individuals and communities in times of natural disaster, terrorist attacks and all other major emergencies. They work

with federal, state, tribal and local governments, private sector partners, volunteer agencies and the public in preparation, response and recovery aspects when dealing with a disaster. They assist in writing and developing plans for local response activities during an emergency, as well as distributing supplies needed by victims and emergency responders during a disaster. They conduct risk analyses to provide better planning to lessen the financial and physical effects of future disasters, and promote a fast recovery of affected communities through employing hazard mitigation tactics. They also act as a middle man in communication between all involved parties throughout the process of mitigating disaster (Federal Emergency Management Agency, FEMA 3-6).

Once the President issues a disaster declaration, FEMA can expend federal funds to provide assistance to communities and states. They do this via Section 403 of the *Stafford Act*, which makes funds available to the state and government for emergency shelter, and Section 408 which makes funds available to the individual displaced person for longer term temporary housing. A displaced household is entitled to \$26,200 under Section 408. This money can be used for home repairs, rent, and other personal costs. This assistance is provided for up to eighteen months or until the full amount is reached, whichever happens first (Crowley, 129).

There are a number of options that FEMA uses for temporary housing solutions. The main choice, if infrastructure is not too damaged, is rental units. Direct Housing, or the use of prefabricated units placed on the homeowner's private site or an existing commercial site, is only used when all other housing options like rental assistance have been exhausted or are deemed unreasonable (Federal Emergency Management Agency, 2009 Disaster Housing 1; McCarthy, 12).

4.2.1.2 The United States Department of Housing and Urban Development (HUD)

The U.S. Department of Housing and Urban Development (HUD) was established in 1965 when the *Department of Housing and Urban Development Act* was passed and in 1968 they were given the responsibility to enforce equal housing rights for all with the passing of the *Fair Housing Act* (U.S. Department of Housing and Urban Development, Mission, HUD Strategic Plan FY 2010-2015).

HUD runs programs that support the right for everyone to have fair housing, low-income families, renters and owners alike. Some examples are federal housing allowance programs and the Section 8 tenant-based certificates program which allows for an increase in choice of housing for low income tenants. HUD's aim is to strengthen the housing market while providing affordable homes for everyone, creating sustainable, inclusive communities that are free from discrimination, and to use housing as a way to improve quality of life for all (U.S. Department of Housing and Urban Development, Mission, HUD Strategic Plan FY 2010-2015).

HUD worked closely with FEMA in providing disaster housing assistance for survivors of Hurricane Katrina. This was achieved through the Disaster Housing Assistance Program (DHAP). The DHAP was established through the Bush Administration in November of 2007 to help transition survivors from temporary to permanent housing, helping them become self-sufficient, rebuild and return to their homes. This was done by an interagency agreement between FEMA and HUD. In this agreement, HUD took over the long-term rental assistance of 45,000 families affected by Hurricane Katrina from FEMA, while FEMA continued the management of the

manufactured housing program involving trailers and mobile homes. However, the DHAP fell short in supporting families who, due to low income previous to Hurricane Katrina, were unable to reach self-sufficiency within the allotted time. Because of this, multiple extensions and more money were given to aid in supporting people who were still working toward permanent housing. This was occurring well into 2009, four years after Hurricane Katrina, and people are still struggling today to find their way back to a permanent home (Rose & Tuggle, 8-9; McCarthy, 39; U.S. Department of Housing and Urban Development, Disaster Housing Assistance Program).

HUD's responsibility in providing assistance during a disaster is ultimately to help survivors find permanent housing. This is achieved by providing case management for each individual and family, and information and available options through their national network of Public Housing Agencies. (U.S. Department of Housing and Urban Development, Disaster Housing Assistance Program). However, the lack of temporary housing options for such a large number of people displaced by Hurricane Katrina taxed the affordable housing aid intended for locals of states outside of the affected area so that locals in need of housing assistance did not receive it. This was because, with HUD's encouragement, the Public Housing Authorities gave priority to evacuees and set aside units for evacuees that were intended for local people in need (Crowley, 126).

Due to all of the issues FEMA had with providing shelter for the displaced from Hurricane Katrina, legislation was approved in 2006 that appointed HUD the lead agency to provide long-term (30 days or more) disaster housing assistance and FEMA the agency to deal with the immediate disaster response shelter issues (Crowley, 138).

4.2.2 User Profile

4.2.2.1 Residents of the Lower Ninth Ward

The proposed users of the transitional houses are residents of the Lower Ninth Ward. The Lower Ninth Ward was mainly occupied by low-income families before Hurricane Katrina. The neighbourhood was known for its rich and diverse culture and was “a comprehensive vibrant crossroad of families, music and social interaction in New Orleans.” (GRAFT, Design in Times 117).

The 2000 US Census evidenced that 98.3 percent of the Lower Ninth Ward population were black, with a significant loss of jobs due to a drop in New Orleans’ economy (McMichael Reese, 44). Residents were able to keep their property by passing the property titles down through hereditary succession, even though many were living with poverty (McMichael Reese, 45; Barnett & Beckman, 299). The 2000 US Census states that 59% of homes in the Lower Ninth Ward were owner-occupied (a higher percentage than the Orleans Parish in its entirety at 46.5%), were comprised of African American residents and were multifamily use (McMichael Reese, 45; Zdenek, 169; U.S. Department of Housing and Urban Development, Current Housing Unit Damage 39).

Seventy-nine percent of all of the housing stock lost in New Orleans was affordable to low-income housing: 65% ownership units and 89% rental housing (Crowley, 124). Seventy-three percent of all homes in the most acutely affected or flooded areas were damaged or destroyed, and 71% of those affected units were

affordable to low-income households, 57% of which were owner-occupied and 88% rental units (Crowley, 124).

Almost two-thirds of the displaced population relocated outside of Louisiana and all over America, with the majority going to Texas. The residents that were displaced the furthest were statistically low-income African Americans (Logan, 283-84). And, due to distance and lack of resources, the low-income people that were relocated the furthest are unable to return to New Orleans (Logan, 284; Hack, 238). By October of 2006, two-thirds of the white population had returned whereas the black population was down by almost three-quarters of its pre-Katrina level (Logan, 279).

Predominantly upper-class flood-affected areas were beginning to repopulate by October 2005 whereas the poorer, working-class neighbourhoods that were flood-affected were still almost vacant by January 2006. This was due largely to authorities discouraging the former residents of the lower-income neighbourhoods from returning, stating that there were health and safety risks like mould in their homes. However, many houses in lower-income neighbourhoods, like the Lower Ninth Ward, were built with board sheathing and plaster which are more resistant to mould than newer homes built with more porous materials. These houses could have been salvaged (Zdenek et al., 167-69). As of May 2006, salvageable homes in the lower-income and working-class neighbourhoods still lay vacant and had further deteriorated (178).

The damage to 84% of the homes in the Lower Ninth Ward was so severe that the one asset, both economical and emotional, that the residents of the Lower Ninth Ward had, was lost to them (McMichael Reese, 45; U.S. Department of Housing and Urban Development, Current Housing Unit Damage 39). Due to multiple reasons, and as

illustrated in the figure below, the Lower Ninth Ward has been one of the neighbourhoods slowest to rebuild. In total, 5,701 housing units were destroyed or suffered damage of various degrees and as of June 2010 only 24 % of the homeowners had returned (Plyer, Neighborhood Recovery Rates 2; U.S. Department of Housing and Urban Development, Current Housing Unit Damage 39).

4.2.2.2 2000 Census Statistics for the Lower Ninth Ward

Total numbers (2000) Lower Ninth Ward	
Population	14,008
Total households	4,820
Family households	3,467
Gender (2000) Lower Ninth Ward	
Female	53.7%
Male	46.3%
Age (2000) Lower Ninth Ward	
5 years old and under	9.3%
6-11 years old	10.9%
12-17 years old	10.5%
18-34 years old	21.6%
35-49 years old	19.8%
50-64 years old	13.9%
65-74 years old	7.6%
75-84 years old	4.9%
85 years old and older	1.5%
Racial & ethnic diversity (2000) Lower Ninth Ward	
Black or African American	98.3%
White	0.5%
Asian	0.0%
American Indian	0.0%
Other	0.1%
2 race categories	0.6%
Hispanic (any race)	0.5%
Marital status (2000) Lower Ninth Ward	
Total population 15 years and older	10,418
Never married	36.9%
Married	31.8%
Separated	6.3%
Widowed	10.8%
Divorced	14.2%

Households by type (2000) Lower Ninth Ward	
Total households	4,820
Female householder (no husband present) with children under 18	24.9%
Male householder (no wife present) with children under 18	3.4%
Married-couple family, with children under 18	14.8%
Nonfamily households, with children under 18	0.2%
Households with no people under 18 years	56.7%
Children in households (2000) Lower Ninth Ward	
Population under 18 years in households	4,293
Children living as head of household	0.0%
Children living with mother only	40.7%
Children living with father only	4.7%
Children living with married parents	25.4%
Children living with grandparents	23.0%
Children living with other relatives	4.9%
Children living with non-relatives	1.3%
Elderly in households (2000) Lower Ninth Ward	
Elderly in households	1,963
Living alone	26.8%
Living in family households	71.2%
Living in nonfamily households	2.0%

Supervision of children (2000) Lower Ninth Ward	
Total children under 6 in families and subfamilies	1,036
Children under 6 in families where at least one parent does not work	57.6%
Children under 6 in families where at least one parent does not work	42.4%
Total children 6-17 in families and subfamilies	2,522
Children 6-17 in families where both parents or the single parent works	61.3%
Children 6-17 in families where at least one parent does not work	38.7%
Grandparents as caregivers (2000) Lower Ninth Ward	
Total grandparents living in households with grandchildren under 18	839
Grandparent responsible for grandchildren under 18	57.6%
Grandparent not responsible for own grandchildren under 18	42.4%

Table 1: 2000 Census Statistics for the Lower Ninth Ward. Image by Author.
(Greater New Orleans Community Data Center, Lower Ninth Ward Neighborhood: People & Household Characteristics)

Based on the above statistics, there is a mixture of possible users for the proposed housing which includes, but is not limited to: single, married with- or without children, multigenerational families, grandparents raising grandchildren, and single mothers with

children. As many of these family types as possible should be accommodated in the design of the proposed housing.

4.3 Spatial Requirements and Analysis

4.3.1 Functional and Aesthetic Spatial Requirements

Primary Spaces	Min. Space (sq.ft.)	Max. Space (sq.ft.)	Physical Needs	Emotive Needs
Kitchen	72	168	sink, refrigerator, stove, storage	functional, organized
Bathroom	36	80	toilet, tub/shower, sink	pleasant, clean, functional
Entrance	20	64	outerwear storage, overhead lighting	welcoming, inviting
Mechanical	21	48	furnace, water heater, electrical panel	utilitarian
Living Room	96	192	seating, tables, shelving, table lamps	comfortable, inviting
Dining Room	72	168	seating, dining table	welcomes conversation
Bedroom	64	192	bed, side tables, storage, dresser, chair	serene, calm, retreat
Secondary Add-on Spaces	Min. Space (sq.ft.)	Max. Space (sq.ft.)	Physical Needs	Emotive Needs
Additional Bedrooms	64	192	bed, side tables, storage, dresser, chair	serene, calm, retreat
Laundry	21	48	washer, dryer, storage, work surface	functional, organized, utilitarian
Study	64	192	shelving, seating, tables, table lamps	relaxing, retreat
Office	64	192	shelving, table, chair, task lighting	private, utilitarian, relaxing
Storage	21	48	shelving, organization bins	utilitarian, organized
Porch	72	168	seating, table	connection to inside and outside
Basement	480	1920	multi-use space (depends on use)	multi-use space (depends on use)
Garage	120	216	space for 1 or 2 cars, storage, work surface	organized, utilitarian, functional
Den	96	192	seating, tables, media centre, table lamps	relaxed, retreat
Alcove/Nook	64	100	seating, shelving, table lamps	relaxed, retreat
Additional Bathroom	36	80	toilet, sink (if 2 pc), bath/shower (if 3 pc)	pleasant, clean, functional
Sunroom	120	168	seating, table	relaxing, connection to in and out
Courtyard	120	168	seating, table	relaxing, connection to in and out
Guest room	64	192	bed, side tables, storage, dresser, chair	inviting, serene, calm, retreat
Safe Room (Roof-Flooding)	64	121	storage, cots, first aid kit, survival supplies	safe, secure, reassuring
Safe Room (Basement-Tornado)	64	121	storage, cots, first aid kit, survival supplies	safe, secure, reassuring

(secondary add-on spaces based on possible individual changing needs of user as well as differing disaster typologies depending on location)

(min. and max. sq.ft. accounts for different size of dwellings based on occupancy)

Table 2: Functional and Aesthetic Spatial Requirements. Image by Author.

4.3.2 Spatial Adjacency Requirements

4.3.2.2 Zoning

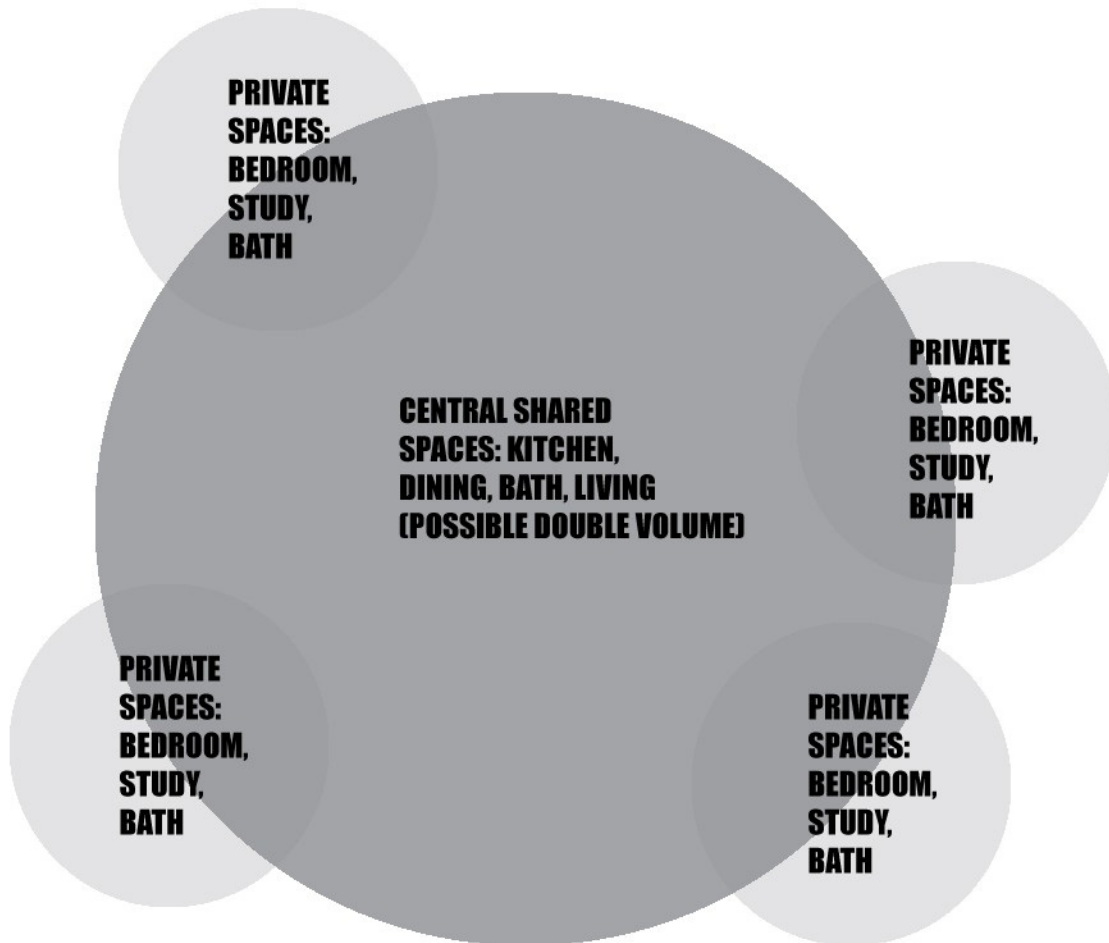


Figure 84: Zoning Diagram. Image by Author.

