THE GLOBAL **KIT**

Dreams of Affordability and Delusions of the Architect

by

Mohammad A. Reekan

A thesis submitted to the Faculty of Graduate and Postdoctoral Affairs
In partial fulfillment of the requirements for the degree of

Master

In

Architecture

Carleton University
Ottawa, Ontario

This Thesis Is Dedicated To

My Family & Loved Ones

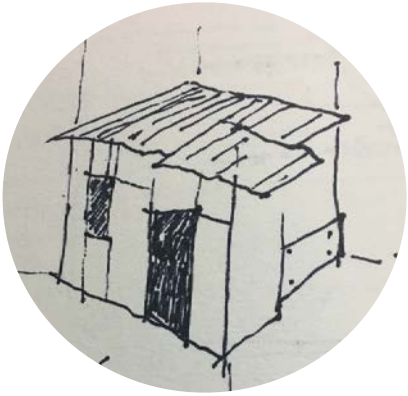
&

To My Late Father Who Inspired Me To Follow My Dreams

'Abdullah Gadei Reekan'

1949-2018

Fig.01 Incremental - Housing



THE GLOBAL **KIT**

Dreams of Affordability & Delusions of the Architect

Abstract:

To survive harsh living conditions whatever shape they take is one of the main contemporary challenges' architects face. Today adequate and affordable building systems are proving essential to a successful. This thesis explores contemporary conditions, innovative building systems, and societal constructs defined by today's standards. Historical research, case studies, and speculative drawings are used to test insights into (un)imaginable architectural ideas, innovative ways of re-defining space tantalizingly suggesting the impossible made possible. The project emerging designs and develops a 'Building Assembly' system of parts and connections which can be utilized by those who need to survive their present difficult realities. What is the ultimate building assembly? Can we then talk of the ultimate community? Could this community be built by the dwellers with their own hands? Could this be the solution for the growing problem of inadequate housing today? A Global kit? Realities of affordability or delusions of an architect?

Fig.02 Sulaibiya, Kuwait

Acknowledgments

I would like to thank my thesis advisors Roger Connah and Yvan Cazabon for all their help, input, and effort in helping me in the process of developing the thesis and honing my ideas…i.e. killing my darlings. Their wealth of knowledge and experience truly makes us strive to become better thinkers and better professionals.

I would like to thank Carleton University and The Azrieli School of Architecture and Urbanism for all their help during my undergraduate degree and now through my graduate degree. Thanks go also to all professors, instructors, and teaching assistants for all their guidance and help during my academic studies.

Finally, I would like to thank my family and friends for their support and encouragement during my education. They have truly helped me become a better student and a person. Thank you all for all your help, and I am truly grateful for all what you have done for me. Thank you.

Table of Contents:

i Abstract
iii Acknowledgements
iv Table of Contents
v Image Index
1 Introduction
5 Context
From the Formal to Informal
13 Analyzing the Informal
14 Informal Settlements & Communities
27 Informal Housing Analysis
41 Index of Informal Housing Typology
52 Analyzing the Self-Built (Case Studies)
53 Self-Built 01 - Masoro Village – Rwanda
57 Self-Built 02 - Empower Shack – South Africa
62 Self-Built 03 – Kambi Moto Housing - Kenya
67 Self-Built 04 - Iquique Housing - Chile
72 Assemblies
74 Prefabrication Explorations
82 Abstract Assembly Explorations
87 Housing Possibilities & Typologies
93 Project Incremental
94 Housing Systems 'The Global Kit'
107 Housing Typology
117 Housing Increments
130 Reflection
133 Notes to Sources Used (Endnotes)
135 Annotated Bibliography

Image Index:

Figure	Title & Sources
Fig.01	**Incremental – Housing** (Illustration)
Fig.02-12	**Sulaibiya, Kuwait – Photographs**
Fig.13	**Favela 1- Rocinha, Brazil** Stasiak, David, Adelino Alves, and Myrna Walsh. "Nightfall In The Favela Da Rocinha by Adelino Alves." Fine Art America. Accessed October 10, 2018. https://fineartamerica.com/featured/1-nightfall-in-the-favela-da-rocinha-adelino-alves.html.
Fig.14	**Dharavi, India** "Tours That Dispel Negative Notions of Mumbai's Dharavi Slum." TripSavvy. Accessed October 11, 2018. https://www.tripsavvy.com/mumbai-dharavi-slum-tours-4072927.
Fig.15	**Dharavi, India** "rental housing: solution for housing urban poor? – iaac blog." iaac blog. accessed october 11, 2018. http://www.iaacblog.com/programs/rental-housing-solution-for-housing-urban-poor/.
Fig.16	**Dharavi, India** ; "Mumbai-Dharavi Slums- Aparna :: One Million Lights." One Million Lights RSS. Accessed October 11, 2018. http://onemillionlights.org/blog/2013/08/20/mumbai-dharavi-slums-aparna/.
Fig.17	**Dharavi, India** Oddviser. "Dharavi Slums, Mumbai." Things to Do in the World. May 30, 2017. Accessed October 11, 2018. https://oddviser.com/india/mumbai/dharavi-slums.
Fig.18	**Khayelitsha, South Africa** Furlong, Ashleigh. "Three Years after the Khayelitsha Commission, Is There Any Progress?" TimesLIVE. Accessed October 11, 2018. https://www.timeslive.co.za/politics/2017-08-25-three-years-after-the-khayelitsha-commission-is-there-any-progress/.
Fig.19	**Khayelitsha, South Africa** Davis, Rebecca. "'Black Lives Don't Matter': Police Inaction in Khayelitsha Comes under Fire." Daily Maverick. August 13, 2015. Accessed October 11, 2018. https://www.dailymaverick.co.za/article/2015-08-12-black-lives-dont-matter-police-inaction-in-khayelitsha-comes-under-fire/.
Fig.20	**Khayelitsha, South Africa** Merwe, Marelise Van Der. "Khayelitsha – Where's the Weakest Link?" Daily Maverick. September 21, 2017. Accessed October 11, 2018. https://www.dailymaverick.co.za/article/2017-09-21-khayelitsha-wheres-the-weakest-link/.

Fig.21	**Khayelitsha, South Africa** "How to Visit Khayelitsha Township, Cape Town." TripSavvy. Accessed October 11, 2018. https://www.tripsavvy.com/visiting-khayelitsha-township-cape-town-south-africa-4158886.
Fig.22	**Kibera, Kenya** "Kibera Slum Guided Day Tour from Nairobi in Kenya Africa." WizTours. Accessed October 11, 2018. https://www.wiztours.com/tour/kibera-slum-guided-day-tour-from-nairobi-18104.html.
Fig.23	**Kibera, Kenya** "Kibera." Wikipedia. November 08, 2018. Accessed October 11, 2018. https://en.wikipedia.org/wiki/Kibera.
Fig.24	**Kibera, Kenya** The Namibian. "Hope And Dignity Rising In The Slums Of Africa." The Namibian. Accessed October 11, 2018. https://www.namibian.com.na/index.php?id=122304&page=archive-read.
Fig.25	**Kibera, Kenya** "A Selection of Conditions & Volunteers in Kibera." Kibera UK. February 14, 2018. Accessed October 11, 2018. https://www.kibera.org.uk/photos/.
Fig.26	**Rocinha, Brazil** "R/UrbanHell - Rocinha, the Largest Favela in Brazil." Reddit. Accessed October 11, 2018. https://www.reddit.com/r/UrbanHell/comments/7kor84/rocinha_the_largest_favela_in_brazil/.
Fig.27	**Rocinha, Brazil** Janeiro, Río De, and EFE. "Vivir En Las Favelas De Río De Janeiro, Una Opción Para Los Extranjeros." Diariodenavarra.es. April 30, 2017. Accessed October 11, 2018. https://www.diariodenavarra.es/noticias/magazine/sociedad/2017/04/30/vivir_las_favelas_rio_janeiro_una_opcion_para_los_extranjeros_529336_1035.html.
Fig.28	**Rocinha, Brazil** Dabldy. "Фавела да Rocinha трущоб." Depositphotos. Accessed October 11, 2018. https://ru.depositphotos.com/98202572/stock-photo-favela-da-rocinha-slum.htm.
Fig.29	**Dharavi, India** Athiparambath, Shanu. "Rural Migrants Aren't the Reason Why India's Major Cities Are Overcrowded, the Apathetic Government Is." Quartz. July 13, 2016. Accessed November 10, 2018. https://qz.com/india/730034/rural-migrants-arent-the-reason-indias-major-cities-are-overcrowded-the-apathetic-government-is/.
Fig.30	**Kibera, Kenya** "Kibera Slums." Vanja Lisac. Accessed November 01, 2018. http://vanjalisac.com/kibera-slums-2/.

Fig.31	**Rocinha, Brazil** "City Urban Design: Learning from Favelas." Unit 16. November 07, 2012. Accessed November 01, 2018. https://unit16bartlett.wordpress.com/2012/11/07/city-urban-design-learning-from-favelas/.
Fig.32	**Dharavi, India** Moreno, Angelica Italia. "Angélica Italia." Tango - Roxanne. January 01, 1970. Accessed November 10, 2018. http://angelicaitalia.blogspot.com/2013/05/dharavi-el-mayor-tugurio-del-mundo.html.
Fig.33	**Khayelitsha, South Africa** "Day 1 in Cape Town." Kaitlin Bardswich. September 25, 2016. Accessed November 10, 2018. https://kaitlinbardswich.ca/2011/11/22/day-1-in-cape-town/.
Fig.34	**Dharavi, India** "Slum Hotel." Accessed November 10, 2018. https://www.imagenesmy.com/imagenes/slum-hotel-41.html.
Fig.35	**Dharavi, India** "How The Dharavi Slums Of Mumbai Captured A Piece Of Our Hearts." Wanderers & Warriors. October 12, 2018. Accessed November 10, 2018. https://wanderersandwarriors.com/dharavi-slums-of-mumbai/
Fig.36	**Rocinha, Brazil** K, Coisas De Karol Com. "Tudo De Cor Para Você." Coisas De Karol Com K. January 01, 1970. Accessed November 01, 2018. http://coisasdekarolcomk.blogspot.com/2014/11/tudo-de-cor-para-voce.html.
Fig.37	**Khayelitsha, South Africa** "Empower Shack." Arcspace.com. Accessed November 10, 2018. https://arcspace.com/feature/empower-shack/.
Fig.38	**Dharavi, India** Rosenfield, Karissa. "Interview: William Hunter Discusses Contested Urbanism in Dharavi." ArchDaily. July 28, 2013. Accessed November 10, 2018. https://www.archdaily.com/403220/contested-urbanism-the-politics-of-slum-redevelopment-in-dharavi-mumbai.
Fig.39	**Khayelitsha, South Africa** "Empower Shack." Arcspace.com. Accessed November 10, 2018. https://arcspace.com/feature/empower-shack/.
Fig.40	**Kibera, Kenya I** "The Kibera." Lunchbowl. Accessed November 01, 2018. http://www.lunchbowl.org/the-kibera.html.
Fig.41	**Rocinha, Brazil** K, Coisas De Karol Com. "Tudo De Cor Para Você." Coisas De Karol Com K. January 01, 1970. Accessed November 01, 2018. http://coisasdekarolcomk.blogspot.com/2014/11/tudo-de-cor-para-voce.html
Fig.42 -45	**Dharavi Houses** (Illustration)
Fig.46 -49	**Khayelitsha Houses** (Illustration)
Fig.50 -53	**Kibera Houses** (Illustration)
Fig.54 -57	**Rocinha Houses** (Illustration)