4.3.2.3 Spatial Adjacencies

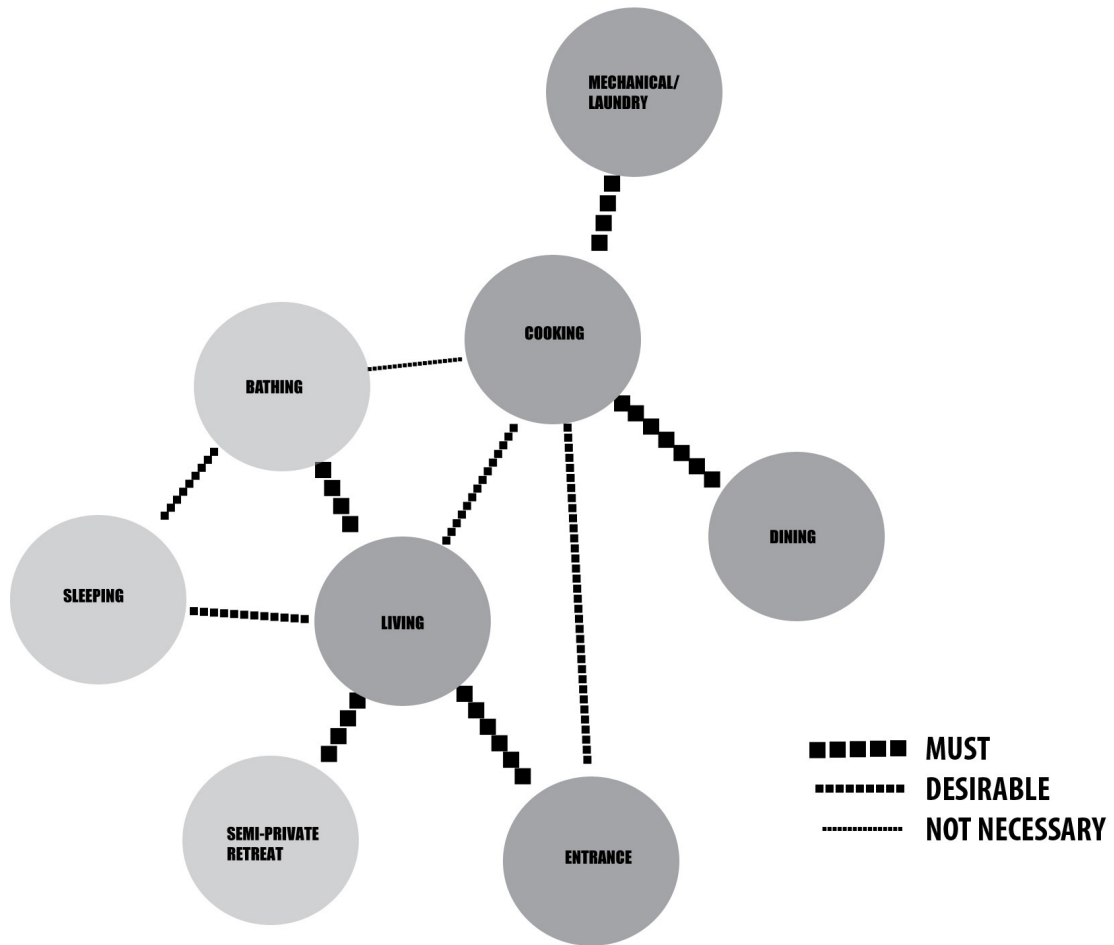


Figure 85: Spatial Adjacencies Diagram. Image by Author.

4.4 Life Safety Requirements

4.4.1 2012 International Building Code

- **310.5 Residential Group R-3.**

Occupancy Classification: Residential Group R-3

- **420.2 Separation walls.**

All walls separating sleeping units in the dwelling should be built as fire partitions.

- **420.3 Horizontal separation.**

Floor assemblies separating sleeping units are required to have a fire resistance rating.

- **[F] 420.4 Automatic sprinkler system.**

Equip Group R occupancies with an automatic sprinkler system.

(International Code Council, 2012 International Building Code)

4.4.2 2012 International Residential Code for One- and Two-Family Dwellings

SECTION R303 LIGHT, VENTILATION AND HEATING

- **R303.1 Habitable rooms.**

All habitable rooms should have a glazing area of not less than 8 percent of the floor area of the particular room.

- **R303.3 Bathrooms.**

Bathrooms should have a glazing area of not less than 3 square feet (0.3 m²), one-half of which must be operable unless artificial light and exhaust system is supplied.

- **R303.7 Stairway illumination.**

All interior and exterior stairways, including the landings and treads should be provided with some form of illumination.

SECTION R304 MINIMUM ROOM AREAS

- **R304.1 Minimum area**

There should be at least one habitable room per dwelling that has not less than 120 square feet (11 m²) of gross floor area.

- **R304.2 Other rooms**

Except for kitchens, other habitable rooms should have a floor area of not less than 70 square feet (6.5 m²).

- **R304.3 Minimum dimensions**

Except for kitchens, no habitable room should be less than 7 feet (2134 mm) in any horizontal dimension.

SECTION R305 CEILING HEIGHT

- **R305.1 Minimum height**

Habitable spaces should have a ceiling height of not less than 7 feet (2134 mm).

SECTION R307 TOILET, BATH AND SHOWER SPACES

- **R307.1 Space required**

Center of toilet 15 inches (381mm) from wall beside it and tub next to it.

21 inches (533.4 mm) of clearance between edge of sink/toilet and wall across from them.

24 inches (609.6 mm) clearance in front of shower door opening.

21 inches (533.4 mm) clearance between edge of toilet and edge of tub.

SECTION R310 EMERGENCY ESCAPE AND RESCUE OPENINGS

- **R310.1 Emergency escape and rescue required**

There should be one operable emergency escape and rescue opening per sleeping unit, with a sill height of no more than 44 inches (1118 mm) high, as well as in habitable basements and attics.

SECTION R311 MEANS OF EGRESS

- **R311.2 Egress door**

Each dwelling should have a minimum of one egress which should be side-hinged, and have a minimum clear width of 32 inches (813 mm) and 78 inches (1981 mm) in height.

- **R311.3 Floors and landings at exterior doors**

There should be a landing on each side of each exterior door that has a minimum dimension of 36 inches (914 mm) measured in the direction of travel.

- **R311.6 Hallways**

The minimum width of a hallway should be not less than 3 feet (914 mm).

- **R311.7 Stairways**

- **R311.7.1 Width**

Stairways should not be less than 36 inches (914 mm) wide.

- **R311.7.2 Headroom**

The minimum headroom in all parts of the stairway should not be less than 6 feet 8 inches (2032 mm).

- **R311.7.3 Vertical rise**

A flight of stairs should not have a vertical rise larger than 12 feet (3658 mm) between floor levels or landings.

- **R311.7.6 Landings for stairways**

There should be a floor or landing at the top and bottom of each stairway with a minimum depth of not less than 36 inches (914 mm).

- **R311.7.8 Handrails**

Handrails should be provided on at least one side of each continuous run of treads or flight with four or more risers.

SECTION R312 GUARDS AND WINDOW FALL PROTECTION

- **R312.2.1 Window sills**

Windows should be a minimum of 24 inches (610 mm) above the finished floor of a room whose opening of an operable window is located more than 72 inches (1829 mm) above the finished grade outside.

SECTION R314 SMOKE ALARMS

- **R314.3 Location**

Smoke alarms should be installed in each bedroom, outside of bedrooms, on each additional story of the house including basement and habitable only attics.

SECTION R315 CARBON MONOXIDE ALARMS

- **R315.1 Carbon monoxide alarms**

A carbon monoxide alarm should be placed outside of each bedroom.

SECTION R322 FLOOD-RESISTANT CONSTRUCTION

- **R322.1.6 Protection of mechanical and electrical systems**

All electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment should be located at or above the design flood elevation.

- **R322.2.1 Elevation requirements**

Habitable areas of buildings should be elevated to, or above, the design flood elevation.

- **R322.2.2 Enclosed area below design flood elevation**

Enclosed areas, including crawl spaces, that are below the design flood elevation

should only be used for parking, storage and building access. They should have a minimum of two flood openings, measuring a minimum of 3 inches in any direction, on different sides of the enclosed area. The openings should be situated 1 foot or less above the adjacent ground level.

(International Code Council, International Residential Code)

4.4.3 American National Standard: Accessible and Usable Buildings and Facilities

304 Wheelchair Turning Space

- Min. 60 inches (1525 mm) diameter.

306.2 Toe Clearance

- Min. Depth 17 inches (430 mm).
- Max. Depth 25 inches (635 mm).
- Min. Width 30 inches (760 mm).

306.3 Knee Clearance

- Min. Depth 11 inches (280 mm).
- Max. Depth 25 inches (635 mm).
- Min. Width 30 inches (760 mm).

308 Reach Ranges

- Max. High forward reach 48 inches (1220 mm).
- Min. Low forward reach 15 inches (380 mm) above floor.

402 Accessible Routes

- Min. Width 36 inches (915 mm).

404 Doors and Doorways

- **404.2.3** Doorways clear opening min. of 32 inches (815 mm).

405 Ramps

- **405.2** Ramp runs running slope no steeper than 1:12.
- **405.5** Min. Width of ramp 36 inches (915 mm).
- **405.6** Max. rise of ramp 30 inches (760 mm).
- **405.7** Ramps shall have landings at the bottom and top of each run.
- **405.7.2** Landing width should be at least as wide as the widest ramp run leading to the landing.
- **405.7.3** Landing length should be 60 inches (1525 mm) minimum clear.
- **405.7.4** Min 60 inch (1525 mm) by 60 inch (1525 mm) landing for ramps that change direction.

604 Water Closets and Toilet Compartments

- **604.2** The centerline of the water closet min. 16 inches (405 mm) max. 18 inches (455 mm) from the wall.
- **604.3.1** Min. 60 inches (1220 mm) clearance around water closet, measured perpendicular from the side wall, and 56 inches (1420 mm), measured perpendicular from the rear wall.
- **604.4** Min 17 inches (430 mm) and max 19 inches (485 mm) above the floor for water closet seat height.
- **604.5.1** Side wall grab bar min 42 inches (1065 mm) long, 12 inches (305 mm) max from the rear wall and extending 54 inches (1370 mm) minimum from the rear wall.

- **604.5.2** Rear wall grab bar min. 24 inches (610 mm) long, centered on the water closet.

606 Lavatories and Sinks

- **606.3** The front of lavatories and sinks max 34 inches (865 mm) above floor.

607 Bathtubs

- **607.2** Clearance in front of bathtubs shall extend the length of the bathtub and shall be min 30 inches (760 mm) wide.
- **607.4.2.1** Two grab bars on the back wall that are 24 inches (610 mm) long, 24 inches (610 mm) maximum from the head end wall, and 12 inches (305 mm) maximum from the foot end wall.
- **607.4.2.2** Min 24 inches (610 mm) long grab bar at foot end wall.
- **607.4.2.3** Min 12 inches (305 mm) long grab bar at front edge of the bathtub.

804 Kitchens

- **804.2.1 Galley Areas** Clearance between all opposing base cabinets, counter tops, appliances, or walls within kitchen work areas shall be 40 inches (1015 mm) minimum.
- **804.2.2 U-Shaped Areas** In kitchens with counters, appliances, or cabinets on three contiguous sides, clearance between all opposing base cabinets, countertops, appliances, or walls within kitchen work areas shall be 60 inches (1525 mm) minimum.

(American National Standards Institute, American National Standard)

4.5 Design Guidelines

- The permanent house should be raised 5 to 8 feet above grade (GRAFT, Design Guidelines 122).
- Allow for some layouts that lend to planning a space similar to the pre-existing structures common to the site, such as the Shotgun House. This will serve to maintain a sense of continuity for the residents and neighbourhood.
- Porches should be incorporated into the design to maintain a sense of continuity in the architectural vocabulary of the neighbourhood, as a vernacular use of passive climate control via ventilation and shading, as well as promoting a return to similar pre-disaster social patterns of the community.
- Consideration should be given to means of egress in the case of future disasters. GRAFT suggests a raised patio on the roof with an area to store emergency equipment for people to go to for safety during future floods (Design Guidelines 128).
- The Americans with Disabilities Act guidelines should be followed in the design of accessible option housing.
- Operable windows are a necessity to promote natural ventilation through the interior.
- Use Energy Star appliances, low flow showers, faucets and low flush toilets as well as incorporating a household recycling area, efficient choices of lighting and building envelope insulation to limit the carbon footprint of the house.

- Consider rainwater collection tanks, photovoltaic panels and a vacuum tube solar hot water collector (south facing roof plane) to further lower the carbon footprint of the house (McDonough, 112-14).
- Design elements like moveable walls and shelves should be incorporated to allow for user to change space as needed over time.

Chapter 5: Design Outcomes

The following chapter outlines the proposed design for an interim house that transitions into permanent housing for individuals who have survived a natural disaster. It is informed by the previous literature review and precedent chapters, and incorporates theories on dwelling, elements of home, and how we understand home through our orientation and identification with space. The element of choice and flexibility in the design is crucial to the psychological welfare of disaster survivors. This element of choice and flexibility is also important in allowing a person to dwell in the space, instilling a sense of home for that person through their constant modification or ‘building’ of the space.

5.1 Introduction

The proposed transitional house is intended for residents whose homes are destroyed beyond repair. It is intended to be a completely self-sustaining modular unit that will adapt to the user's needs and will grow with them through the recovery phase to permanent housing. It would use passive systems for power, water and sanitation. As these services return to the area, the house could be connected to them, or some form of hybrid between the two methods of delivery may be possible. As the community revives itself, people return to work and school and money flows through the community, the user of the transitional house could build additional rooms onto the unit, transforming the transitional unit into their permanent dwelling.

The unit would be placed on a strip foundation initially, as it is the most affordable of foundations. This foundation is comprised of strips of prefabricated concrete that run the length of all the loadbearing walls. It is a favourable choice for temporary foundations in the Lower Ninth Ward since the main soil type - Sharkey Clay - is very solid and dense. However, because of the risk of future hurricanes and flooding, the house, once hooked up to the utility grid and deemed a permanent residence, would have to be elevated above the base flood elevation (BFE). This could be by way of piles, a crawl space with points of entry and exit for flood water, or a first floor with entry and exit points for flood water that could only be used for parking and storage (Federal Emergency Management Agency, Chapter 5 87-107; Cooke, 151; ACORN Housing/University Partnership, 17; University of the West of England, 1).

The proposed transitional unit would be supplied by FEMA and the user would

be responsible for the cost of any future additions as well as for elevating the house above the base flood elevation. In this hypothetical proposal, FEMA could have a certain number of the wall, floor and roof systems prebuilt and stored in a warehouse. This way, when houses are ordered, the particular parts that apply to each custom order can be pulled from the warehouse and inserted. This could potentially cut down on the user's wait time for the end product. Because of the element of standardization necessary to execute the production of the units, there would have to be some compromise in the degree of flexibility in the design. An example of this is the use of built-in storage in the bedrooms. This was necessary so there could be a set amount of standardized plans and rooms pre-built and ready to go. However, having multiple combinations of units to choose from, as well as choices in room finishes and interior elements, still offers an ample amount of flexibility for the user.

An online database is proposed as the method for offering the selection of housing options. This would include the floorplans, room options, furniture, exterior and interior finishes, and millwork options. A survey of questions to help eliminate choices, leaving only selections relevant to the individual, would be used. It would include questions about the individual user's values and preferences, as well as how many people live with them, their ages and so on. Designers could be made available to give consultations and help with the design. Then, in the future, the user would be able to order add-ons and replacement interior elements such as furniture, millwork and finishes from the same website.

Through the act of ordering the initial layout, the add-on spaces, interior materials and finishes, as well as modular flexible interior details, the transitional house would

become a home for the user. This is largely due to the user's input throughout the process. Even though the user would not physically build the home, they would play a major role in the design of the house. Also, the design would allow them to appropriate the space through modifying and customizing it to their changing individual needs over time. Because of these acts of determining the initial design and physically manipulating the space over time as daily routines are established, the inhabitant can truly dwell in the space and thus come to think of it as home.

Everyone was hit by the same storm, but their living arrangements and personal needs before Hurricane Katrina were different. To offer one standardised design solution, like a travel trailer, is inadequate. The transitional house that this project proposes accounts for the different needs of the various survivors of a disaster. It is a standardised solution for the large number of survivors in need of housing, with adaptability and flexibility.

5.2 Concept

The concept of a house made to order is not new. There are many historical examples that show the success of catalogues of homes made to order. One of the most successful examples is the Sears house.

At the end of the First World War there was a boom in the U.S. population. Because of this there was a need for well-constructed, affordable housing that could be built quickly. The Sears Roebuck Company, which was well established as a catalogue mail order company, added housing to their available line of products. They released a

catalogue of houses called the *Book of Modern Homes and Building Plans*. It contained twenty-two house designs that ranged in price from \$650 to \$2,500 US. The package came complete with a detailed manual and over 30,000 labelled pieces that were needed to complete the job including pre-cut lumber, nails, millwork, building paper, paint and varnish, shingles, windows and so on, and were delivered by rail (two boxcars per house). It was estimated that forty percent of labour cost was saved by buying a house in kit form. Between 1908 and 1940, approximately one hundred thousand Sears homes, which included four hundred and fifty different models, were sold and built. The catalogue order approach for housing was a success, although Sears did not account for economic recession and the dwindling need for housing after 1924. The home construction division closed at that time (Davies, 51-53; Gallagher, 38; Friedman, 152-53; Carper, 9).

I had originally planned on employing a ‘kit of parts’ concept for the design, where all the lumber, wall systems and so on would be shipped and built on-site like the Sears house. However, on exploring the different construction methods available for prefabricated housing, I found that modular housing was cheaper, more structurally sound and can be ready for occupation the same day it is placed on site. For all of these reasons, I chose to use modular housing over a panelized system of construction. However, I maintained the concept of the ‘kit of parts.’ Instead of individual wall panels, pre-cut lumber, and so on, the residents are delivered a completed room or building that can be connected to other rooms and buildings. These units still act like a ‘kit of parts,’ but on a larger scale. The concept of the ‘kit of parts’ also occurs in the planning stage, where the residents can choose the ‘parts’ (rooms, finishes, and so) but have them constructed off-site and delivered ready to live in.

5.3 Sectional Units, Add-ons, Room Units and Building Forms

The transitional house is flexible in its layout in order to accommodate a number of different types of users. Users have differing spatial needs, based on both psychological and social circumstances and a full range of family configurations. Some of the psychological and social needs that informed the design include differing desired levels of privacy versus social interaction, preference for open versus closed plans as well as differing preferred household activities. These needs affect the layout as well as the options in room size that are based on a hierarchy of activity zones within the house. As an example, if a person is more introverted, they could choose to have a larger bedroom (private space) and a smaller living space. This would be reversed if a user preferred to be around people more than having time to themselves.

The basic guidelines followed in developing the size of the sectional housing units and add-on units are based upon the average dimensions of a New Orleans lot size (30' x 120') and the typical dimensions of manufactured sectional houses (12' x 38-56') that are informed by shipping standards. Because of easements required by the building code, the largest a structure could be on a typical New Orleans lot is 24' x 80'. To stay within the shipping requirements of the prefabricated sections, the final dimensions of one sectional unit is 12'x 40' and up to four of them can be connected together on a typical lot in New Orleans. Of course, more could be added by stacking them vertically.

Each unit is 480 square feet. The proposed guideline for FEMA to use to decide how many units a resident receives is based on the number of occupants. The guidelines are as follows:

- 1-3 people = 1 unit
- 4-6 people = 2 units
- 7-10 people = 3 units
- 11+ people = 4 units

Residents who need an accessible unit would receive one extra unit.

The sleeping quarters and bathrooms are pre-planned in the sectional unit options, leaving the rest of the plan open for the user to decide where they would situate the kitchen, dining and living areas. This allows them to choose adjacencies based on their preferences, such as allowing the main entrance to enter into the kitchen instead of the living space. This way, they can also choose the size of different spaces based on their individual needs and preferred activities. For example, if they tend to entertain, they could choose the unit that has a smaller bedroom and a larger living room.



Figure 86: Sectional Unit Options. Image by Author.

The add-on unit options are developed with the future needs of the user in mind. For example, users may want a larger living area, cooking area or more bedrooms. As well, the add-on units are meant to add to living space for a higher number of occupants.

The initial sectional unit will have a maximum of two bedrooms. If there are more than three occupants, they would want to select an add-on with additional bedrooms as well as additional living space.



Figure 87: Add-on Unit Options. Image by Author.

A variety of pre-planned room units in different sizes with a variety of layouts would be provided for selection. The sizes of the room units range from 6-14' x 12'. These particular sizes were chosen so that a variety of possible groupings of these room units could fit within the footprint of one 12' x 40' unit when placed in succession. For example, a user could group together a 10' x 12' bedroom, 8' x 12' bathroom, 8' x 12' kitchen and 14' x 12' living/dining area to make up one 40' x 12' sectional unit.

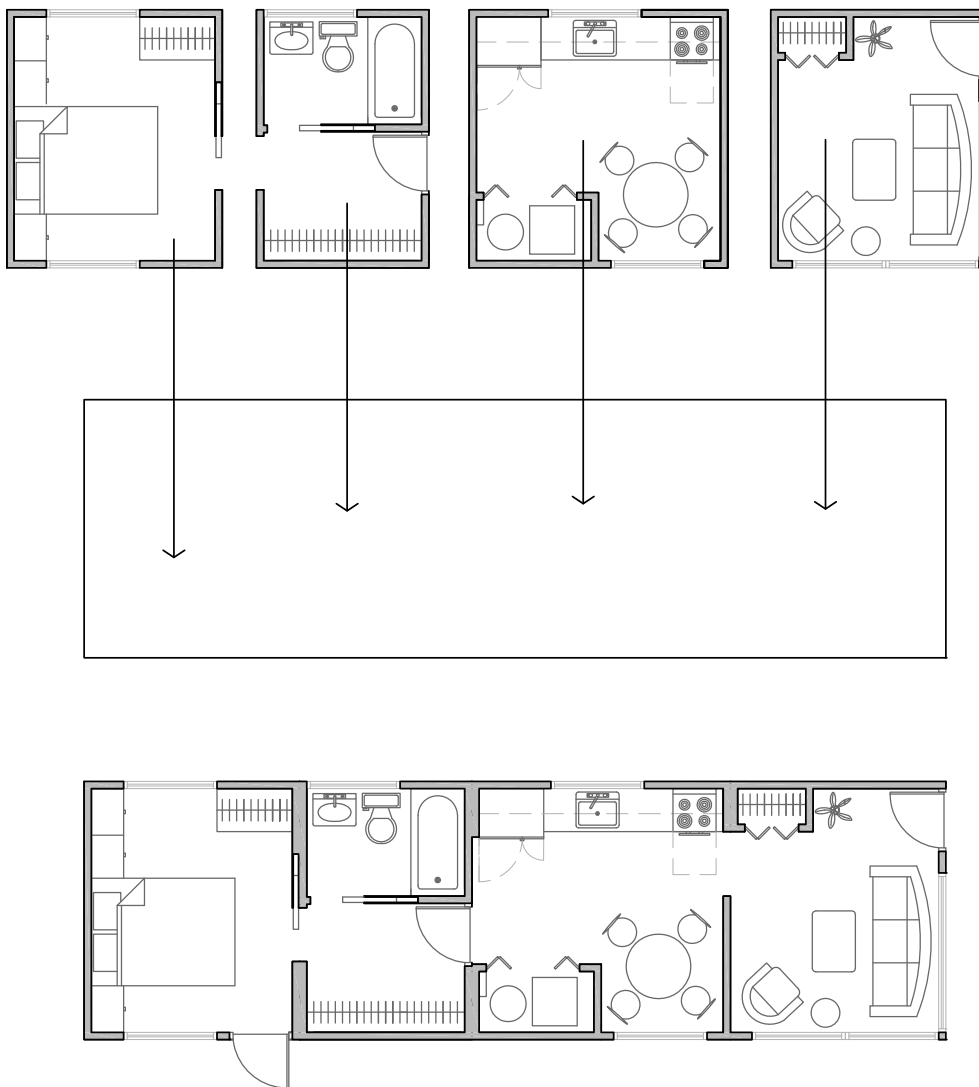
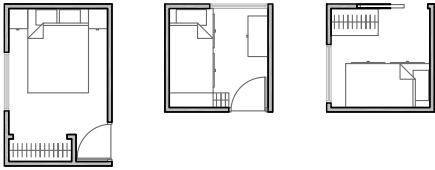


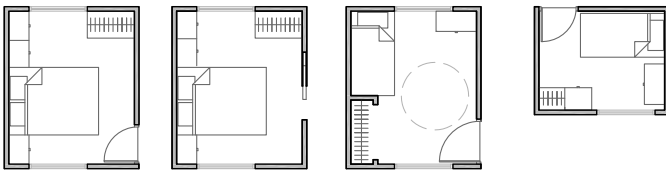
Figure 88: Example of Building a Floor Plan. Image by Author.

There is a variety of possible layouts of living rooms, as well as different possible kitchen layouts: one-wall, u-shaped, island, g-shaped, and l-shaped. The dining areas provided consist of seating arrangements with the necessary circulation space outlined around them. There are also a selection of bedrooms, bathrooms, mechanical rooms, storage rooms, as well as sunrooms and porches available in different sizes to choose from.

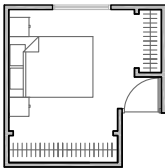
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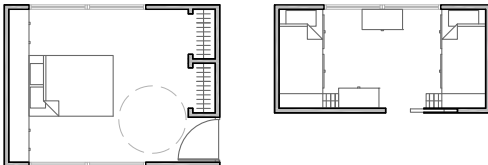
10'



12'



14'



16'

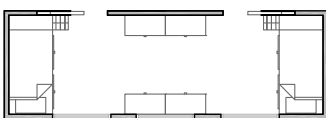
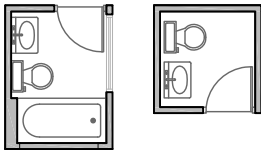
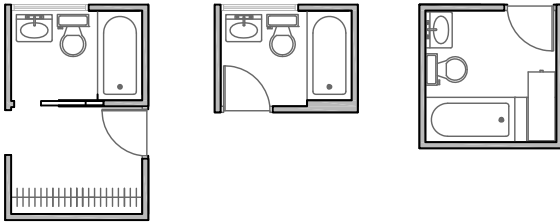


Figure 89: Sleep Units. Image by Author.

6'



8'



10'

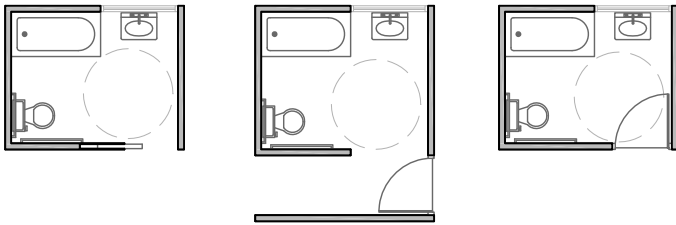
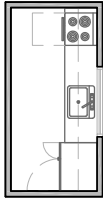
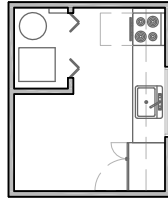
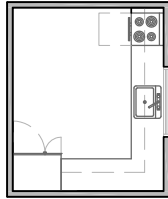
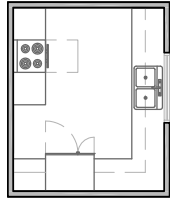
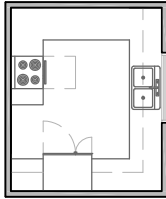


Figure 90: Bathroom Units. Image by Author.

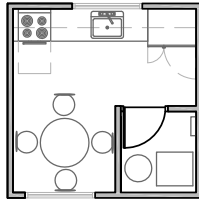
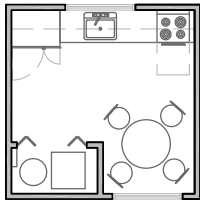
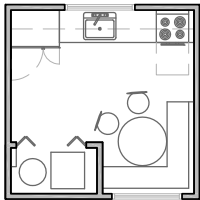
6'



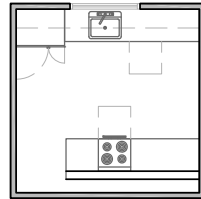
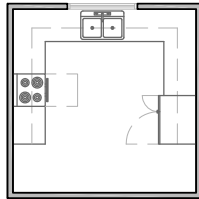
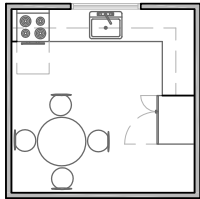
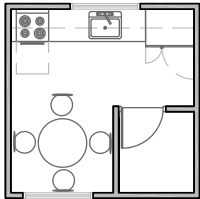
8'



10'



12'



14'

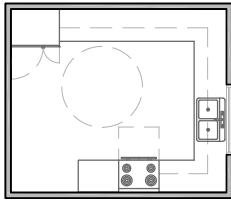
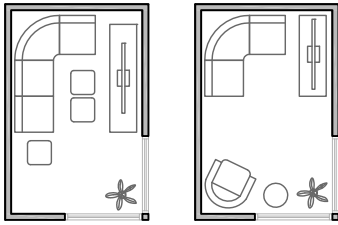
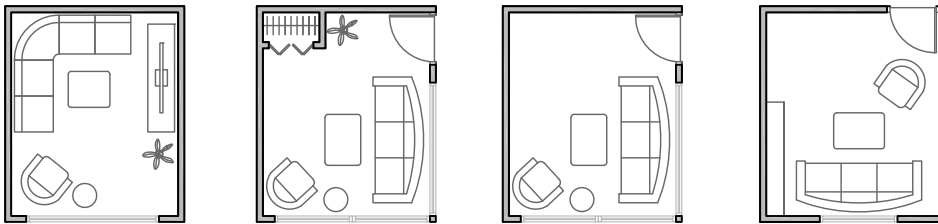


Figure 91: Kitchen Units. Image by Author.

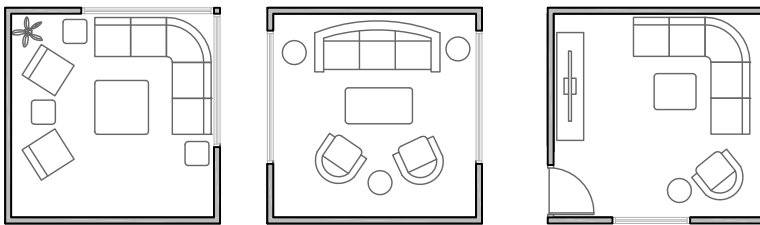
8'



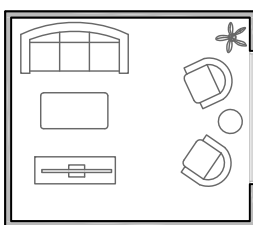
10'



12'



14'



16'

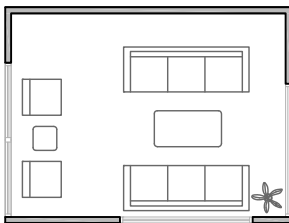
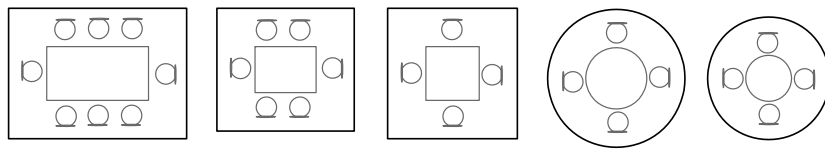
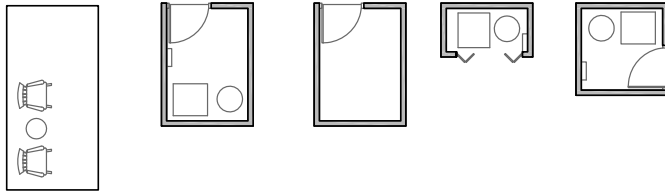


Figure 92: Living Units. Image by Author.

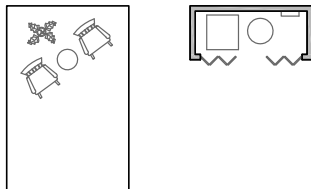
DINING (with circulation)



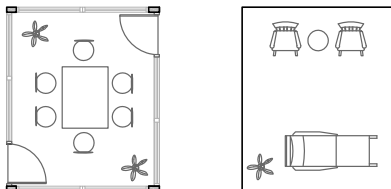
6'



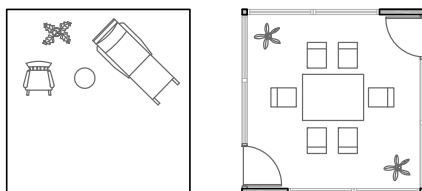
8'



10'



12'



14'

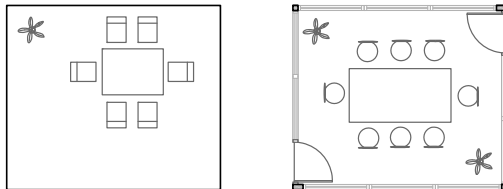


Figure 93: Additional Unit Options. Image by Author.

Both the sectional units and room units, in plan, can be flipped on their horizontal or vertical axes and rotated in order to accommodate preferred views, entry points, and to achieve the desired floor plan within a combination of multiple units.