Fig.58	**Iquique 1, Chile** M, Josh. "On Architectural Participation." On Architectural Participation. January 01, 2016. Accessed December 01, 2018. http://spacesofconflict.blogspot.com/2016/02/on-architectural-participation.html.
Fig.59	**Masoro 1, Rwanda** Survant, Tyler. "Masoro Village Project / GA Collaborative." ArchDaily. September 20, 2013. Accessed November 10, 2018. https://www.archdaily.com/430409/masoro-village-project-ga-collaborative.
Fig.60	**Masoro 2, Rwanda** (Illustration) Franco, José Tomás. "Proyecto Aldea Masoro: Empoderando a Las Comunidades a Través De La Arquitectura." Plataforma Arquitectura. July 30, 2014. Accessed November 10, 2018. https://www.plataformaarquitectura.cl/cl/624830/proyecto-aldea-masoro-empoderando-a-las-comunidades-a-traves-de-la-arquitectura.
Fig.61-63	**Masoro 3, Rwanda** Ibid
Fig.64-68	**Empower 1, South Africa** Frearson, Amy, and Amy Frearson. "Urban-Think Tank Develops Housing Prototype for South African Slums." Dezeen. March 20, 2018. Accessed November 11, 2018. https://www.dezeen.com/2014/03/07/empower-shack-urban-think-tank-housing-south-africa-slums/.
Fig.69-72	**Kambi 1, Kenya** "AID - Kambimoto Housing." Architecture In Development - Homepage. Accessed November 12, 2018. http://architectureindevelopment.org/project.php?id=225.
Fig.70-75	**Kambi 2, Kenya** "Technical Team Planning for Self-Help Housing in the Kambi Moto Community." World Habitat. Accessed November 11, 2018. https://www.world-habitat.org/world-habitat-awards/winners-and-finalists/technical-team-planning-for-self-help-housing-in-the-kambi-moto-community/.
Fig.76-79	**Iquique 2, Chile** Nuijsink, Cathelijne. "Less money, more creativity." Mark Magazine, Aug/Sept 2008, issue #15, pages 174-183. Accessed December 1, 2018. http://www.elementalchile.cl/wp-content/uploads/080814_QM_Mark_Magazine_HQ.pdf
Fig.80-82	**Levitt 1, Levittown 1949** "The Man Who Built Suburbia." Mental Floss. July 27, 2015. Accessed January 23, 2019. http://mentalfloss.com/article/66434/man-who-built-suburbia. Marshall, Colin. "Levittown, the Prototypical American Suburb – a History of Cities in 50 Buildings, Day 25." The Guardian. April 28, 2015. Accessed January 27, 2019. https://www.theguardian.com/cities/2015/apr/28/levittown-america-prototypical-suburb-history-cities.
Fig.83	**Prefabricated Home Strategy Matrix** (Illustration)
Fig.84	**Modular Concept Sketch 1** (Illustration)

Fig.85	**Modular Concept Sketch 2** (Illustration)
Fig.86	**Modular Concept & Details** (Illustration)
Fig.87	**Modular Wall Assembly** (Illustration)
Fig.88	**Assembly Ver.001** (Illustration)
Fig.89	**Assembly Ver.002** (Illustration)
Fig.90	**Assembly Ver.003** (Illustration)
Fig.91	**Stacked** (Illustration)
Fig.92	**Home Stacking 1** (Illustration)
Fig.93	**Home Stacking 2** (Illustration)
Fig.94	**Housing Variations Ver.001** (Illustration)
Fig.95	**Housing Variations Ver.002** (Illustration)
Fig.96	**Housing Variations Ver.003** (Illustration)
Fig.97	**Housing Variations Ver.004** (Illustration)
Fig.98	**Housing Variations Ver.005** (Illustration)
Fig.99-113	**Kit Components** (Illustration)
Fig.114	**Kit Assembly** (Illustration)
Fig.115	**Sustainable Home** (Illustration)
Fig.116-119	**Housing Models** (Illustration)
Fig.120-123	**Elevations** (Illustration)
Fig.124-126	**Layout/ Plans** (Illustration)
Fig.127	**Model H.6** (Illustration)
Fig.128	**Increments** (Illustration)
Fig.127	**Model H.6** (Illustration)
Fig.128	**Increments** (Illustration)
Fig.127	**Model H.6** (Illustration)
Fig.128	**Increments** (Illustration)
Fig.129-132	**Phases** (Illustration)
Fig.133-136	**Overtime** (Illustration)
Fig.137	**Home** (Illustration)
Fig.138	**Freedom** (Illustration)

Fig.03 Sulaibiya, Kuwait

Introduction:

A dream is a collection or series of sensations, experiences, images, and thoughts that happen or are initiated when one sleeps. Sometimes these are contemplations or explorations passing through one's unconscious and conscious mind whilst thinking how to achieve or envision a reality. What then is a daydream? And what exactly are delusions? And what on earth are they doing in an architectural thesis? Is there a connection between architecture, dreams, and delusions?

Everyone dreams at some time and contemplates their reality, and this would be the case in the mind of an architect as well. Like others, architects have their own dreams, imagination, thoughts and hopeful speculation about what architecture could be for the individual and the community as a whole.

One important question arises immediately: why do existing communities and new informal settlements become slums or are classified as 'informal'? Do the economic conditions dictate the decay and the classification? Or is it the lack of governmental or external economic support and maintenance? Surely, a variety of scenarios and conditions lead to such classifications, but ultimately it is reduced to economics, money or the lack thereof.

In Sulaibiya (my hometown Fig.03) the community started with the government giving houses to Kuwaiti citizens in 1980. Over the years as their income increased when the country improved its economic conditions, these citizens chose to move to improved housing arrangements. This meant that the non-citizens (Bedoon), those without rights began to migrate to the community because of lower costs, whilst also not needing documentation to reside in these homes. Corruption and other issues produce despair: the Bedoon were clearly willing to accept less to survive and keep their families safe with a roof over their heads. Rising despair asks of us all a solution to this problem. As hopeful, professional architects how do we play a major role in the solution to this dilemma?

Can we make a case for affordable architecture? Can we research the possibilities of developing a building assembly or a new affordable architectural system of building components? To apply this type of architectural system, we also need to understand the recipients of such a system. Studying other informal settlements, and understanding the level of self-built possibilities, housing typology, and craftsmanship becomes a testing ground for the system. The system may also not only be for the poor; it could be accessible to everyone and anyone who cares, has the chance or wishes to use it.

We will proceed by developing this building assembly starting at the microscale of joints, materials, connections, mobility, ease of assembly and durability. The

process will include the exploration in all aspects that make up a successful effective building component. These building components become part of the overall assembly or part of an architectural building kit; ease of assembly is crucial and would be required by individual or organization.

From this, the project will consist of designing a housing typology based on an inclusive structure. The housing project proposed is to be built on the premise that it will generate profits for the investors, government bodies or organizations and ultimately create much-needed jobs for the local community and its inhabitants. The project will not serve as a charity, but rather a solution to the economic problem facing the residents of these various informal settlements. It is quite possible that architecture needs a paradigm shift to look at projects as opportunities for financial gain for the investor and the community as a whole to maintain long-term viability. But demanding profits from a project that is intended to help people in need is neither brutal or irrelevant. Any system needs to be viable to be repeated and become financially stable.

Fig.04 Sulaibiya, Kuwait – Photograph 3

Fig.05 Sulaibiya, Kuwait

Context

From the Formal to Informal;

Let me start at the beginning, I was born in Kuwait 1983, in the middle east and at the time my family lived in a social housing community called Sulaibiya. This social housing community was built in 1980 and to the best of my knowledge, my father moved to this community in the early eighties. The community housing from my earliest memories were fairly clean and no informal settling was established, but living there for around twelve years I saw the community deteriorate over time and slowly began to show signs of informal additions to existing homes. Fortunately, my father worked extremely hard as an architect and did well financially to move my family and me out of Sulaibiya to Andalus in Kuwait as well. Unfortunately, many of my family members and friends did not

have the fortune to move out, and they experienced the extreme deterioration of their homes, and essentially watched the community become an informal settlement 'SLUM', where the inhabitants began to informally expand their homes with their own hands (Fig.04).

The community today for lack of a better word is considered a 'SLUM', shanty town and as the UN classifies it an informal settlement. Residents of the community out of necessity began to informally add additions to the houses they live in, which they don't own. A backlash from the government was received due additions implemented without permits, and not having ownership of the home or tenure of the land. Some residents who had an expansion of their family size and or decided to make some income by renting out additional space in their dwellings built higher by adding a second level (Fig.06, 07, 08).

Fig.06 Sulaibiya, Kuwait

Fig.07 Sulaibiya, Kuwait

Fig.08 Sulaibiya, Kuwait

The majority of these additions were constructed using steel framing and clad with tin or corrugated steel panels; the rationale behind the selection of such materials was ease of access, construction, lower labor costs if any, fast turnaround, durability and the overriding cheapness of the materials (Fig.09, 10, 11).

Fig.09 Sulaibiya, Kuwait

Fig.10 Sulaibiya, Kuwait

Fig.11 Sulaibiya, Kuwait

Understanding my roots allows me to recognize the *informal*, not just as a settlement that pops into existence, but rather it is a gradual process of necessity over time. Sulaibiya is not a one-off case, but rather a byproduct of economic conditions; in this case, the 'stateless', non-citizen people of Kuwait who have to live in inadequate conditions, with deteriorated homes, streets, communal spaces (Fig.12).

*

I am unable to shake off my past and I find myself daydreaming, where I envision a dystopian future with millions living with inadequate housing and resources. Rather than continue to have these dreams, I imagine the antidote is to begin researching the issues and try to find a solution for this problem that millions face. Possibly help build a community that is self-sustaining, but very affordable and efficient? So, what did I gain from my experience living in social housing that ended up as a 'slum'? It always struck me that I needed to create or be part of the solution to this global problem that affected my own family and loved ones in one of the richest countries in the world, Kuwait. I daydream about what the world would look like if this problem is not solved, and what it would be like if it were solved. Surely, when one attempts the impossible or even has borderline utopian ideas, they are most likely be called delusional.