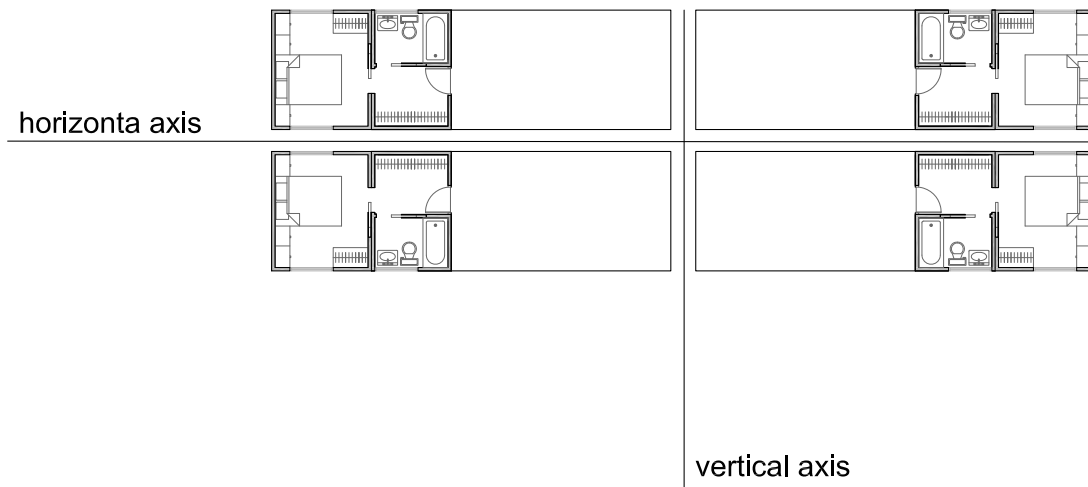


Figure 94: Example of Sectional Unit Flipped on Horizontal & Vertical Axes. Image by Author.

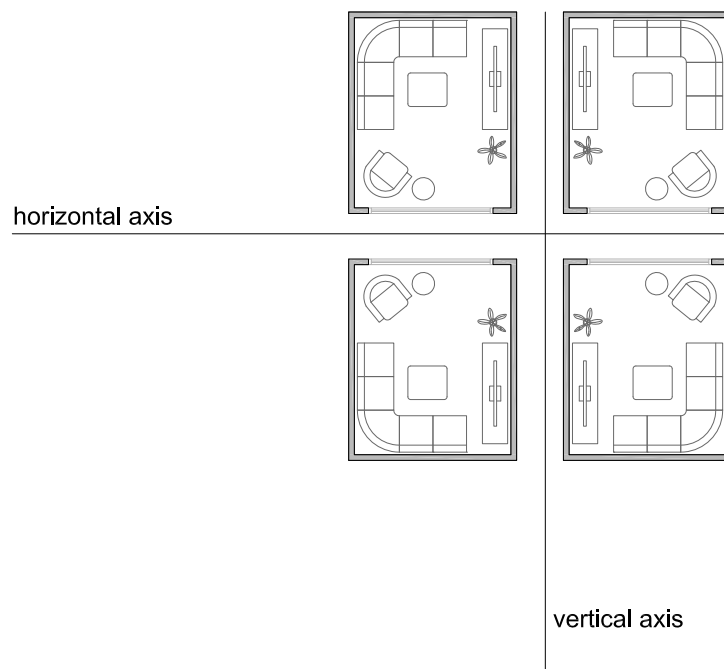


Figure 95: Example of Room Unit Flipped on Horizontal & Vertical Axes. Image by Author.

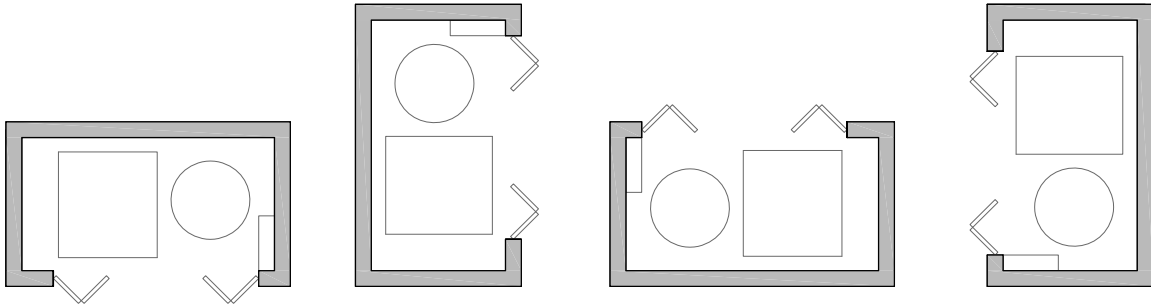


Figure 96: Example of Room Unit Rotated in 90 Degree Increments. Image by Author.

In making their choice, a selection of plan shape options would be made available to the user to help them visualize the ways the units could be grouped together. These plan shapes can also be used to place the individual room units, if the user wants more flexibility in choosing the layout of their house. Instead of having the partially pre-planned sectional units grouped together, they could choose each individual room unit and place it where they like, within the plan shape of their choice, to build their own floor plan. Below is a selection of possible plan shapes based on different groupings of sectional housing units.

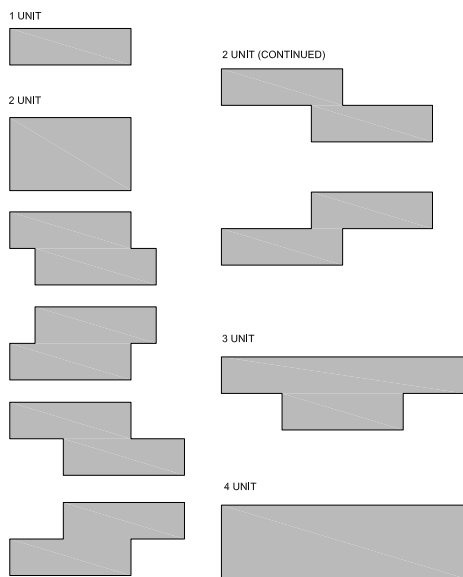


Figure 97: Plan Shape Options. Image by Author.

The design of the units allows for their use on sites other than New Orleans. Although no more than four sectional units can be grouped together on a lot in New Orleans, more sectional units or room units could be added on in a variety of ways on different sites with different allowable building sizes. As well, different room options – ones that are disaster specific, such as basement safe rooms for tornadoes - would be available for disasters inherent to sites other than New Orleans.

The user would, money permitting, be able to order additional sectional units or room units to build onto the transitional house to create their permanent home. Or, they could choose to make the transitional house their permanent home if they are satisfied with it. In the case of New Orleans specifically, as noted above, users would still have to raise the unit above the base flood elevation in order to use the house as their permanent home.

5.4 Transitional House Examples

What follows are four examples of transitional houses that were designed through the process described above. The examples include an accessible two-unit option, a three-unit option and a four-unit option, all using the pre-planned sectional units and add-ons. The final example is a single unit that was planned with room units, as opposed to the pre-planned sectional units, to illustrate how using the rooms as building blocks can free up the plan and allow more flexibility and choice in the design. This final example has also been fully developed into a permanent structure to show one of many possible design solutions available through the addition of more room units.

5.4.1 Sectional Unit and Add-on Examples

The following three examples are options using the pre-planned sectional units and add-on units to build the floorplans of the houses.

5.4.1.1 Two-Unit Accessible Option

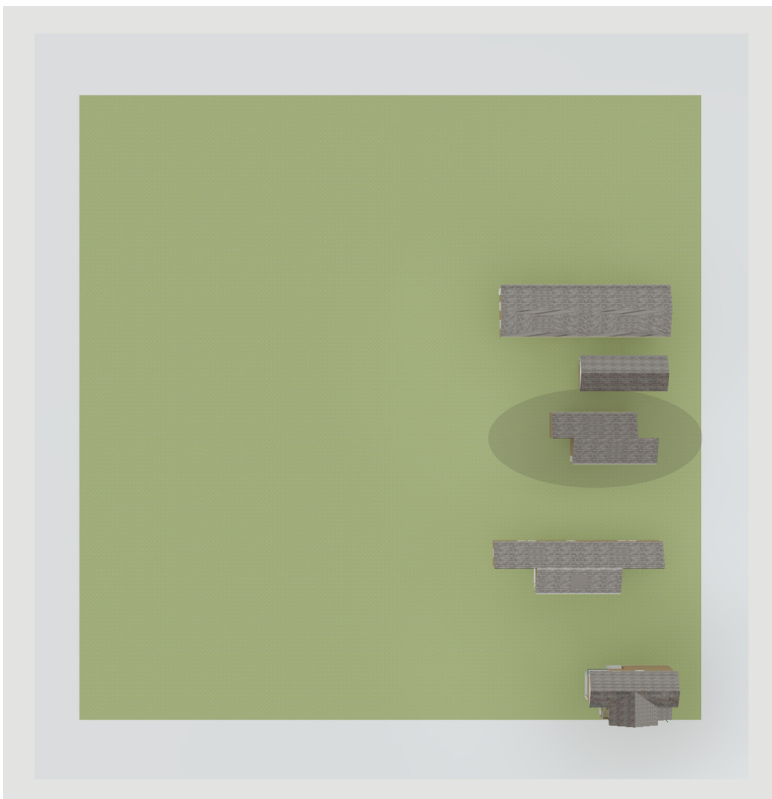


Figure 98: 2 Unit Site. Image by Author.



Figure 99: 2 Unit Exterior. Image by Author.

This two-unit option is designed for one hypothetical user who is in need of an accessibly designed space. Because of this, they are allotted an additional unit for the extra space needed. This design supports a person who is social and outgoing, and enjoys entertaining. Owing to this, less square footage was allotted for the private spaces (bedroom and bathroom) and more of the footprint of the house is used for social activity zones.

This particular option combines the accessible bedroom unit option Number 10a from the list of sectional house unit options, with a 6'-0" mechanical room unit and the 14'-0" accessible kitchen room unit placed in the flexible part of its plan. It is then grouped together with the add-on option Number 13 from the add-ons list, which includes a porch in its floorplan. Two 10'-0" living room units are placed into the plan, including a den with television and a living room off of the main entrance. The remaining 8'-0" of space between these two spaces has a four seat dining area placed in it, and the rest

is left open for additional circulation. The decision of where the walls will be left open between the sectional units and room units within the plan is left up to the user at the time of planning the layout of the house. This is one instance where a consultation with a designer would be an important step in the overall process.

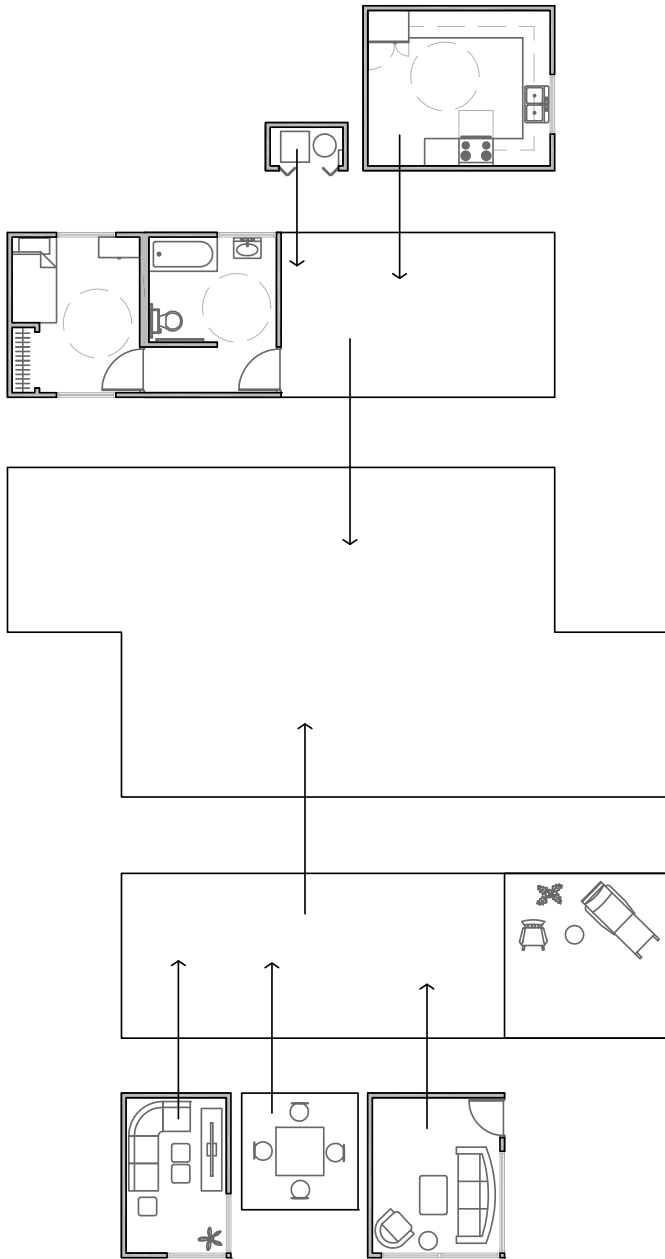


Figure 100: Building the 2 Unit Option. Image by Author.

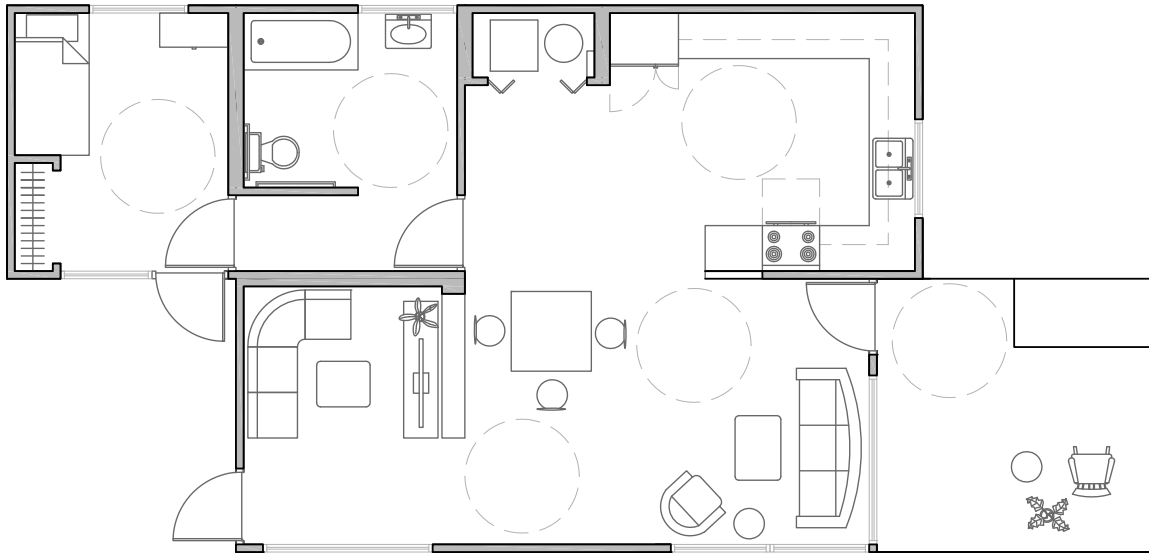


Figure 101: 2 Unit Floorplan. Image by Author.



Figure 102: Axonometric Drawing of 2 Unit Option. Image by Author.

As specified earlier, social connection is important to this user. The porch, therefore, is an important feature as it allows them to maintain a social connection with

their community. Also, looking at important elements of a home, the porch blends the line between interior and exterior space and therefore indicates a sense of being allowed, or welcomed further, into the interior space of the home.



Figure 103: Front Porch. Image by Author.

Once inside, the front entrance opens into an open concept main living area that includes entertaining and dining areas, again inviting people further into the space. The living space has numerous windows to gather an abundance of natural light into the major communal activity zones. This also offers views of the neighbourhood, providing a visual connection between the interior and exterior.



Figure 104: View on Entry. Image by Author.



Figure 105: Living Area. Image by Author.

The kitchen is very close to the main entrance with a lowered countertop connecting the two spaces. This makes it possible for someone to enter through the front door with groceries and place them directly on the counter. The kitchen itself is fully accessible with room under the counters for toe clearance, and room under the sink and stove for knee clearance. The counters are lowered to 34” from the standard 36”. For

easier reach, the space between the counters and the cabinets above them is reduced to 16” from the standard 18”.



Figure 106: Entrance Close to Kitchen. Image by Author.



Figure 107: Accessible Kitchen. Image by Author.

Further into the house, there is a semi-private den that has some separation from the main area via a shelving unit that partially obscures the view into the den. This allows for a bit of a retreat from the main activity in the central area, but is also a place people can gather to watch television together. The bedroom and bathroom are completely closed off to the main area visually and are tucked away in a corner opposite the main entrance. This signifies that it is a much more private area compared to the rest of the house.



Figure 108: Den Off of Main Area. Image by Author.

5.4.1.2 Three-Unit Option

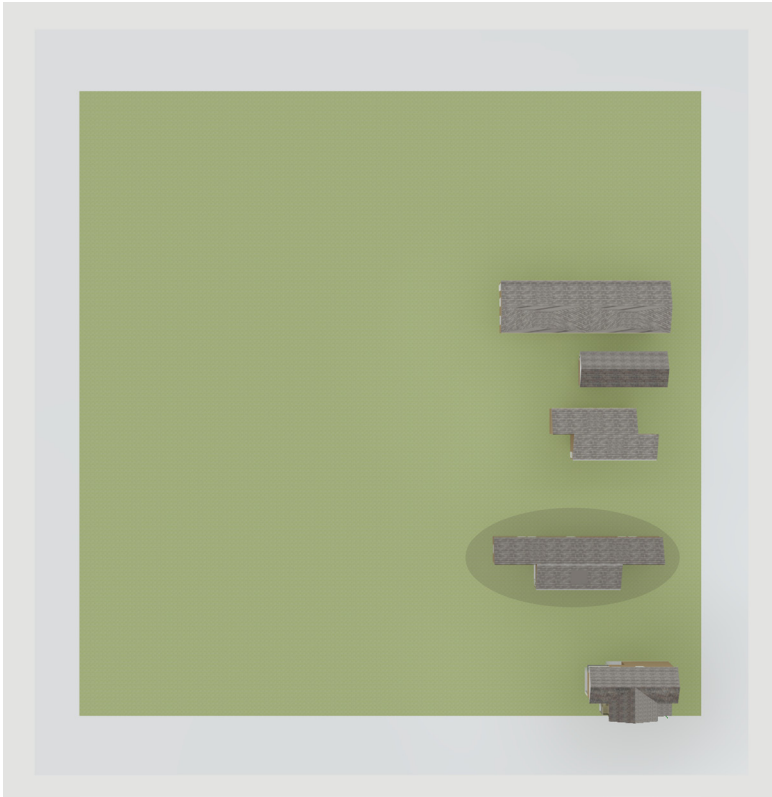


Figure 109: 3 Unit Site. Image by Author.



Figure 110: 3 Unit Exterior. Image by Author.

This three-unit option is designed for two hypothetical families that are related and lived together pre-disaster. There are four adults and four children. They desire some privacy and separation for their sleeping quarters but wish to share all of the common spaces. Therefore, the sleeping quarters of each individual family are situated in two different wings of the house, separated by the central shared living area. As well, both families have their own bathrooms situated next to their sleeping quarters.

This particular transitional house uses two of the Number 20 add-on units. There is a 6'-0" mechanical room unit that is banked up against the bathroom in the left add-on unit. The remaining space of the left add-on unit contains a dining set that seats four people. The add-on unit to the right contains an 8'-0" broken u-shaped kitchen. The final unit is Number 19 from the add-on unit list and it contains a sunroom. The rest of the house contains additional living space with a 14'-0" living room and a 10'-0" den room unit placed in it.

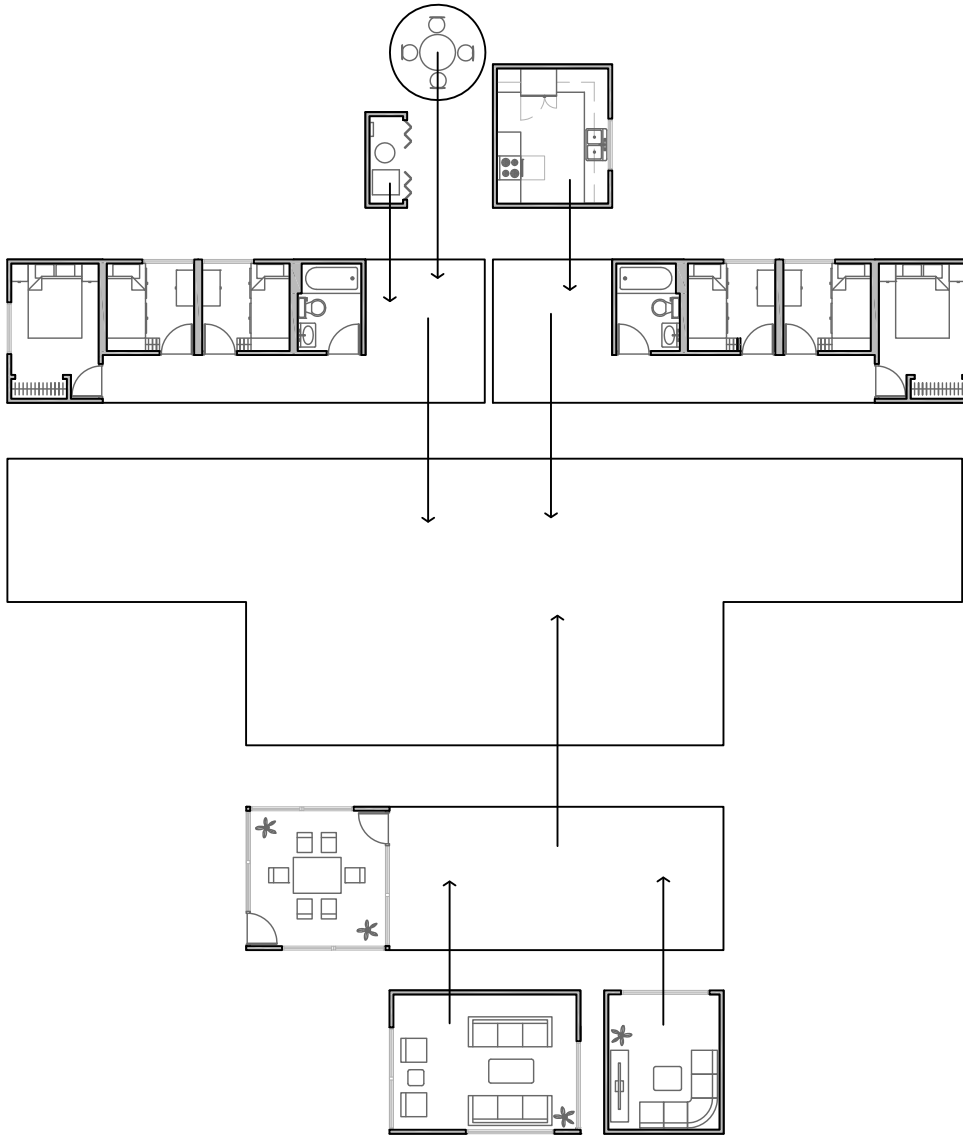


Figure 111: Building the 3 Unit Option. Image by Author.

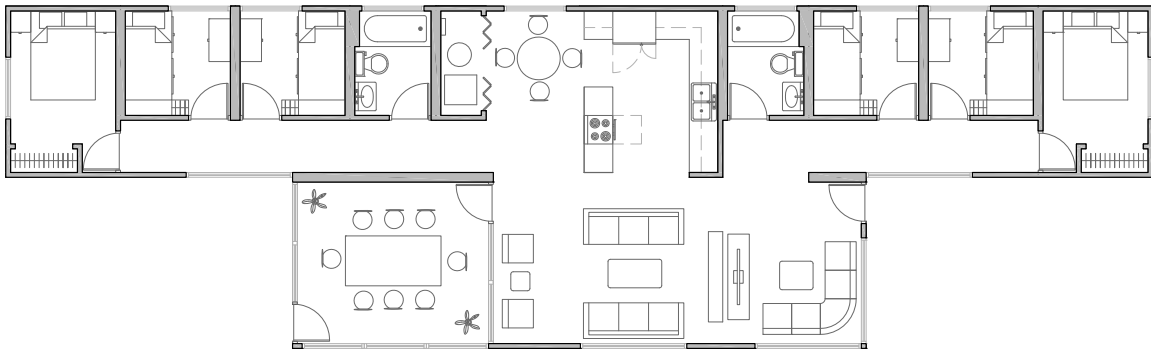


Figure 112: 3 Unit Floorplan. Image by Author.

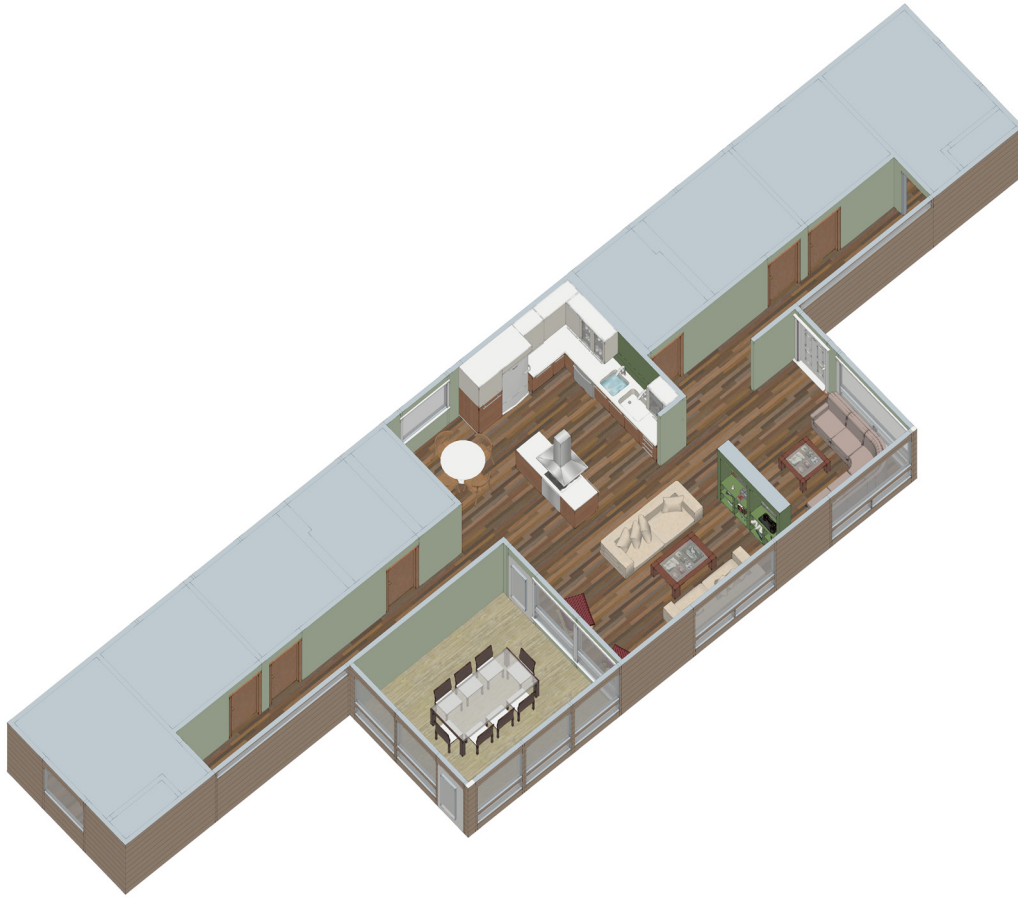


Figure 113: Axonometric Drawing of 3 Unit Option. Image by Author.

As stated previously, a desire for some privacy in the individual bedrooms is required, while a connection between those more private areas and a communal space, where the families could come together for all other activities, is desired. Within the communal space, there are multiple areas where subgroups of the larger family group can retreat if they want some separation: the den at the front of the house, the sunroom and the individual bedrooms. The central living space is open to the kitchen so that cooking and conversation or other shared activities can take place concurrently. There is a smaller dining area immediately off of the kitchen for quick meals for smaller subgroups.

Additionally, there is a dining table that seats eight in the sunroom to be used when both families wish to eat together. There are ample windows in the major activity areas that provide natural light, and that also serve to increase the space visually, connecting it to the exterior. The sunroom, like the porch, acts as an in between space, blurring the boundaries between inside and outside, and reinforcing a sense of connection to the site.



Figure 114: View from Front Entrance. Image by Author.



Figure 115: Kitchen with Smaller Dining Area and Central Living Area. Image by Author.



Figure 116: Sunroom with Larger Dining Set. Image by Author.

5.4.1.3 Four-Unit Option

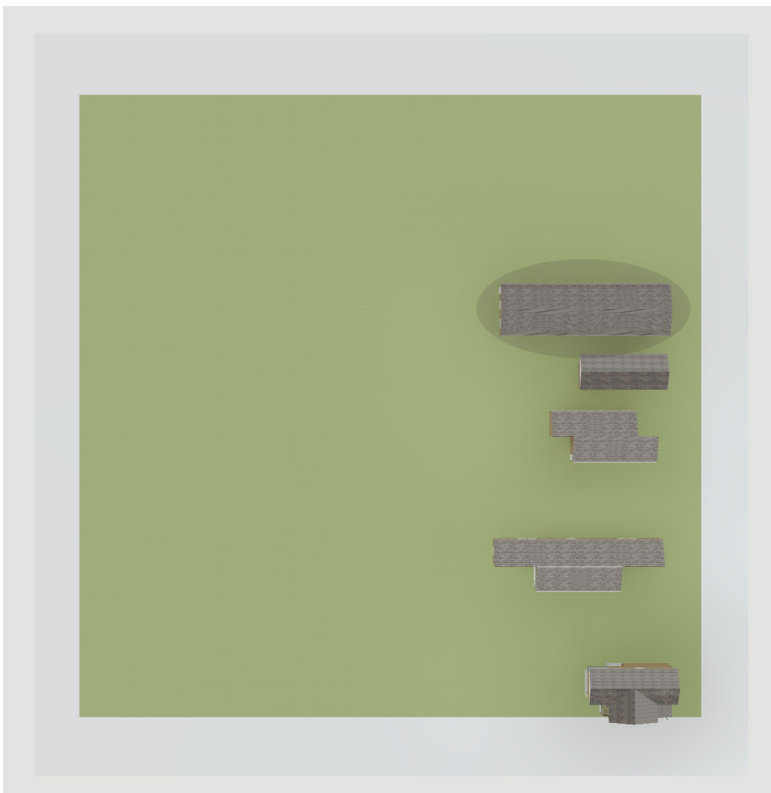


Figure 117: 4 Unit Site. Image by Author.



Figure 118: 4 Unit Exterior. Image by Author.

The four-unit option is for two hypothetical families (11 people in total) who, like the three-unit option above, wish to live together. However, these particular families want a more distinct separation between their living spaces. They still wish to have a shared common space, but would like more separation between their shared common space and their individual living quarters.

This option is comprised of two of the Number 15 and Number 20 add-on options. There is a Number 15 unit with a Number 20 unit beneath it in plan. The other Number 15 and 20 units are flipped on their vertical axes so that they form a mirror image of the other two. Each of the Number 15 units on the top have a 10'-0" living room unit in them as well a dining set that seats six people. The remaining space in the two units comprises the shared common space that consists of a 10'-0" living room unit and a dining set that seats eight people. The Number 20 units below each have a mechanical room unit rotated and banked against the bathroom and a 6'-0" kitchen room unit.