Fig.12 Sulaibiya, Kuwait

Fig.13 Favela 1 – Rocinha, Brazil

Analyzing the Informal:

The phenomenon of informal settlements is vast and is a complex topic, but in this section, we will explore its characteristics and the housing typology utilized by its inhabitants. Informal settlements do set a precedent for affordable housing, but are perhaps inadequate to today's standards, as set by the United Nations Habitat program. In their fact sheet number 21 '*The Right to Adequate Housing*', the UNH sets the criteria for minimum adequate housing (Security of tenure, availability of services, materials, facilities, and infrastructure, affordability, accessibility, location, and cultural adequacy).[1]

> *"Informal settlements – are residential areas where inhabitants have no security of tenure vis-à-vis the land or dwellings they inhabit, with modalities ranging from squatting to informal rental housing, the neighborhoods usually lack, or are cut off from, basic services and city infrastructure and the housing may not comply with current planning and building regulations and is often situated in geographically and environmentally hazardous areas. In addition, informal settlements can be a form of real estate speculation for all income levels of urban residents, affluent and poor. Slums are the most deprived and excluded form of informal settlements characterized by poverty and large agglomerations of dilapidated housing often located in the most hazardous urban land. In addition to tenure insecurity, slum dwellers lack formal supply of basic infrastructure and services, public space and green areas, and are constantly exposed to eviction, disease, and violence."* [2]
>
> *Source: Habitat III Issue Papers.* Version 2.0. Quito, Ecuador: Habitat III, 2016.

To narrow down the vast topic of informal settlements across the globe, we will concentrate on four of the largest informal settlements in the world: Dharavi, India (Fig.14), Khayelitsha, South Africa, Kibera, Kenya (Fig.22), and Rocinha, Brazil (Fig.13). Each of these informal settlements presents a unique perspective on urban morphology and typology and the region they are located in.

Informal Settlement & Communities

Informal Settlement 01:

The Dharavi informal settlement in India houses approximately between 600,000 to 1,000,000 residents who live in mostly self-built housing. Dharavi is one of the largest informal settlements in the world and is extremely dense in terms of urban fabric (Fig.14). The housing typology varies in form and material, with some permanent structures and some are temporary in nature such as shacks. There seems to be no rationale to the urban pattern, but rather a spontaneous growth of structures atop of other structures due to land scarcity and availability. (Fig.14).

Fig.14 Dharavi, India

Fig.15 Dharavi, India

Due to this density, several issues are faced by the community: circulation, sanitation, public open spaces, communal spaces, community programs more. There are not many streets to speak of or public walkways, but rather litter and sewage infested pathways through the settlements (Fig.16). The outskirts or the edge of the settlement is mainly comprised of temporary structures such as sheds and shacks, possibly due to new settlers coming into the area (Fig.17). Certainly, Dharavi presents a unique scenario where the scarcity of land and increase of population led to the density and form of the urban fabric seen at present.

Fig.16 Dharavi, India

Fig.17 Dharavi, India

Fig.18 Khayelitsha, South Africa

Informal Settlement 02:

Khayelitsha, South Africa is considered a shanty town, and it is one of the largest in Africa. The settlement houses approximately 320,000 residents and is mainly comprised of low scale housing, essentially tin shacks (Fig.18, 19). Similar to Dharavi, the homes are mainly self-built of found materials, or purchased used/affordable material. The common material seen here is tin (corrugated steel panels), similar to that used in Sulaibiya, Kuwait.

Fig.19 Khayelitsha, South Africa

The urban fabric of Khayelitsha presents a more organized formation different from that observed in Dharavi. The lower number of residents with the site not restricted to expansion both led to the housing to be more spaced out, more dispersed with lower overall heights of buildings (Fig.20). There are dirt streets and more room for circulation due to the grid-like layout of the settlements, where houses back onto each other and the frontage leaving just enough room for circulation (Fig.21). By no means does this represent adequate housing, and most likely if the population continues to grow then increased density and severe conditions will set in similar to Dharavi.

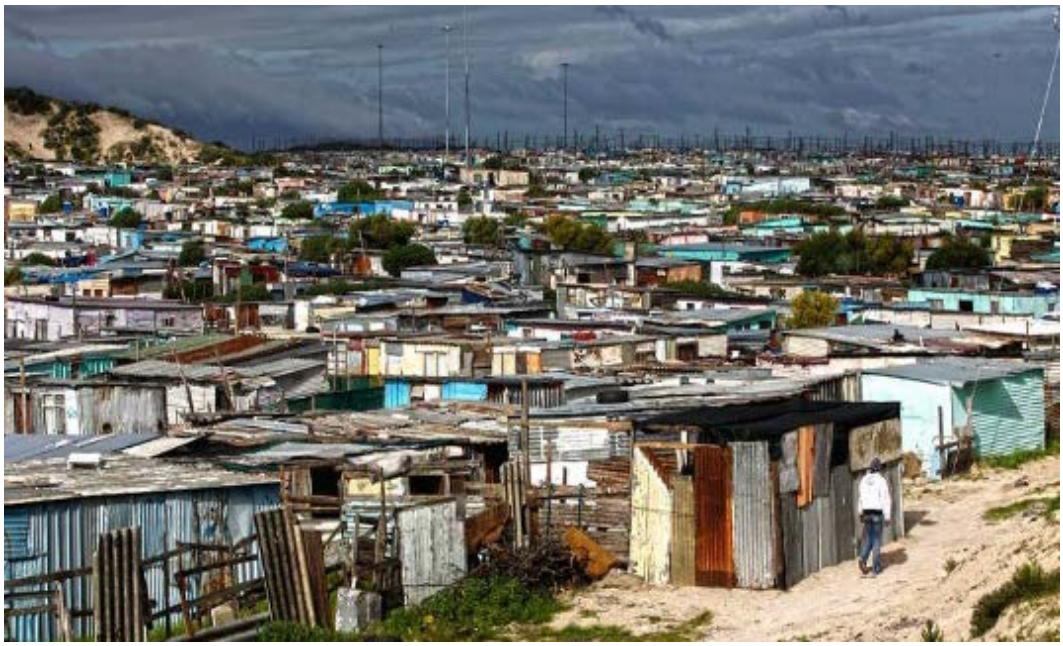


Fig.20 Khayelitsha, South Africa

Fig.21 Khayelitsha, South Africa

Fig.22 Kibera, Kenya

Informal Settlement 03:

Kibera, in Kenya, is another classification of a shanty town and is one of the largest informal settlements in the region. It houses approximately 1.2 million residents and is fairly dense in terms of housing proximities (Fig.22). The urban fabric of the settlement does not follow a grid, or form an organized pattern, but rather conforms and adapts to spatial inadequacies. Due to the increase of density, the early trace of second stories and/or the possibilities of building higher became more prevalent. (Fig.23). The main building vernacular is barn-like with self-built structures which will be explored in the following section.

Fig.23 Kibera, Kenya

Also due to the increase of density, no infrastructure supports the inhabitants, though there is a train that goes through the settlement (Fig.25). But there is little or no sanitation, sewage, garbage collection or electricity (Fig.24). Similar to Dharavi this settlement faces extreme conditions due to unregulated growth over the coming years.

Fig.24 Kibera, Kenya

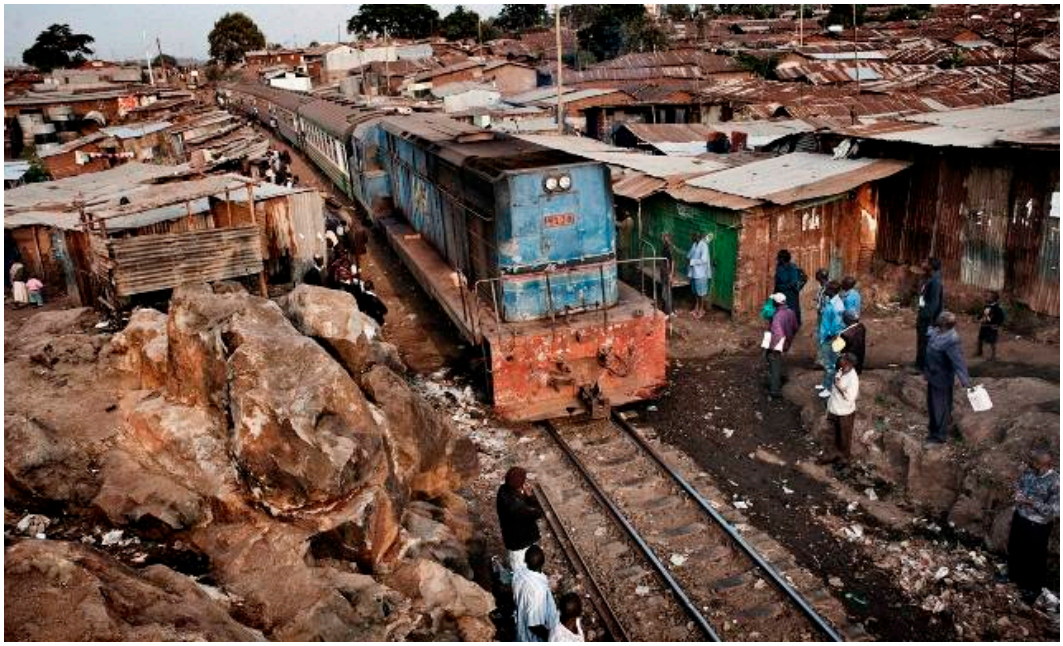


Fig.25 Kibera, Kenya

Fig.26 Rocinha, Brazil

Informal Settlement 04:

Rocinha is a favela, one of the most advanced informal settlements in South America, approximately housing 70,000 people. 'Advanced' in this sense refers to the level of infrastructure that has been established by the settlers over time: paved roads, structurally-sound building techniques, electricity, sanitation, traffic lights, and street lights, schools, and community centers. The settlements are situated on the side of a steep hill (Fig.13, 26) and similar to other informal settlements does not follow a specific grid pattern but presents a unique urban fabric. Out of this irregular fabric, however, there seems to be an order and a rationale within the organization of the housing communities (Fig.27).

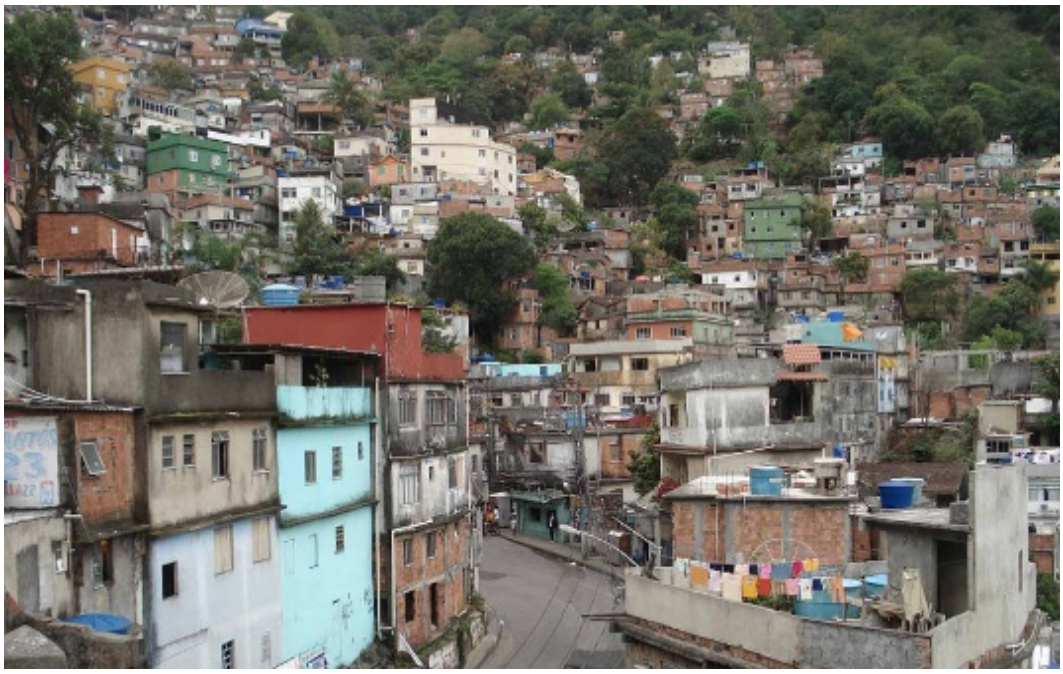


Fig.27 Rocinha, Brazil

This organization follows established circulation through the settlement and begins to produce a rhythm to the apparent chaos. This organization rose through the necessity and the lack of land to accommodate a further increase of density, thus demanding another ingenuity within the existing self-built structures. As residents increased their knowledge and know-how of building techniques, density and building heights grew. Amidst this rising density new challenges arose when it came to adapting to change. Change proves difficult due to the close proximity of each building to the other (Fig.28). Such a challenge highlights the inflexibility in – if we can refer to it as that - the building

system utilized. This forced many newcomers to move to the edges and live in more temporary structures such as shacks.