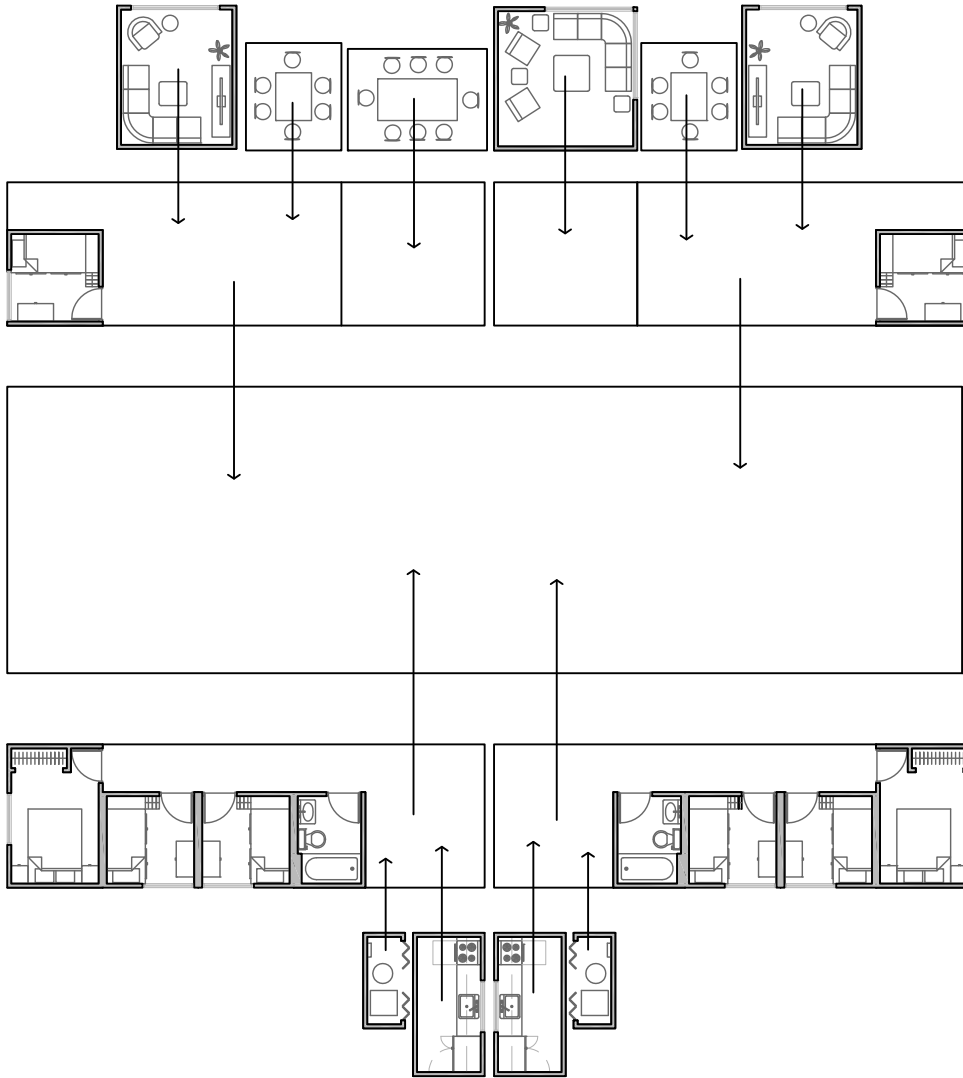


Figure 119: Building the 4 Unit Option. Image by Author.

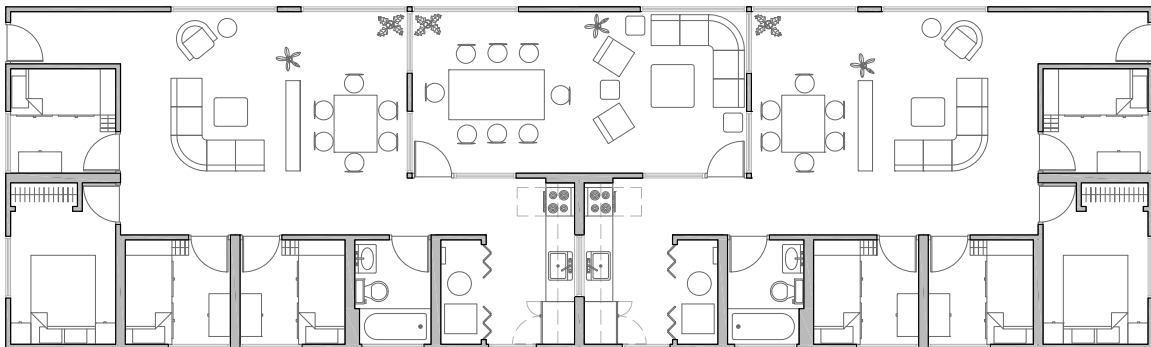


Figure 120: 4 Unit Floorplan. Image by Author.

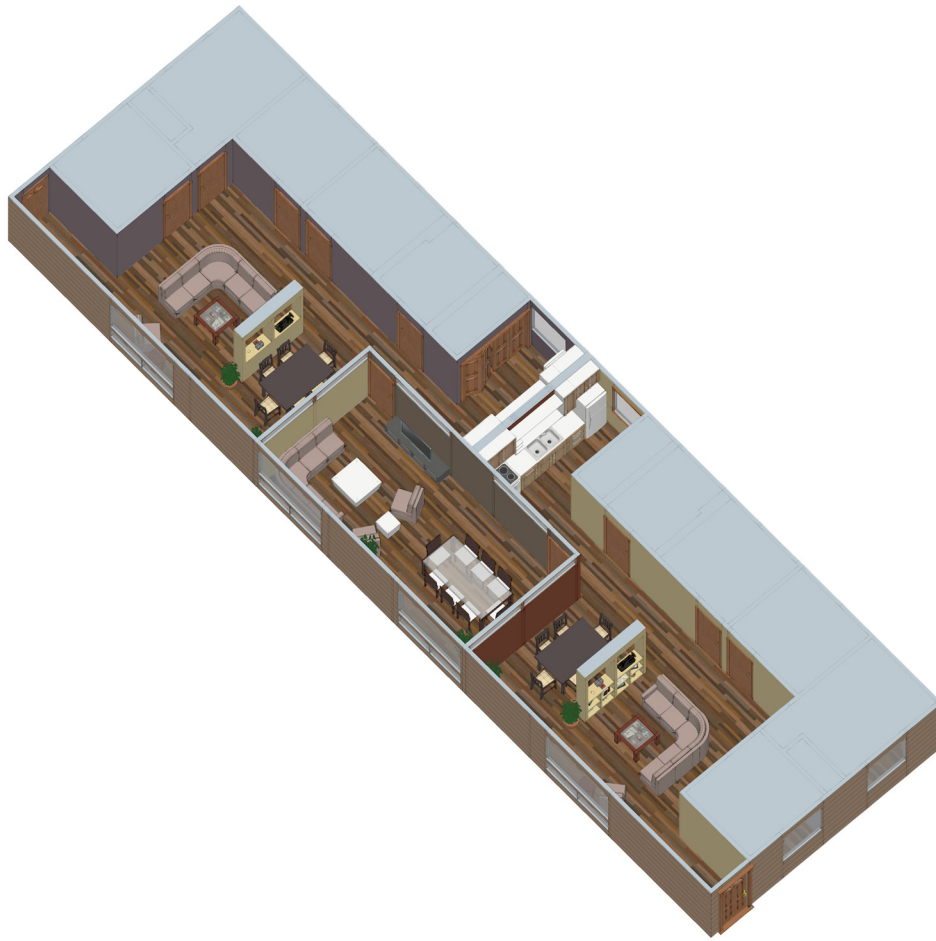


Figure 121: Axonometric Drawing of 4 Unit Option. Image by Author.

Each private unit has its own entrance, living, dining and bathroom. They are completely separate spaces except that they both enter onto a shared central common space where the families can gather when they want to spend time or eat together. The concept of public (shared) space and private (retreat) space occurs on multiple levels in this house, radiating out from its centre. The central shared space is the most public space; the one with the least amount of privacy. The individual can retreat to their living spaces which are semi-private (shared with their individual family members). If they want complete privacy, they can retreat to their bedrooms and close the door. The user

is thus able to control how much privacy and how much interaction with others they experience.



Figure 122: Shared Central Common Space. Image by Author.



Figure 123: Private Living Quarters with Bedrooms off of Main Area. Image by Author.

The physical barriers (walls) between the private homes and the shared common space are punctuated with clerestory windows that provide some connection between the spaces, but still maintain privacy because of their height. Also, there is an operable window between the kitchens. When the families choose to cook and eat together, the

cooking surface area would essentially be doubled. They would be able to converse while cooking and pass items back and forth through the window. When the window is closed, and more privacy is wanted, there is a curtain that can be closed to attain visual privacy.



Figure 124: Clearstory Windows in Shared Central Common Space. Image by Author.



Figure 125: Operable Window between Kitchens in Private Living Units with Privacy Curtain. Image by Author.

5.4.2 Room Unit Example

The following example uses the room units, instead of the pre-planned sectional units, to build the floorplan. It is made into the permanent house by adding on additional room units in the second phase.

5.4.2.1 Transitional House

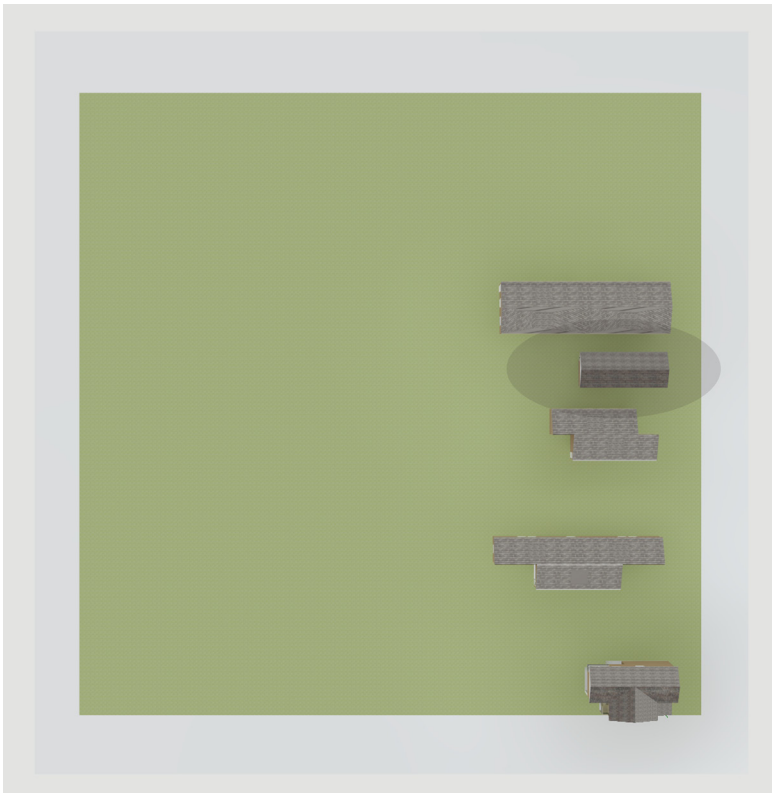


Figure 126: Transitional House Site. Image by Author.



Figure 127: Transitional House Exterior. Image by Author.



Figure 128: Transitional House Exterior Front. Image by Author.

The one-unit transitional house was planned by piecing together individual room units as opposed to the pre-planned sectional units and add-ons. It was designed for a hypothetical couple. They were allowed a 12' x 40' unit, or the equivalent thereof in room units. The plan consists of a 10' x 12' bedroom, 8' x 12' bathroom/pass through storage unit (they opted to use that space as a personal office instead of extra storage), 12' x 12' kitchen/dining combo unit, and a 10' x 12' living room unit. Instead of lining up all of

the individual room units to create a 12' x 40' footprint, the bedroom and living unit are shifted over three feet in order to create outdoor covered spaces that increase the living space. These include a porch off of the bedroom and another off of the kitchen. As well, the covered space at the front of the house - created by shifting the living room unit - becomes a logical location for the mechanical room unit so that it does not take away from the square footage of the living space. This also creates a well-situated entrance to the house. With the covered exterior spaces, the final footprint of the transitional house is 15' x 40'.

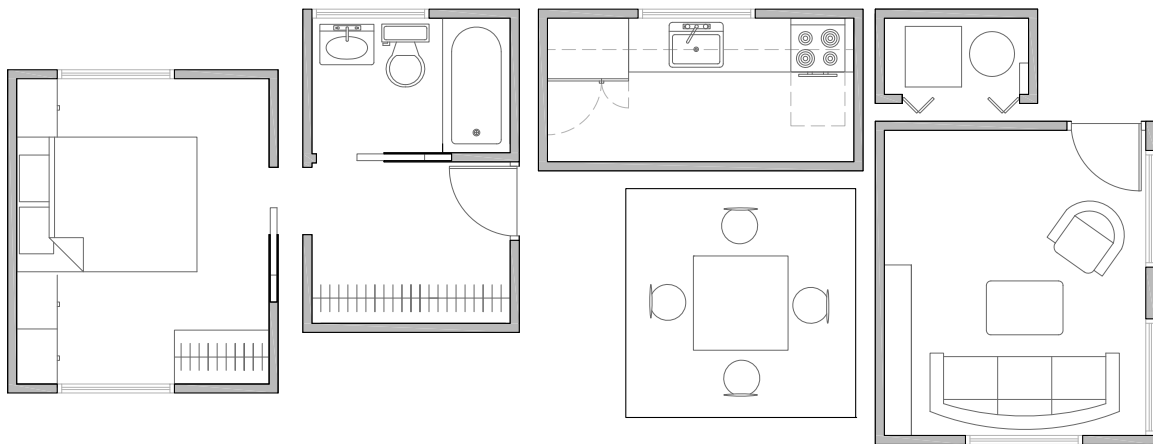


Figure 129: Building the Transitional House with Room Units. Image by Author.

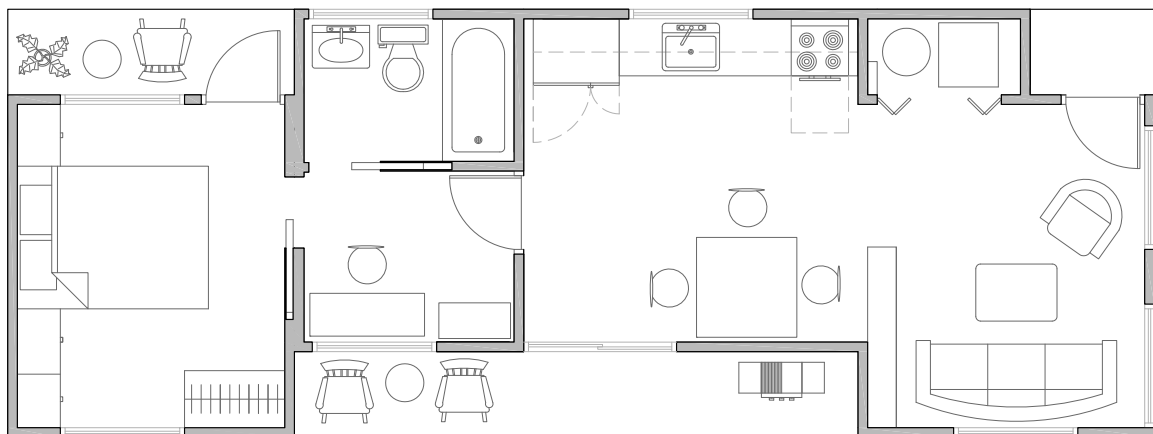


Figure 130: Transitional House Floorplan. Image by Author.



Figure 131: Axonometric Drawing of Transitional House. Image by Author.



Figure 132: Axonometric Drawing of Transitional House. Image by Author.

The layout of this transitional house is indicative of the Shotgun style native to New Orleans. All of the openings, running the length of the house, are lined up in order to allow for proper ventilation. Also running the length of the house are windows directly across from one another to achieve cross-ventilation. Both of these design tactics are traditionally used in the Shotgun style. Another traditional element of the Shotgun style house is the use of covered porches for cool shady places to escape the heat. However, the porches also serve as an extension of the interior living space, increasing the footprint of the house. As explored in the LIFE House precedent, porches are also an element that helps create a sense of home because they act as an in between space from exterior to interior. These in-between places allow a person to watch or connect with the world outside from a vantage point that is deemed a safe place of retreat. This idea of connecting with the exterior world from the safety of the centre of one's universe - in other words, home - from these in-between spaces, reflects Heidegger's theory of dwelling. Being connected to the site and the world around them allows the inhabitant to understand their place in the universe and, therefore, to dwell.



Figure 133 & 134: Cross Ventilation between Bathroom and Office. Images by Author.



Figure 135 & 136: Cross Ventilation between Bedroom Windows. Images by Author.



Figures 137 & 138: Porch Off of Kitchen. Images by Author.



Figures 139 & 140: Porch Off of Bedroom. Images by Author.

Multiple windows in the main living area are used to allow natural light to enter the spaces, and to increase visual connections to the site. Both of these elements are patterns important to creating a sense of home. Another element that helps relay a sense of home in a space is the use of varying ceiling heights, as recommended by Jacobson, Silverstein and Winslow. In the main living area, the ceilings are 9'-0" above the finished floor, whereas the ceilings in the more private areas (bedroom, bathroom and

office space) are dropped down to 8'-0" above the finished floor. This evokes a sense of intimacy and human scale in those spaces. The differing ceiling heights also create a sense of retreat from the main living area when one leaves and arrival when one enters.



Figure 141: View from Entrance of Main Living Area. Image by Author.



Figure 142: View of Kitchen from Living Room. Image by Author.



Figure 143: View of Dining and Living Areas from Kitchen. Image by Author.