Fig.28 Rocinha, Brazil

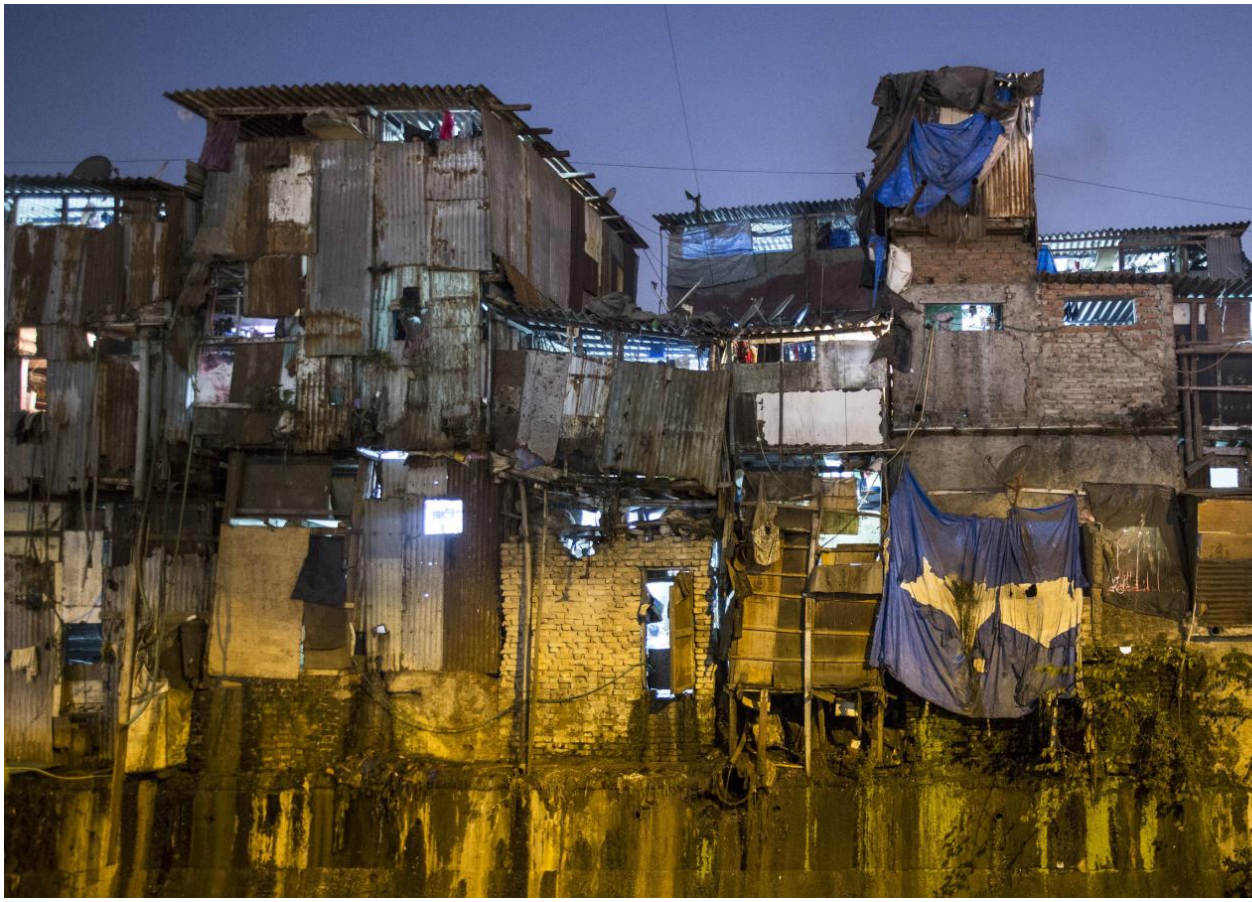


Fig.29 Dharavi, India

Informal Housing Analysis

The intention here is to establish a precedent for the willingness to self-build demonstrated in each of these communities, a willingness similar to that found in Sulaibiya, Kuwait. Each community had the capabilities to take on a project that required self-building strategies, and each community had a level of craftsmanship. In Kibera settlement, local materials such as mud and straw were used (Fig.30), whereas the Rocinha community utilized more advanced building techniques using mainly concrete, steel, and cinder blocks to build the homes (Fig.31).

Fig.30 Kibera, Kenya

Fig.31 Rocinha, Brazil

'The Seven Myths of 'Slums' challenging popular prejudices about the world's urban poor" by Adam W. Parsons, *Share the World's Resources.*[3] discusses the many misconceptions about slums and investigates each of the myths: *"The basic reason why shacks or houses are built on illegally occupied land in many low- and middle-income nations is straight forward; there is a gap between the cost of the cheapest 'legal' accommodation and what large sections of the population can afford".*[4]

Slums embed a wealth of experience and knowledge, demonstrating the capabilities of those who inhabit the slums. So much so that it is not far-fetched to advance the idea for affordable self-built architecture by understanding the motives settlers choose to build for themselves with found and discarded materials, even if lacking any infrastructure.

Lebbeus Woods in '*SLUMS: The Problem*', states why slums exist today and why they are in the condition they are in and why inadequate housing typology exists in these communities.[5] (Fig.29, 32, 33).

> *"Most slums exist in countries struggling to emerge from colonial exploitation, economic isolation, political anarchy, sectarian violence, and a host of other conditions that do not affect more developed countries, or not so drastically. Poverty is the cause of slums—people do not have money and little prospect of getting any. Thus, they don't have adequate food, drinking water, medical care, education, or any way to escape their poverty by moving away or up. They are trapped in poverty, more or less without hope".*[5]

Source: "SLUMS: The Problem." LEBBEUS WOODS. December 30, 2011. Accessed November 11,2018. https://lebbeuswoods.wordpress.com/2008/01/18/slums-the-problem/.

Fig.32 Dharavi, India

Fig.33 Khayelitsha, South Africa

Housing is a contemporary crisis. The case study set in Brazil about self-building or informal building outlines the process of homes being built informally on land without tenure or ownership and the negative effects of this informal process on the urban landscape and the quality of life.[6]

> *"The self-building process has been described as belonging to vernacular architecture or what is termed new traditional environments, but this new tradition must be qualified (Rapoport1988; Kellett & Napier 1994). Studies have shown that vernacular architecture in many places is based on profound elements which embody environmental quality. The self-building process in Brazil,"*
>
> *"Saharan Africa's urban population will take place against a background of poverty and deprivation between now and 2020." If present trends continue over the coming decades, we can expect the same things as forewarned in the 1989 classic Squatter Citizen: "…tens of millions of more households living in squatter settlements or in very poor quality and overcrowded rented accommodation owned by highly exploitative landlords. Tens of millions more households will be forcibly evicted from their homes… The quality of many basic services (water, sanitation, and garbage disposal, health care) will deteriorate still further, and there will be a rise in the number of diseases related to poor and contaminated living environments."*
>
> *"However, has specific characteristics and problems? Mainly due to low-quality design solutions, self-built houses present on the whole a low environmental comfort standard (Labaki & 96 D.C.C.K. Kowaltowski et al. / Habitat International 29 (2005) 95–111 Kowaltowski, 1998). The local new vernacular thus lacks some of the positive elements of many traditional buildings, especially praised for their intelligent solutions to climatic problems."*[6]
>
> Source: Doris C.C.K. Kowaltowski, Silvia A.Mikami G. Pina, Regina C. Ruschel, Lucila C. Labaki, Stelamaris R. Bertolli, Francisco Borges Filho, Édison Fávero, *A house design assistance program for the self-building process of the region of Campinas*, Brazil: Evaluation through a case study, Habitat International, 2005, Volume 29, Issue 1, Pages 95-111.

identifying the types of homes that exist in these informal settlements opens up possibilities and strategies for new housing solutions and the market conditions

required for them. The lack of government participation in supplying or providing the opportunity for the markets to supply affordable housing leads to extreme conditions, where citizens take the informal route. This is a condition outlined by United Nations Habitat, stated in the guide 'Enabling Shelter Strategies: Design and Implementation Guide for Policymakers'.[7]

> "Hundreds of millions of people live in inadequate housing in slums and informal settlements, in particular in developing countries. A primary reason for this is the failure of housing markets in those countries to deliver adequate housing at affordable prices. Effective enabling shelter strategies address market failures directly and improve the functioning of the housing sector. In doing so, they serve the interests of all stakeholders in the housing sector—consumers, producers, and financiers, as well as central and local governments. The overall result is a well-functioning housing sector."[7]
>
> Source: Majale, Michael. *Enabling Shelter Strategies: Design and Implementation Guide for Policymakers.* Nairobi: United Nations Human Settlements Programme (UN-HABITAT), 2011.

Here analysis moves away from initial ideas of why slums or informal settlements have come to fruition, or that slums exist because people are poor and are due to migration. This of course still holds some truth but the challenge is to understand why it is the way it is. 'The Seven Myths of 'SLUMS' has begun to change perceptions identifying how these slums will not go away without action.[8]

"Setting aside all of these analytical and conceptual problems, some straightforward observations can be made about where the world stands in relation to the slums challenge. Firstly, no statistics are required to reveal what every urbanite in the developing world must realize: that the problem of slums is a growing reality. Although the UN's data on slums is contestable and probably underestimated on many counts, the latest figures revealed that "the urban divide still exists" and is expected to increase in coming years. Even according to UN-HABITAT's significantly downward-revised figures, the global slum population will probably grow by six million people each year unless drastic action is taken. Put bluntly, the absolute number of slum-dwellers across the world is expected to increase, and keep on increasing. The number of town and city-dwellers is expected to rise to two-thirds of humanity by 2030, and in the case of sub-Saharan Africa it is likely "that nearly half of the growth in sub- Saharan Africa's urban population will take place against a background of poverty and deprivation between now and 2020." If present trends continue over the coming decades, we can expect the same things as forewarned in the 1989 classic *Squatter Citizen*: "…tens of millions of more households living in squatter settlements or in very poor quality and overcrowded rented accommodation owned by highly exploitative landlords. Tens of millions more households will be forcibly evicted from their homes… The quality of many basic services (water, sanitation, and garbage disposal, health care) will deteriorate still further, and there will be a rise in the number of diseases related to poor and contaminated living environments.".[8]

Source: Parsons, Adam W. *The Seven Myths of Slums: Challenging Popular Prejudices about the Worlds Urban Poor*. London: Share the Worlds Resources, 2010.