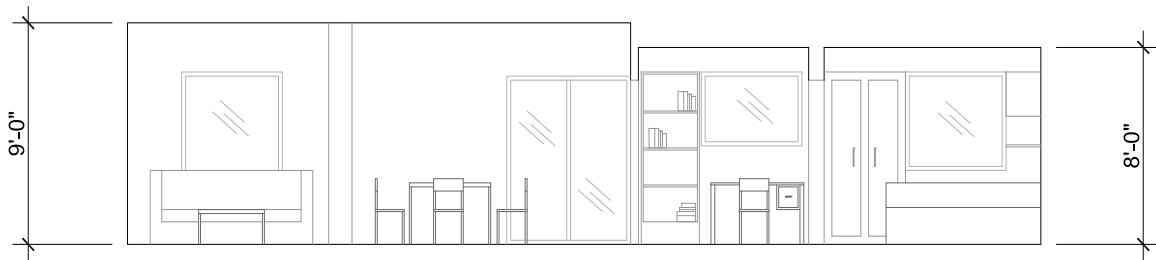


Figure 144: Ceiling Height Difference in Common Area and Private Areas. Image by Author.



Figure 145: Rendered Elevation Illustrating Ceiling Height Difference between Common Area and Private Areas. Image by Author.

5.4.2.2 Permanent House

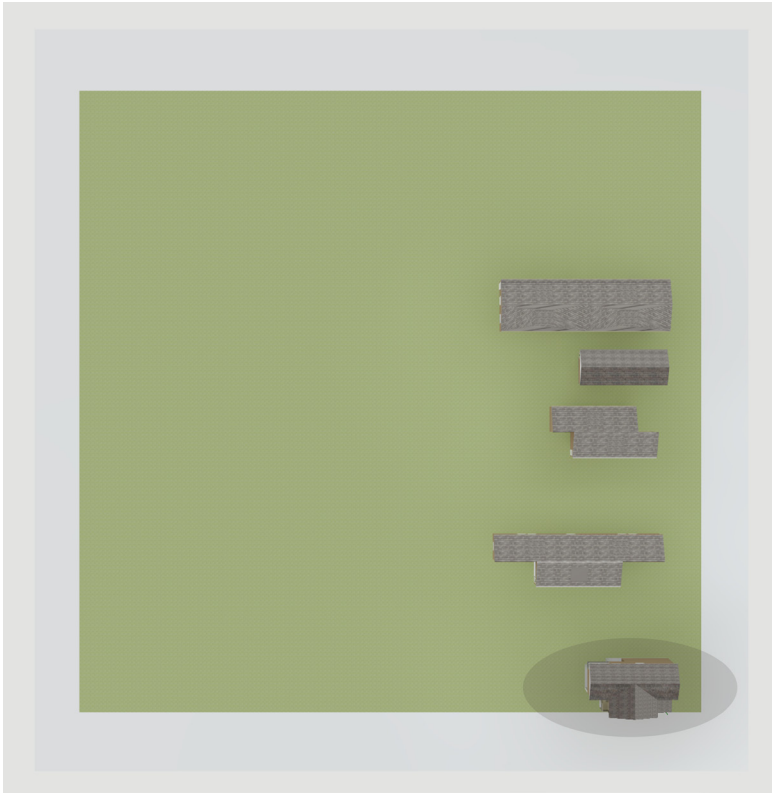


Figure 146: Permanent House Site. Image by Author.



Figure 147: Permanent House Front Exterior Elevation. Image by Author.



Figure 148: Permanent House Side Exterior Elevation. Image by Author.



Figure 149: Permanent House Back Exterior Elevation. Image by Author.



Figure 150: Permanent House Side Exterior Elevation. Image by Author.

In the final outcome of the permanent structure, the needs of the user have changed. They now have a child and so require a second room and additional living space. As noted previously, according to the building code, the permanent structure needs to be elevated above the base flood elevation. For these reasons, the first floor of the transitional house has become the second floor of the permanent structure. An additional 8' x 8' bedroom is added for the child, and an additional 12' x 12' living area is added to increase the shared living space.

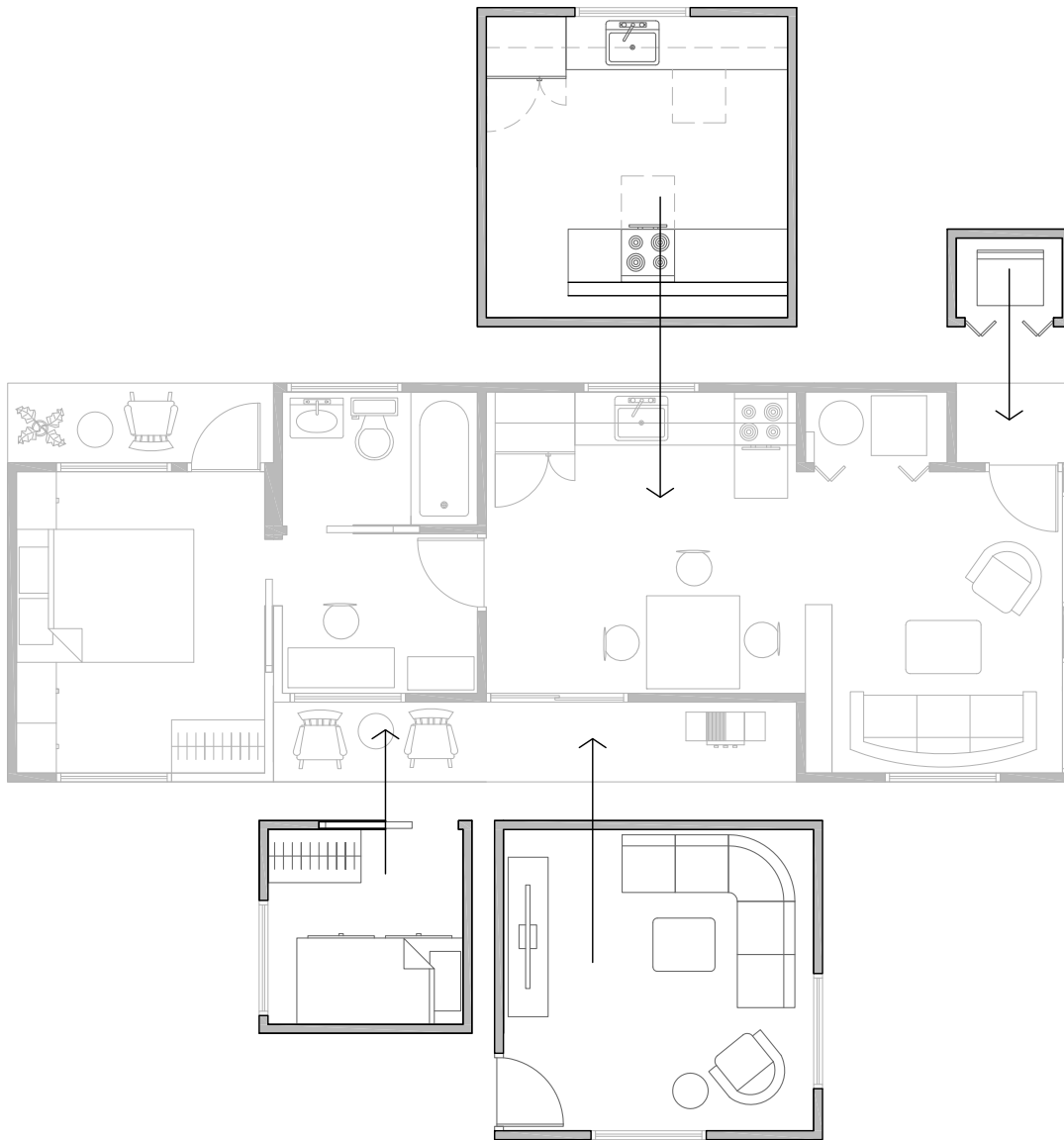


Figure 151: Room Units Added to Transform Transitional House to Second Floor of Permanent House. Image by Author.

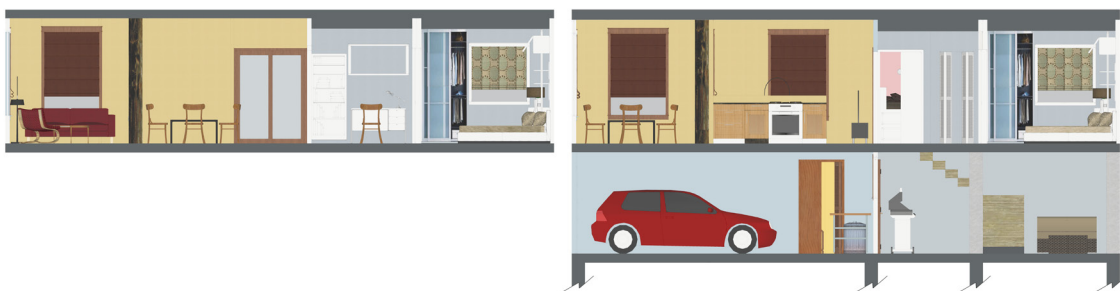


Figure 152: Section of Transitional House vs. Section of Permanent House Illustrating Transitional House as Second Floor of Permanent House. Image by Author.

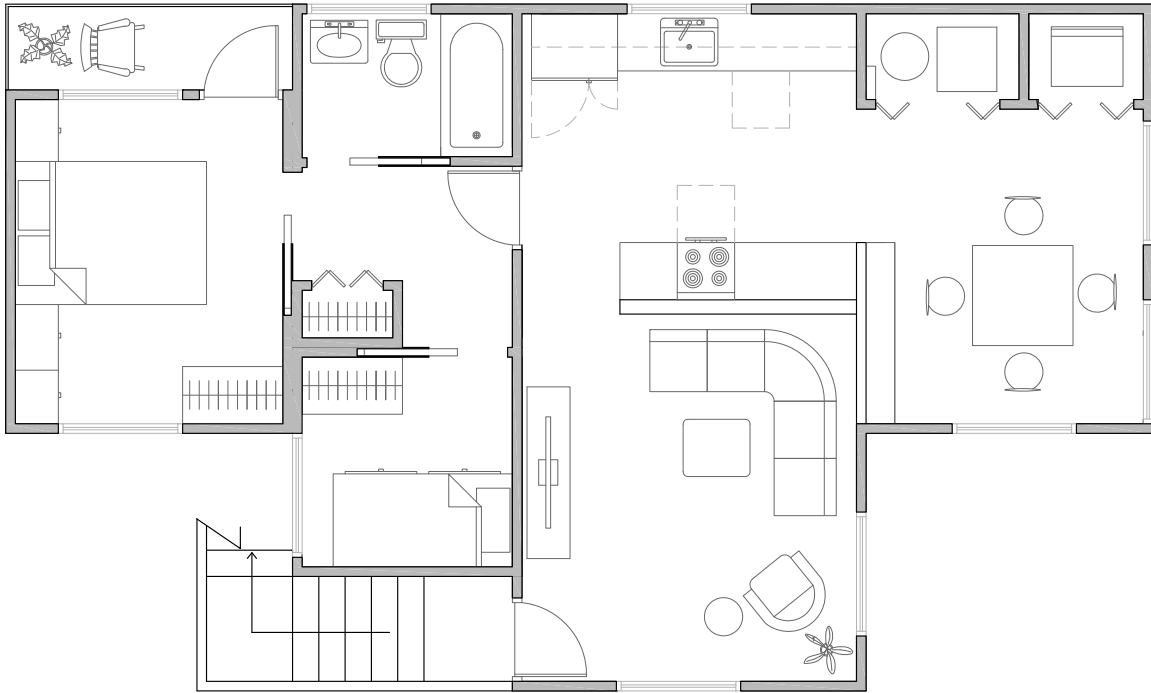


Figure 153: Permanent House Second Floorplan. Image by Author.



Figure 154: Axonometric Drawing of Second Floor of Permanent House. Image by Author.



Figure 155: Axonometric Drawing of Second Floor of Permanent House. Image by Author.

The building code restricts the use of the first floor of the permanent structure to storage, parking and building access. Also, because of the building code, all of the electrical and mechanical must remain above the base flood elevation. This is why the mechanical and laundry are situated on the second floor. This also works to the advantage of the user, as it ends up being more cost effective: all the services run along one wall and do not need to be moved.

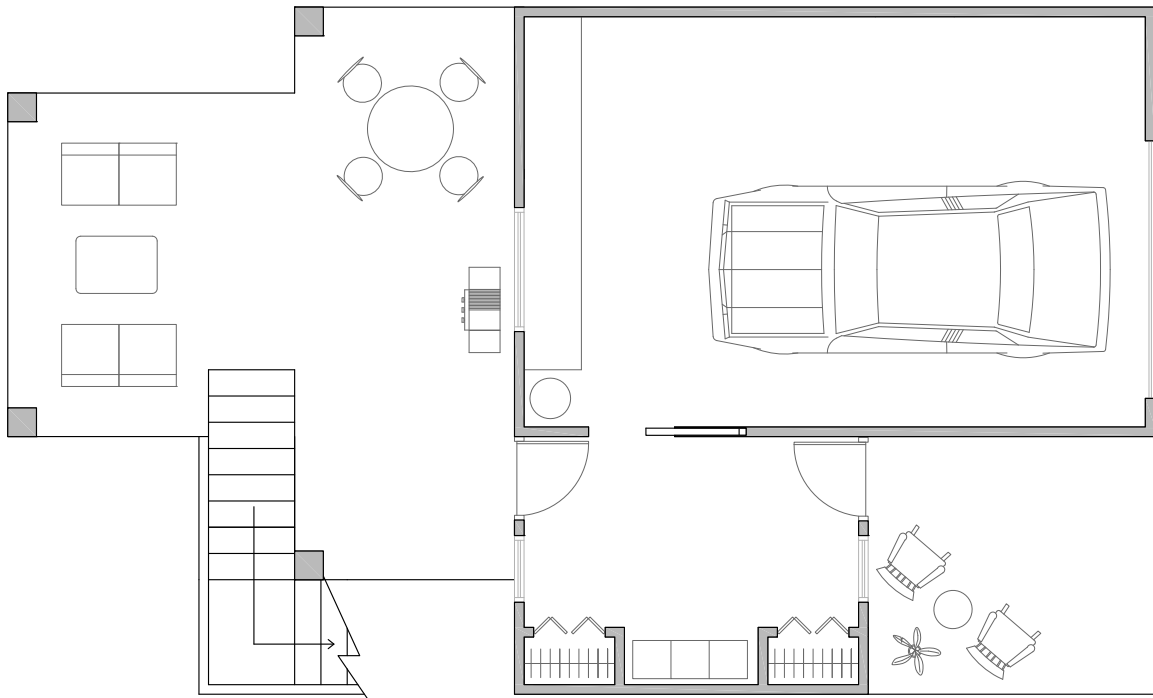


Figure 156: Permanent House First Floorplan. Image by Author.

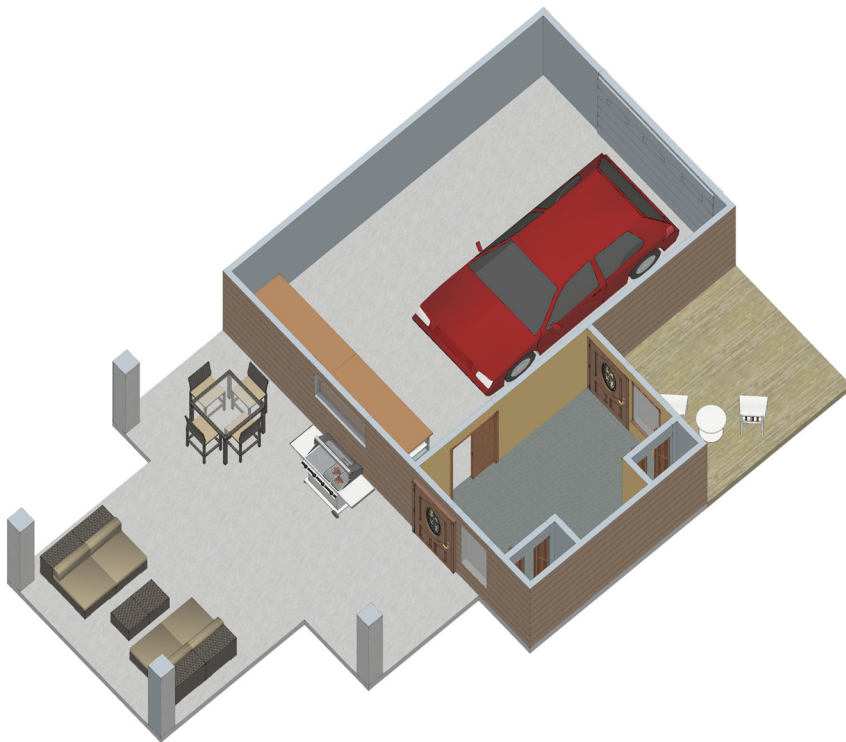


Figure 157: Axonometric Drawing of First Floor of Permanent House. Image by Author.

To encourage and maintain a social connection to the community, as well as maintain the architectural language of the site, a street-level porch has been provided at the front of the house. The porch connects to a breezeway that acts as an entranceway to the house. This creates a sense of arrival for visitors while doubling as storage. The breezeway leads to a covered area behind the house that acts as an additional living area where the stairs to the entrance of the main living area are situated. In this way, the interior and exterior blend together to increase the overall living space. These spaces act as in-between spaces, connecting the user to the site and nature, once again recognizing the importance of Heidegger's theory of dwelling in creating a sense of home for the inhabitant. However, since these spaces are non-essential to supporting life (such as a bathroom or kitchen), they can act as first floor extensions of the living space while still adhering to the building code.

Kevin Lynch's five elements used to create an 'environmental image' can be applied in the example below to understand how people would negotiate themselves through the first floor in order to arrive at the main living area on the second floor. The breezeway acts as a definite 'path' that leads a person into the covered living space that is defined by 'edges' created through the change in materials (concrete and grass). These 'edges' establish the covered living space as a continuation of the entranceway, as well as the first floor living area. The foot of the stairs is a 'node' where all paths of circulation converge. As a node, it directs a person up to the second floor landing and door that acts as a 'landmark', indicating one's arrival to the second floor main living area.



Figure 158: Progression from Street to Entrance of Permanent House. Image by Author.

Exposing the entrance of the main living area to the exterior, as opposed to being built into the structure, is a safety feature. In case of flooding, the residents can more easily evacuate their home than if the stairs led into the first floor enclosure that could be flooded with water. The exposed entrance would be accessible by boat for rescue.

Another requirement of the building code is that enclosed spaces below the base flood elevation need to have a minimum of two flood openings, each measuring a minimum of 3 inches square, and each situated on different sides of the closed area. These cut-outs are strategically placed in the closets of the entranceway to hide them.

There are also two in opposite walls of the garage situated off of the breezeway. The garage includes space for a single car and additional storage space.



Figure 159: Garage Facing Entrance to Breezeway/Entrance. Image by Author.

With the additions to the second floor of the permanent structure, some rooms are repurposed. What was the living room becomes the dining room, and the living room is moved into the new living area addition.



Figure 160: The Living Room in the Transitional House Becomes the Dining Room in the Permanent House. Image by Author.



Figure 161: View from Entrance of New Living Area in Permanent House. Image by Author.

The entranceway is still adjacent to the living room in the new plan, but has been moved to the back of the house following the move of the living room. This is because the entrance from the transitional house has been closed off to contain the laundry room of the permanent house.



Figure 162: Entrance in Transitional House Becomes Laundry Room in Permanent House. Image by Author.

With the dining table being moved, there is more room to add on to the kitchen. The kitchen is transformed from a single-wall kitchen to a galley style kitchen by the addition of an island with a grill top and oven in it, while a dishwasher is placed next to

the sink and the counter is extended. These minimal changes increase both the horizontal work surface and storage.



Figure 163: Single Wall Kitchen in Transitional House Transforms to Galley Style Kitchen with Addition of Island in Permanent House. Image by Author.

The office furniture was moved out of the walkthrough storage area in order to open up the wall for an opening to the second bedroom. Also, because of the need for more storage, a linen closet was added.



Figure 164: Office Furniture in Hallway Moved to Add Door to Bedroom and Linen Closet. Image by Author.

The porch that was adjacent to the bedroom in the transitional house was raised with the transitional house. A railing was placed around it, making into a balcony. This maintains a connection to the exterior and the increase in living space.



Figure 165: Porch in Transitional House Becomes Balcony in Permanent House. Image by Author.

5.4.2.3 Furniture

Furniture that is not anchored down and is easily moveable is an important element in this design because it allows for flexibility in the use of rooms. Rooms are easily repurposed over time. An example of this is the use of wardrobes as opposed to built-in closets in the bedrooms. Eventually, when the child moves out, the parents could turn the child's bedroom into an office. This is a similar concept to the Shotgun style house where all rooms are the same size and are often and easily repurposed overtime because of this.



Figure 166: Aerial View of Child's Bedroom in Permanent House. Image by Author.

Furniture that is moveable can also help maintain a sense of continuity in the interior, because although the form of the building may be modified, having the same furniture placed in the new spaces continues the visual narrative from the old layout into the new. For example, the chairs and table from the porch of the transitional house are placed on the front porch of the permanent house. Also, the dining set is moved from the kitchen of the transitional house to the dining room of the permanent house.



Figure 167: Chairs from Transitional House Porch are Situated on Permanent House Porch Creating a Sense of Continuity. Image by Author.



Figure 168: Dining Furniture from Kitchen in Transitional House Moved to Repurposed Dining Area in Permanent House. Image by Author.

From the beginning of this design process, including choosing the floor plan and adding additional room units as needed, down to repurposing spaces through the movement of furniture, the inhabitant continually builds his or her environment. They are therefore ‘dwelling,’ according to Heidegger’s theory. It is in our everyday routines,

and our constant modification of our home environment to suit the needs of those routines that dwelling occurs.

Although moveable furniture is important for easy modification of space over time, some built-in units have been used. This is mainly in the bedrooms, because they are smaller spaces. The built-ins allow for maximum use of a smaller space for storage purposes, maximizing the use of vertical surfaces. However, to maintain a sense of flexibility and ease of personalization in the space, the shelving units and components in the built-in units can be adjusted in both height and placement to suit the storage needs of the individual. This again, and on a smaller scale, promotes ‘dwelling’ through the act of ‘building’ or modifying one’s space, as understood through Heidegger’s theory of building and dwelling.



Figure 169: Built-in Modular Shelving in Bedroom. Image by Author.

Once again, because of the small square footage of the bedrooms, the furniture itself is used to maximize the availability of storage. The platform bed in the adults' room uses hydraulic lifts for easy access to storage space underneath the bed. The captain style bed in the child's room offers drawers on its side to access storage underneath the mattress.



Figure 170: Captains Bed in Child's Room. Image by Author.



Figure 171: Bed with Hydraulic Lift System in Master Bedroom. Image by Author.

Furniture used to store special objects that conjure memories is also an important feature in the house because it helps facilitate the grieving process that takes place after the loss of one's home and belongings. This sort of loss is psychologically equivalent to the loss of a loved one. A shelving unit that acts as a memorial for recovered cherished objects is situated in the living room of the transitional house, and stays there when the room is repurposed as the dining area. Another furniture element that acts as a memorial is a coffee table which displays recovered pictures between two panes of glass. These pieces of furniture are important elements in the shared space which allow the family to gather, reminisce, and tell stories of their past in order to bond and mourn their loss.



Figure 172: Memory Shelving Unit. Image by Author.



Figure 173: Display Coffee Table. Image by Author.

5.4.2.4 Materials

The materials in the house are used to evoke a sense of home, intimacy and scale. The colours in different activity zones vary based on the purpose of the space. In the common shared areas, more warm, rich and stimulating colors are used to evoke a sense of being welcome to the space, as well as encouraging more dynamic interactions amongst a group: conversing, playing games and so on. In the more private spaces like the bedrooms, more subdued colors are used to evoke a sense of serenity and calmness, allowing for introspection and retreat from the world beyond the bedroom door. Another function of colour is to create a sense of continuity, both temporally and between spaces. As an example, the entrance on the first floor of the permanent house is the same as the original colour in the entrance of the transitional house. This creates a sense of temporal continuity between the two stages of housing. Also, continuing the colour from the main

living area on the second floor of the permanent house down to the entranceway of the first floor creates a visual continuity between the two places. This continuation of similar characteristics connects the two spaces as one distinct ‘district,’ as suggested by Kevin Lynch’s theory of creating an ‘environmental image,’ even though there is a physical break between the two (exterior covered patio).

Patterns and texture are an important element in distinguishing the types of activities happening in the different spaces. More active patterns are used in the common area versus the more organic floral patterns in the bedroom. Pattern is also used to camouflage the addition of rooms. One example of this is the use of carpet tile with a nondescript pattern that allows for carpet to be added later on when an addition is added. This connects the two spaces together and camouflages the break between them. The layering of patterns and textures creates visual interest and depth to the space, encouraging a person to interact with that space and connect with it at a smaller more intimate scale, both visually and through touch. A few examples are the textured wallpaper used in the bedroom, faux fur bedding in the bedrooms, and a variety of patterns in the common area. Finally, patterns that mimic natural elements such as stone and wood are used to connect the interior to the exterior, blurring the boundaries visually between inside and outside and encouraging the user to dwell in the space. One example is the laminate that mimics petrified wood used on the memorial shelf.

Materials, like the moveable furniture, that are flexible in use are important in this design because, as the space changes, the materials should be able to change with it. One example is the carpet tile used in the living room of the transitional house. When the additional living area is added in the permanent house, and what was the living room

becomes the dining room, the carpet tile can easily be picked up and moved to the new living area. As well, additional squares can be ordered to make up the difference in the increase of square footage of the living space. Because of the flexibility of the carpet tile, it is an affordable as well as a sustainable choice of material.

Other affordable material choices used in the design are laminates that have unbroken patterns of stone and wood. Through this, the user gets the look of real granite countertops in the kitchen without the cost. Also, the use of engineered hardwood floors in the kitchen area is considerably less expensive than standard hardwood floors.

Finally, nature itself is used as a material in this design. This is apparent in the trellis detail with climbing plants found at the front porch (acting as a privacy screen), and at the front side of the house opposite the porch (creating a sense of symmetry to the front elevation of the house).



Figure 174: Nature as Privacy Screen and Cladding. Image by Author.



Figure 175: Main Living Area. Image by Author.



Figure 176: Kitchen. Image by Author.

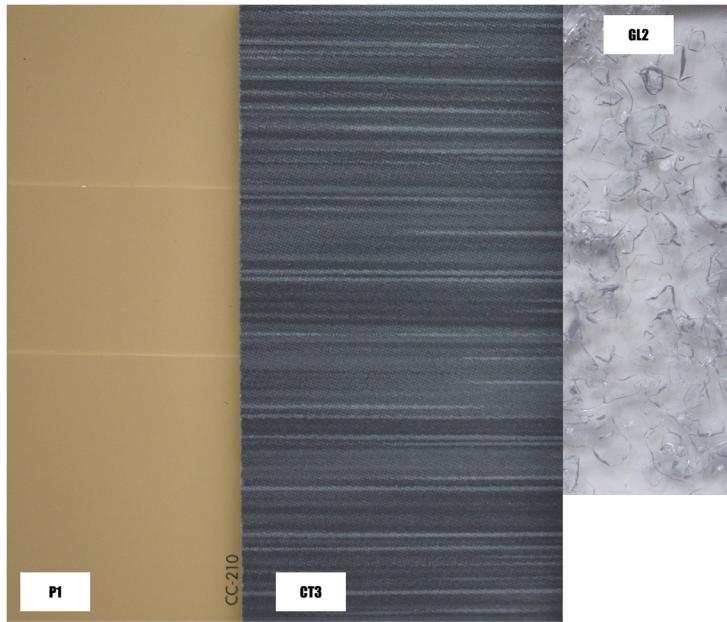


Figure 177: Entrance/Breezeway. Image by Author.



Figure 178: Bathroom. Image by Author.



Figure 179: Master Bedroom. Image by Author.



Figure 180: Child's Bedroom. Image by Author.

Room Name	Floor	Wall	Remarks
Entrance/Breezeway	CT3	P1	GL2 for privacy windows
Living Room	CPT-T1	P1	F1 & F3 for furniture, F2 for window coverings, PLAM1 for memorial shelf
Kitchen	WD1	WC1	PLAM2 for countertops, MW2 & GL1 for cabinets
Bathroom	WC3	SLT1	CT1 for fixtures, CT2 for tub surround
	P3		
Master Bedroom	CPT-T1	P2	F4 for bedding and pillows, F3 for window coverings, MW1 for shelving and wardrobe
		WC2	
Child's Bedroom	CPT-T1	P4	F5 for window coverings, F6 for pillows, F7 for bedding

Table 3: Materials Schedule. Image by Author.

Chapter 6: Conclusion

6.1 Reflections

Time is needed to establish a sense of home in a house. Routines are established through repetition and interiors are the backdrop to those routines that create a sense of home for a person. However, there is a definite sense of nostalgia and place attachment that relates to one's past homes and this is where a designer can help. By understanding the psychology behind place attachment, as well as the elements that allow for a pleasant inhabitable environment (the patterns in the LIFE House precedent, for example), and what it means to dwell, it is possible for designers to create a place where a person would be inclined to attach. Also, incorporating recognizable spatial patterns and elements that existed pre-disaster in order to create a sense of continuity in a person's spatial narrative facilitates an attachment to the new house by creating nostalgic feelings for the lost home.

In essence, giving the survivors of a natural disaster a place where they can dwell - through the manipulation of their environment - allows them to feel at home in that place and therefore facilitates the healing process. By rebuilding their environment, they rebuild their world, as understood by how they identify with and orient themselves in it, and therefore rebuild themselves.

My reason for this design was to address the lack of importance placed on the psychological impact of the interior environment of existing interim housing on the inhabitants. Providing a design where the survivors have choices - from the beginning of the design itself including the layout, where the house is sited, and having flexible interiors that allow the environment to be modified according to their needs - is beneficial to their recovery and resilience. It is in fact this possibility of choice that

underpins the survivors' ability to build their environment, both physically and in turn perceptually, and thus dwell in it, making it home.

Although the transitional house will not necessarily start off as home, it can become home, since it is placed on the site early on in the process; it has the ability to be adapted and modified by the user to grow with them; and it transitions to become their permanent dwelling. The amount of choice in the layout as well as the ability to manipulate and change the environment to their needs means that there is a greater likelihood of satisfaction with the house on the users' part, and it is more likely they will become attached to it and eventually come to think of it as 'home.'

6.2 Further Studies

Despite my research efforts and the expert advice provided by my advising committee, I recognize that the proposal does have short-comings. First, it contains a limited number of options in the supplied catalogue. There is the potential for another designer or researcher to develop additional design options for units and add-ons.

Another limitation of my work has to do with my reliance on secondary sources for site information and data on user experience. I was unable to visit the actual site and interview people living in FEMA trailers for primary source information. Getting their feedback on the proposed units could help push the design further. It would also be valuable to investigate if there is a limit to the amount of choice that should be offered to the survivor. I was able to find an ample amount of data that supported having various choices in the rebuild of one's home, but it would be worthwhile to do a study to see

where the threshold for comfort with making choices exists before survivors become overwhelmed.

The feasibility of this proposal is another potential limitation. In order to truly assess the costs and logistics of my proposal, it would have to be analysed by a disaster planning committee to assess factors such as the response time required to put it into action, as well as technicalities like where the units would be stored and the actual cost to build, deliver and install the units.

This project was limited in that it was designed for North America specifically, using precedents like the LIFE Dream House, and literature such as Jacobson, Silverstein, and Winslow's *Patterns of Home*, that were based on North American culture. I am also biased, as the designer, as I have been raised in North American culture and have had little exposure to other countries. Therefore, it would be worthwhile for someone to take the literature and precedents compiled in this document and apply them to other cultures to observe how this would impact the outcome of the design, or whether these theories and ideas can even be applied successfully in a design for other cultures.

Further studies need to be done to verify that the structural systems of the buildings proposed are satisfactory. The development of additional construction details and the exploration of different technologies for the foundation to be used for the soil stratum local to the Lower Ninth Ward are also required. As well, further research is necessary into the structural elements of hurricane-proof housing.

Further research is necessary regarding the steps to raise the house in the second stage of the design. Preliminary research, based on FEMA's *Chapter 5: Elevating Your House*, suggests that it is possible and explains the process of what is needed in order to

raise a house on piles, a foundation or crawlspace. However, further study on how raising the transitional house would influence the outcome of the design of the permanent structure is needed.

The intention is that this unit would initially be self-sustaining and would incorporate such elements as composting toilets, grey water collection, solar panels and so on that could be reconnected to the city's infrastructure when it became available. Further spatial studies need to be done to confirm whether the proposed spaces could accommodate this. As well, further studies must be done on what type of sustainable products and elements are feasible and/or necessary for the proposed design.

Further study into the proposed second phase of the design (permanent housing), is necessary to develop the best types of foundations used in different regions, disaster-specific elements such as safe rooms for hurricane and flood prone areas, as well as safe rooms and basement design that could be implemented for tornado prone areas and so on. This information would help develop additional add-ons and expand the existing catalogue of choices available in the design for different locations.

Finally, studies are required to see how these houses, once in the permanent stage, would affect the architectural identity of the Lower Ninth Ward. Since the housing stock of New Orleans has a rich history and is integral to the architectural identity of the city, a study assessing the replacement of a large amount of the housing stock would be necessary. This would address where, or even if, the proposed houses would work within the existing architectural identity, and suggest if modifications and further refinements or additional exterior add-on elements are necessary.

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