Slums are not a nuisance or just an unfortunate reality of the poor, but represent a system starting at the official level of governance and ending with the market place, leading to such extreme conditions and realities for these inhabitants or informal settlers.

Fig.34 Dharavi, India

This must lead to a new understanding of the informal housing typology and informal building in terms of construction methods and materials. Materials used are mainly discarded or found and don't always provide adequate structural or environmental value. The repetitive use of corrugated steel even in a wealthy country of Kuwait, which was used in Sulaibiya created its own building

typology. The abundance of the material found in garbage dumps or construction sites and is fairly light to carry, besides being rigid and waterproof, made it an easy material to work with and install. The corrugated steel panels produce a new vernacular that starts to be associated throughout these developments. (Fig.34, 35).

Fig.35 Dharavi, India

These informal settlements might seem to follow an urban pattern at first, (Fig.12-25), but this fabric emerged out of land scarcity and minimum access to

infrastructure. This a hive-like morphology emerges where each home relies on the one next to it, producing an intersecting and even fairly efficient community. The lack of land and space led to the next housing typology, where - in India and Brazil - houses began to rise up in the number of storeys (Fig. 26, 36), Khayelitsha has also begun expanding upwards (Fig.37) and it is likely that Kibera will follow suit over time.

Fig.36 Rocinha, Brazil

Fig.37 Khayelitsha, South Africa

These inadequate Informal housing solutions have risen out of necessity, and the potential for major disasters in the future is high. Brazil shows also how such self-building strategies contribute to a lower quality of life if that is possible.

> *"The self-building process has been described as belonging to vernacular architecture or what is termed new traditional environments, but this new tradition must be qualified (Rapoport1988; Kellett & Napier 1994). Studies have shown that vernacular architecture in many places is based on profound elements which embody environmental quality. The self-building process in Brazil,"*

Source: Doris C.C.K. Kowaltowski, Silvia A.Mikami G. Pina, Regina C. Ruschel, Lucila C. Labaki, Stelamaris R. Bertolli, Francisco Borges Filho, Édison Fávero, *A house design assistance program for the self-building process of the region of Campinas*, Brazil: Evaluation through a case study, Habitat International, 2005, Volume 29, Issue 1, Pages 95-111.

As present conditions in Dharavi, Khayelitsha, Kibera, and the outskirts of Rocinha do not meet the minimum requirements set out by the United Nations (Fig.38, 39, 40, and 41).

> "Hundreds of millions of people live in inadequate housing in slums and informal settlements, in particular in developing countries. A primary reason for this is the failure of housing markets in those countries to deliver adequate housing at affordable prices. Effective enabling shelter strategies address market failures directly and improve the functioning of the housing sector. In doing so, they serve the interests of all stakeholders in the housing sector—consumers, producers, and financiers, as well as central and local governments. The overall result is a well-functioning housing sector."[7]
>
> Source: Majale, Michael. *Enabling Shelter Strategies: Design and Implementation Guide for Policymakers*. Nairobi: United Nations Human Settlements Programme (UN-HABITAT), 2011.

any solutions then must meet the minimum requirements or criteria set by UN-Habitat and account also for market strategies.

> "Security of tenure, availability of services, materials, facilities and infrastructure, affordability, accessibility, location, and cultural adequacy."
>
> Source: *The Right to Adequate Housing*. Geneva: Office of the United Nations High Commissioner for Human Rights, 2009.

Fig.38 Dharavi, India

Fig.39 Khayelitsha, South Africa

Fig.40 Kibera, Kenya

Fig.41 Rocinha, Brazil

Informal Housing Typology

Looking at the housing typology in four regions of the world that have some of the largest informal settlements helps to further understand these extreme conditions, and begin developing a solution for affordable housing. We will use the approach of an 'Assembly System'; not dissimilar to what has been observed in these communities. The purpose is to use the willingness of the settlers/inhabitants of to self-build and utilize the level of craftsmanship or skills they might have. Each region relies on locally sourced materials either discarded or new and we will attempt to show how informal settlements over time may become self-sufficient and advance their own building techniques. The suggestion is that these communities are able to advance and improve over time if given the opportunity and the resources.

All the houses chosen to be shown in this proposed illustrated catalog serve a purpose in demonstrating the required craftsmanship of the building typology, the level of advancements each community can make and the materials associated with these buildings. Height variances show how some communities have extreme overpopulation thus increasing building heights to increase density per footprint of each area of land developed.

Dharavi, India Housing Typology:

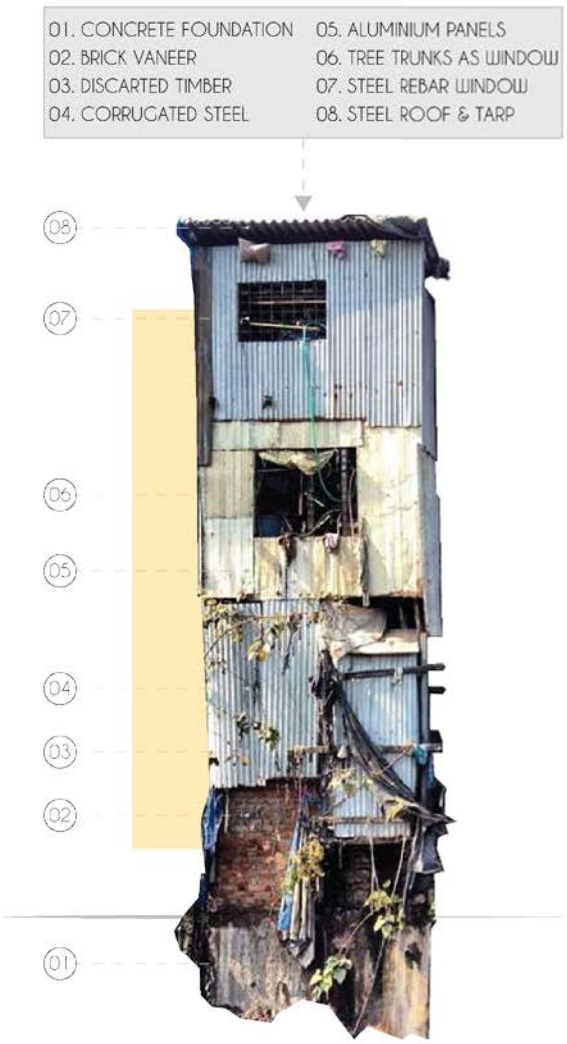


Fig.42 Dharavi House 1

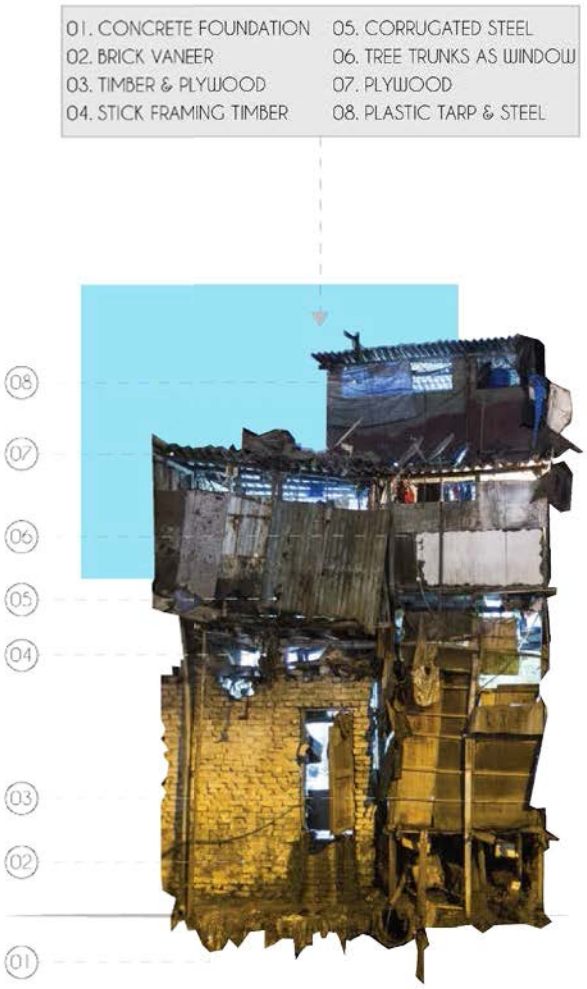


Fig.43 Dharavi House 2

Dharavi, India Housing Typology:

Fig.44 Dharavi House 3

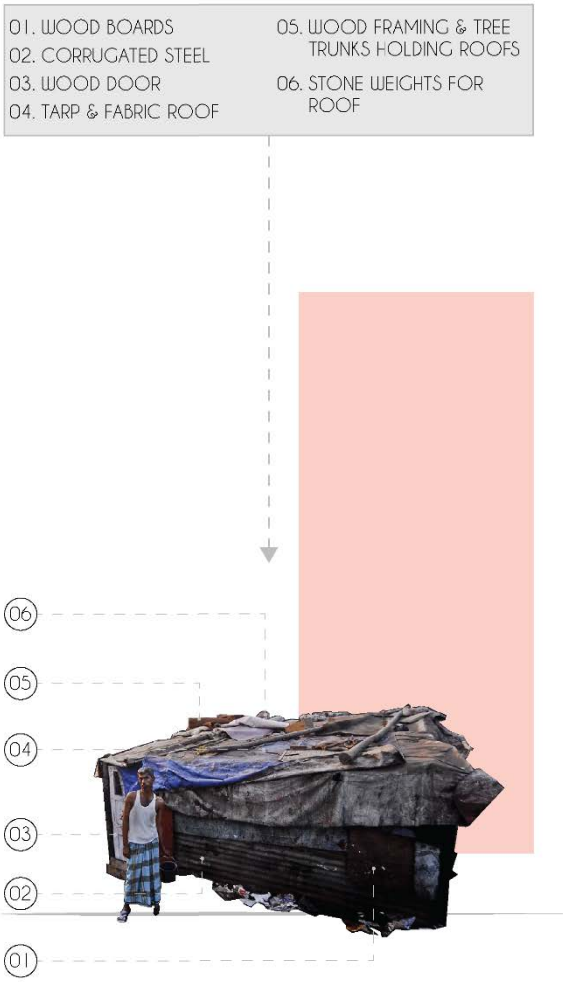


Fig.45 Dharavi House 4

Khayelitsha, South Africa Housing Typology:

Fig.46 Khayelitsha House 1

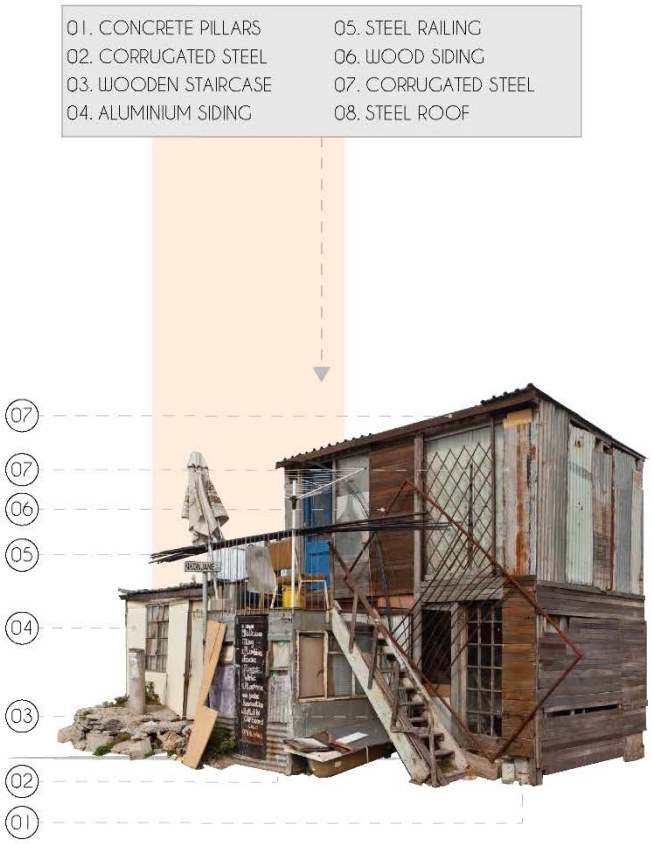


Fig.47 Khayelitsha House 2

Khayelitsha, South Africa Housing Typology:

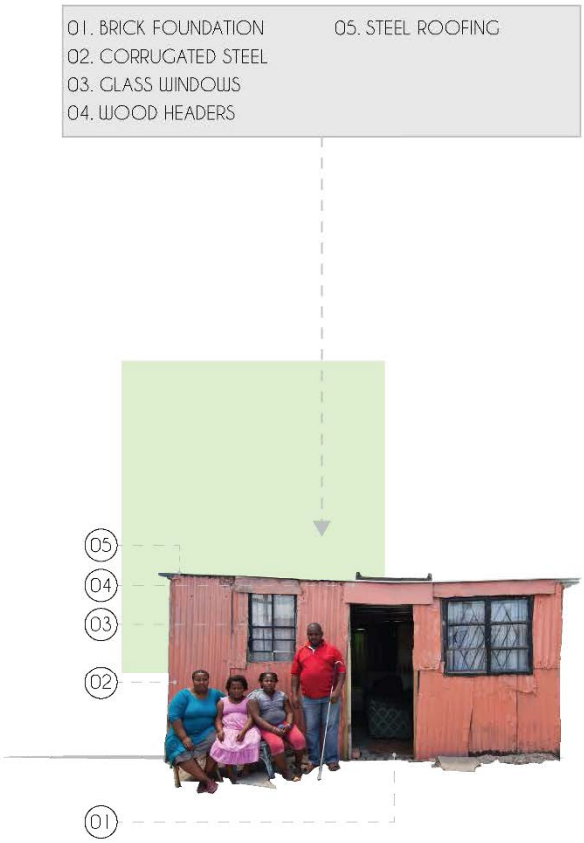


Fig.48 Khayelitsha House 3

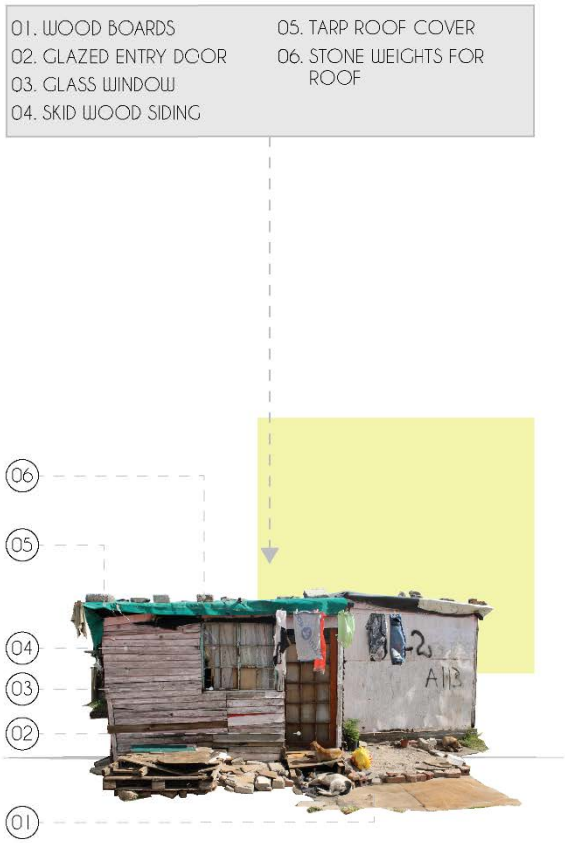


Fig.49 Khayelitsha House 4

Kibera, Kenya Housing Typology:

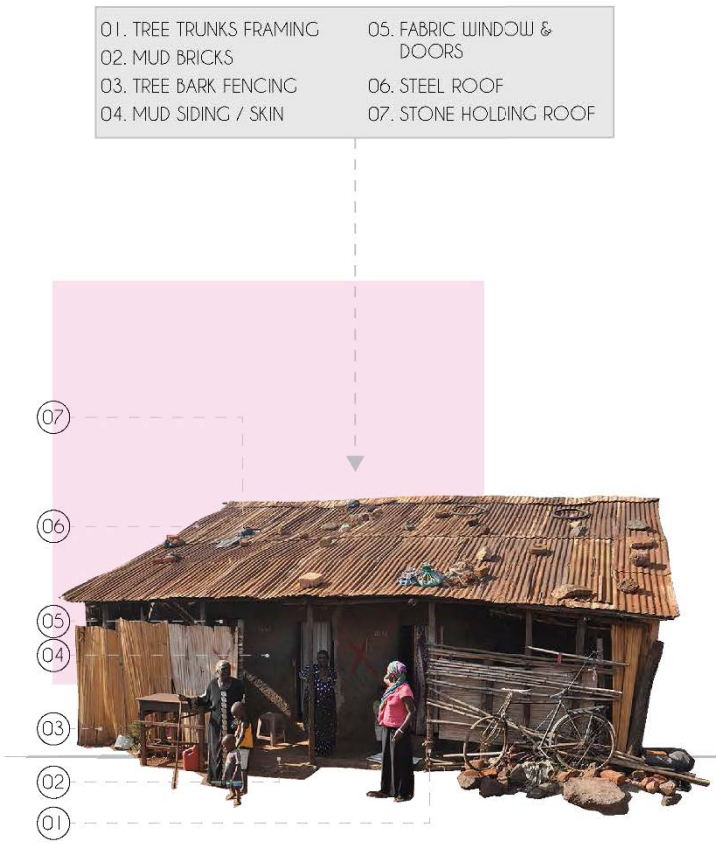


Fig.50 Kibera House 1

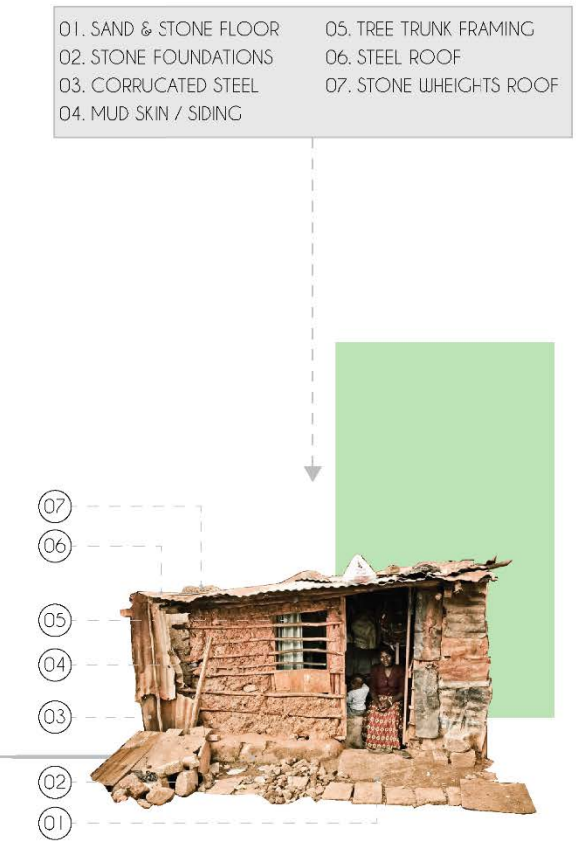
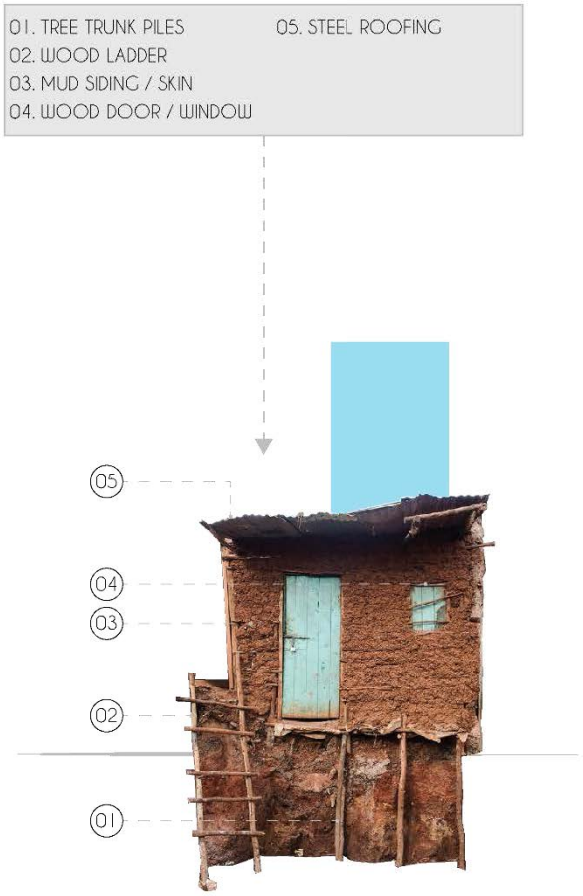


Fig.51 Kibera House 2

Kibera, Kenya Housing Typology:



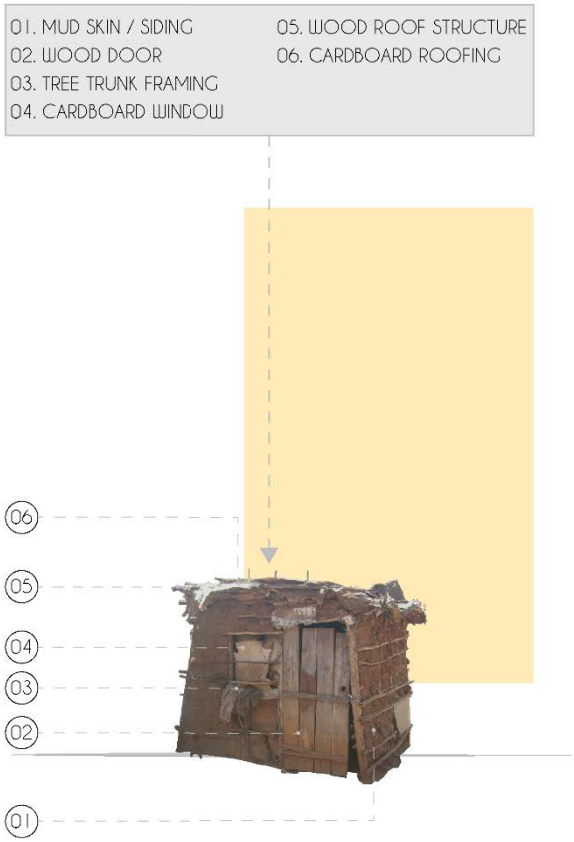


Fig.52 Kibera House 3

Fig.53 Kibera House 4

Rocinha, Brazil Housing Typology:

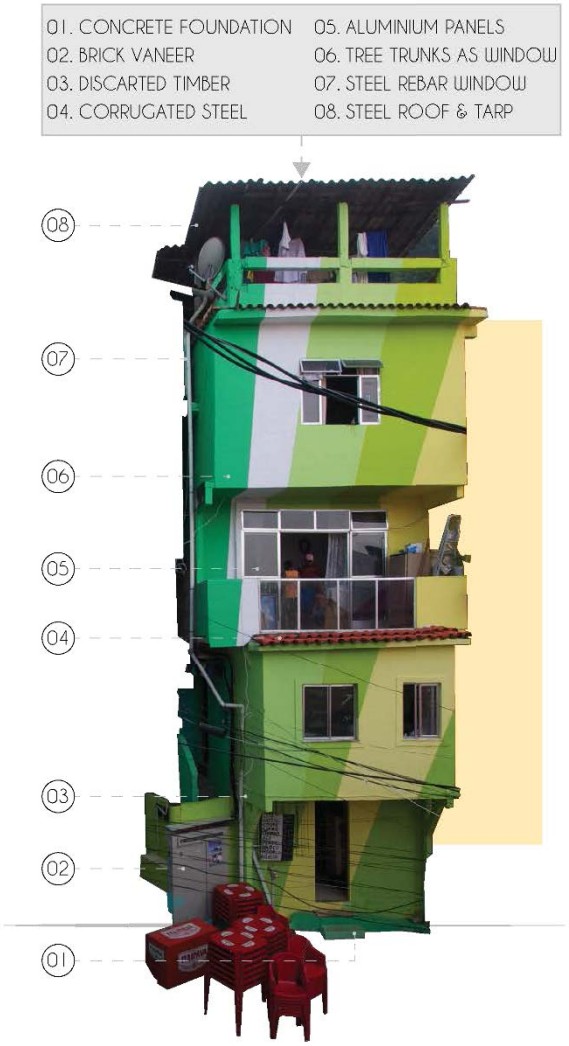


Fig.54 Rocinha House 1

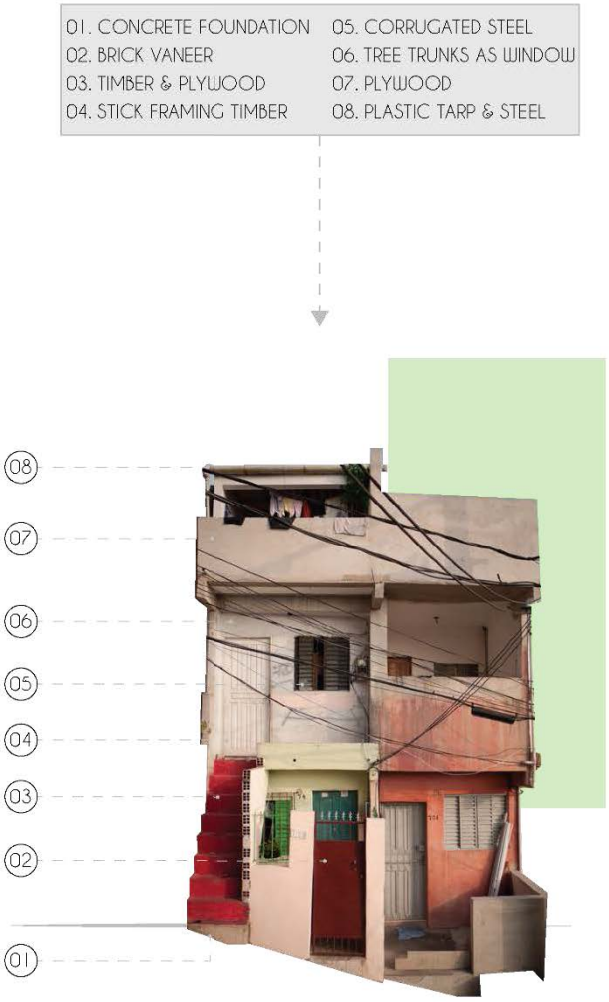


Fig.55 Rocinha House 2

Rocinha, Brazil Housing Typology:

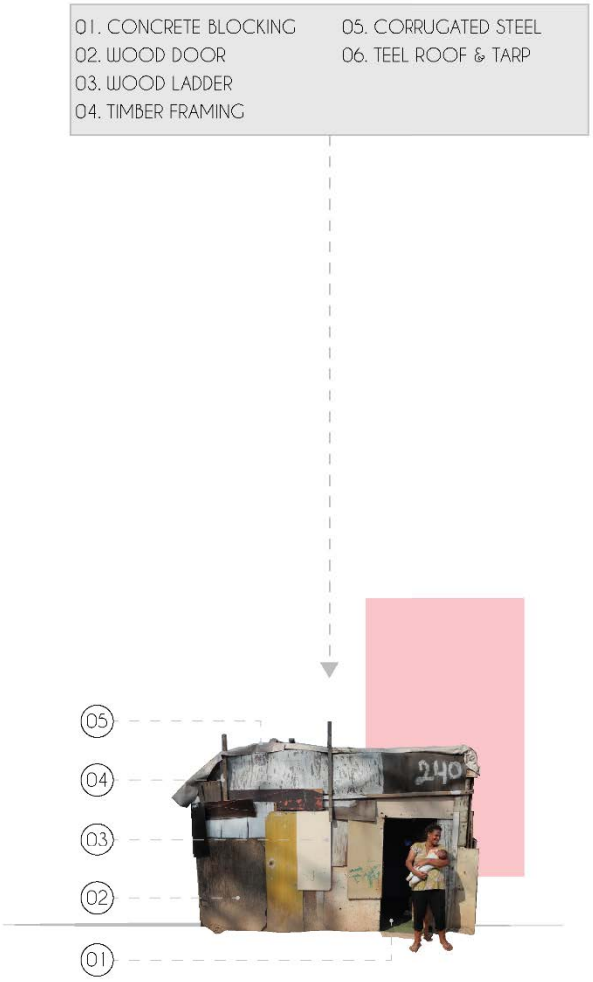


Fig.56 Rocinha House 3

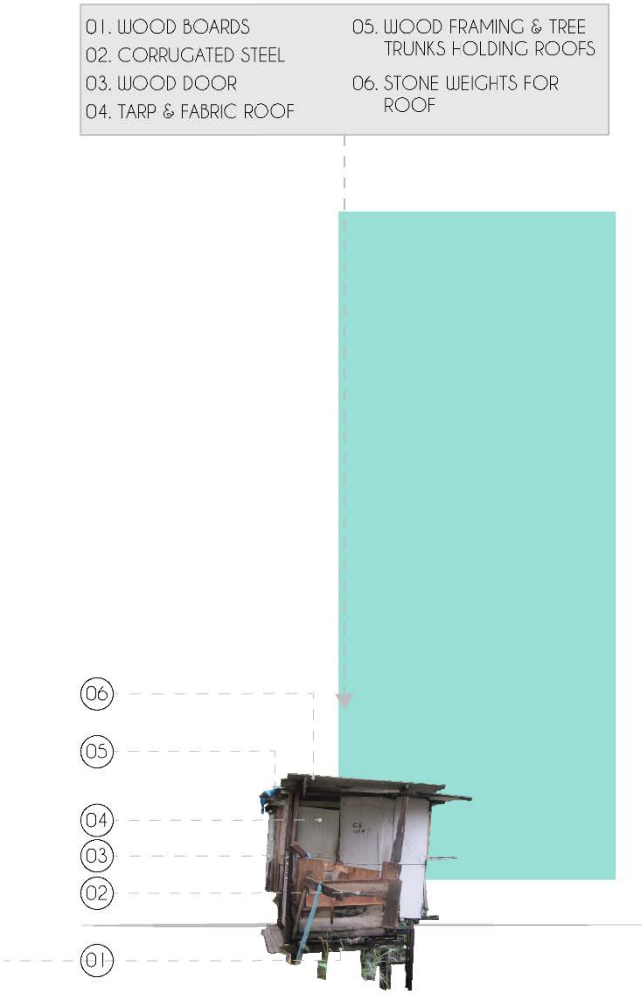


Fig.57 Rocinah House 4

The housing typology cataloged above showcases the willingness of the self-building settler to build shelters for themselves and their families. It is quite possible if presented with a new and innovative 'Assembly System' or 'Building System' this could improve their current living conditions and possibly provide a better future. The probability of such a community embracing the new building system is most likely high. Slums exist today and they are a fact of reality, these informal settlements provide new morphologies, urban organization and a unique housing typology arising out of ingenuity and the passion and necessity of survival.

It is suggested that professional practice should take on the issue of inadequate housing as a challenge that faces the profession and the global market for housing. Understanding the conditions that lead to informal settlements and the wealth of knowledge and experience possessed by these informal settlers allows settlers to become part of the solution: a possible combination of professionally designed housing assemblies which are self-built by the user. This strategy could lead to a new type of housing typology from the perspective of the architect but at the same time a more traditional housing typology from the perspective of the resident.

In the following section, we will explore such measures taken by organizations and professional practices when attempting to develop a viable solution to the affordable housing problem in the wider sense.

Fig.58 Iquique 1, Chile

Analyzing the Self-Built (Case Studies)

Self-building is not a new topic when it comes to architecture and its practice, but it is an important topic to be discussed in present times due to the rise of inadequate housing and the potential access to affordable housing. Several initiatives combating the lack of access to habitable and affordable shelters have been attempted across the globe. One of the key areas in this is giving control back to the people and aiding them to self-sustain and define their future by deciding their own outcome. In the book "*Self-Build Homes: Social Discourse, Experiences and Directions*" Linn (1969) states:

> *"People are alienated from their physical environment if they are unable to leave their personal imprints on their immediate surroundings. Relegating human beings to the role of passive spectators of their environment threatens their mental equilibrium, and robs them of the opportunity to assert their authority, to develop mastery over their places of habitat."*[9]
>
> Source: Benson, Michaela. *Self-build Homes: Social Discourse, Experiences and Directions.* London: UCL Press, 2017

This will help us as we now expand four case studies that have attempted and successfully achieved projects that were fully or partially self-built by the community or the residents of the individual homes.

Self-Built 01 – Masoro Village - Rwanda:

Fig.59 Masoro 1, Rwanda

This is the initiative by GA Collaborative (General Architecture Collaborative) a nonprofit organization out of the United States. The project is specifically designed to account for material scarcity and extreme financial limitations in the region. The project is to build small family homes (Fig.59) for the members of the women's cooperative in Kigali, Rwanda. The project cuts out the need for

professional labor, designers, and contractors. Thus, the opportunity is given to the community to gain the necessary skills required to build these small family homes. The project does not require training or construction techniques or experience, thus empowering the people to decide on what to build (Fig.60).

"where a 'traditional African way of life' is simply a polite name for poverty." [2] One wonders how GA Collaborative and its Masoro clients would represent Rwandan domesticity given an American-sized budget. Ultimately, though, their project is less about the politicization of architecture than the 'architecturalization' of the political—a subtle semantic distinction, maybe, but one that shifts the importance from the built project to the project of building, from noun to verb. While the Masoro Village Project prototype has yet to be tested by habitation, the process and fieldwork involved in its realization have demonstrated that designers can deploy design and construction procedures politically (and cheaply), to serve an underserved global public. "10

Furguson, GA Collaborative

Fig.60 Masoro 2, Rwanda (illustration)

The people get the chance to educate themselves and be involved in the process from start to finish (Fig.61). The project does not follow traditional construction methods, but rather uses new techniques.

Fig.61 Masoro 3, Rwanda

The uncommon building method utilized here is earthbag construction which has never before been used in Rwanda. The earthbag method uses large plastic bags, either new or discarded, filled with dirt from the site, and then stacked on top of each other to form walls (Fig.62). Doors and windows if any are positioned

in place as the walls are being built (Fig.63). Finally, the walls are clad with a skim coat of mud as protection from the elements such as rainwater. This is happening simultaneously as the building is constructed.[11]

Fig.62 Masoro 4, Rwanda

Fig.63 Masoro 5, Rwanda

Self-Built 02 – Empower Shack - South Africa:

Fig.64 Empower 1, South Africa

This project was initiated by the design strategy collective *Urban-Think Tank,* to solve the problem of housing conditions for informal settlers across South Africa's largest slums. There are approximately over 2700 informal settlements across the region, and such initiative is important in setting a precedent for prototype housing for the region that could be self-built. 'Empower Shack' is comprised of developing and designing a 2-storey low-cost shack, in a *design-and-build* a workshop in Khayelitsha (Fig.64). The project involves the community as a whole

in determining a strategy of developing a system of building blocks to be arranged and organized in such a way to allow for circulation and access to the general services system, such as emergency vehicles and sanitation (garbage collection) whilst taking into account the infrastructure associated with building a community (Fig.65).

"Our work on the Empower Shack project is not the result of the usual architectural pursuit for a new housing typology. While we are absolutely trying to innovate upon the design and technology of low-cost housing, we're more concerned with the general 'system' that surrounds housing in the context of informal South African settlements. This includes the infrastructure that makes housing decent, such as power and sanitation, along with the urban configuration of homes. The Empower Shack project seeks to address these larger challenges, and in doing so, hopefully changes not just the built landscape of places like Khayelitsha, but also the social, political and economic structures that shape residents' lives." 12

Alfredo Brillembourg, Urban Think Tank

Fig.65 Empower 2, South Africa

The first storey of the home is the main living space and the second serving as the sleeping area, both levels are open with no separation walls except for the washrooms (Fig.66, 67).

Fig.66 Empower 3, South Africa

The 'Empower Shack' takes on the approach of using familiar materials and construction methods, so that the residents who choose to embark on taking on the project of building their own homes can do so with ease. The structure is based on traditional stick framing construction, rough lumber for the main structure and plywood sheets for the roof, and flooring. The structure is then clad with corrugated tin/ steel panels due to their light weight, ease of access, cost-effectiveness, and quick assembly (Fig.68). Essentially, the materials and

methods are already in use in Khayelitsha, as we have seen in the previous section when analyzing the housing typology in Khayelitsha. Nothing is out of the ordinary in terms of material selection, rather the process of planning out the design and execution of the design makes the difference here. Educating the residents of these informal settlements is key to a successful outcome of not only bringing in techniques for affordable construction but a quality-controlled process which produces safe and habitable homes for the ones who need it most.[13]

Fig.67 Empower 4, South Africa

Fig.68 Empower 5, South Africa

Self-Built 03 – Kambi Moto Housing - Kenya:

Fig.69 Kambi 1, Kenya

'Kambi Moto' is a housing initiative started by 'The Technical Team' comprised of an informal group or network of professionals such as architects, planners, engineers, surveyors, and others. The team worked with the local NGO, the Pamoja Trust, Nairobi City Planning Department and the local universities in the region, in order to collaborate with the residents of Kambi Moto in Huruma,

Nairobi, Kenya. The project aims to establish an opportunity for the local community to build their own homes, get the chance to secure land tenure and ultimately expand and develop their skills. The housing project is incremental in nature, where homes are built one level at a time, and expanded over a longer period span by the people when it is financially feasible (Fig.69, 70).

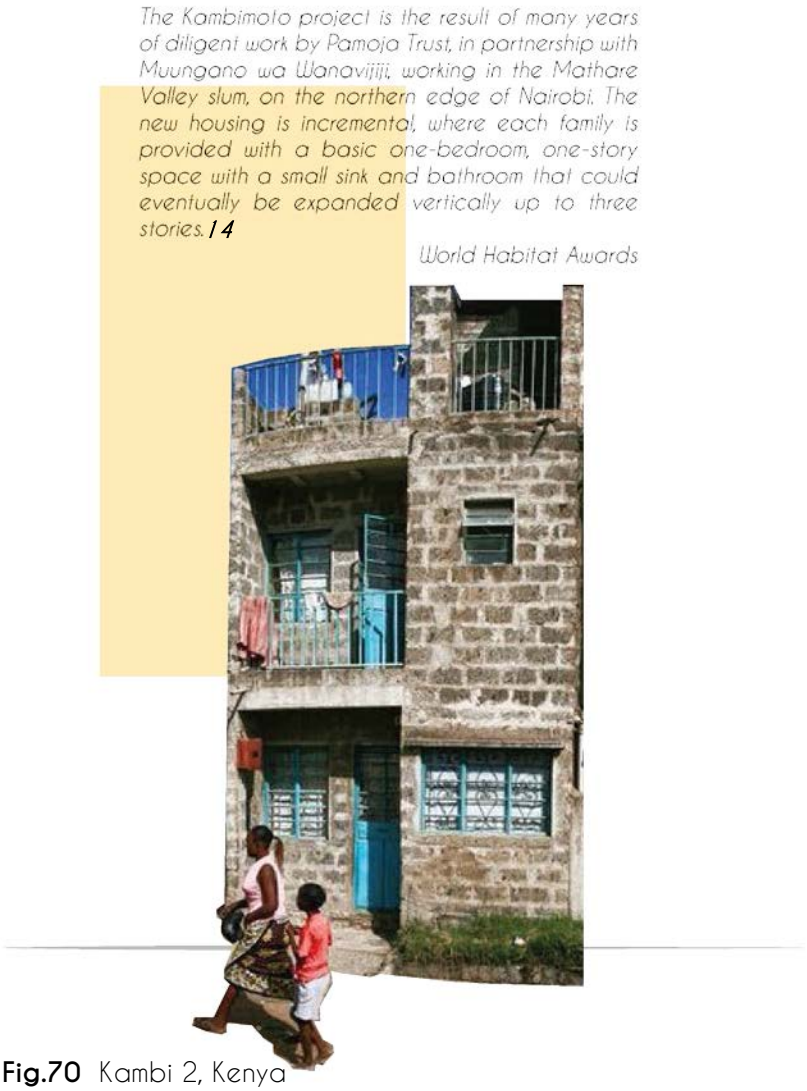


Fig.70 Kambi 2, Kenya

The main structural element here is cinderblock made of concrete and is assembled on site by using locally sourced mud and cement (Fig.70). These are basic structures initially with no windows, but rebar or steel rods to act as windows and incrementally upgraded when it is feasible for each home dweller.

Fig.71 Kambi 3, Kenya

Fig.72 Kambi 4, Kenya

Fig.73 Kambi 5, Kenya

This incremental building process allows for affordable housing: as each family grows and expands, they are able to increase the amount of space needed. Or when the residents feel that they can financially increase their livable space, they are able to do so as the design allows for expansion, (but no more than three stories). *The Technical Team* designed the structure to hold a maximum of three floors/levels per dwelling. Initially, it is one level, a basic residence enough to house the settlers until they are able to expand and build higher. This allows for a successful transition from the shacks they used to live in over a much shorter time frame rather than waiting for all three stories/levels to be completed, which traditionally takes longer to construct. From the initial single level structure to the present three storey structures of today, we can see the progress that has been made by the community (Fig.74, 75).[15]

Fig.74 Kambi 6, Kenya

Fig.75 Kambi 7, Kenya

Self-Built 04 – Iquique Housing - Chile:

Fig.76 Iquique 2, Chile

The Iquique Housing initiative started by Alejandro Aravena in conjunction with a local firm 'Elemental'. Together they designed and developed a housing typology consisting of primary concrete structures comprised of a single ground level and two stories taking up half of the footprint, leaving the second half open for future growth (Fig.76, 77). The second half is to be designed or built

by the homeowner on their own time and terms. This represents a unique approach to solving the social housing problem for the poor in Chile. Aravena states that 60% of housing in Chile is a form of social housing and subsidized by the government.

Arevena, further states that these types of subsidies are not enough to cover fully constructed structures or homes with enough room and space for a small family. Elemental's unique approach was to build half the structure (approximately 36 square meters in total) at a higher structural and finished quality. (Fig.77).

Fig.77 Iquique 3, Chile

The remainder of the second half of the house is to be constructed and expanded to the individual/family's need and financial capabilities. This strategy not only allows families to expand their livable space over time but to increase the house value as well. Building only half the building is an interesting approach to design because the possibilities of affordable and culturally appropriate designs are achievable (Fig.78).

Fig.78 Iquique 4, Chile

Other important aspects of this housing project are ownership and land tenure. Aravena explains that without ownership, the resident or homeowner would not feel the need in improving or investing in the project, because of the lack of return. Advocating for the ownership of the home allows for residents to put in the extra effort in improving and expanding their dwellings. Finally, by allowing the owner to decide what goes in the open half of the building has yielded interesting results in terms of how space is defined (inside, outside), and ultimately how the dwelling looks and feels like someone's home (their pride and joy) where efforts well spent (Fig.58, 79).[17]

Fig.79 Iquique 5, Chile

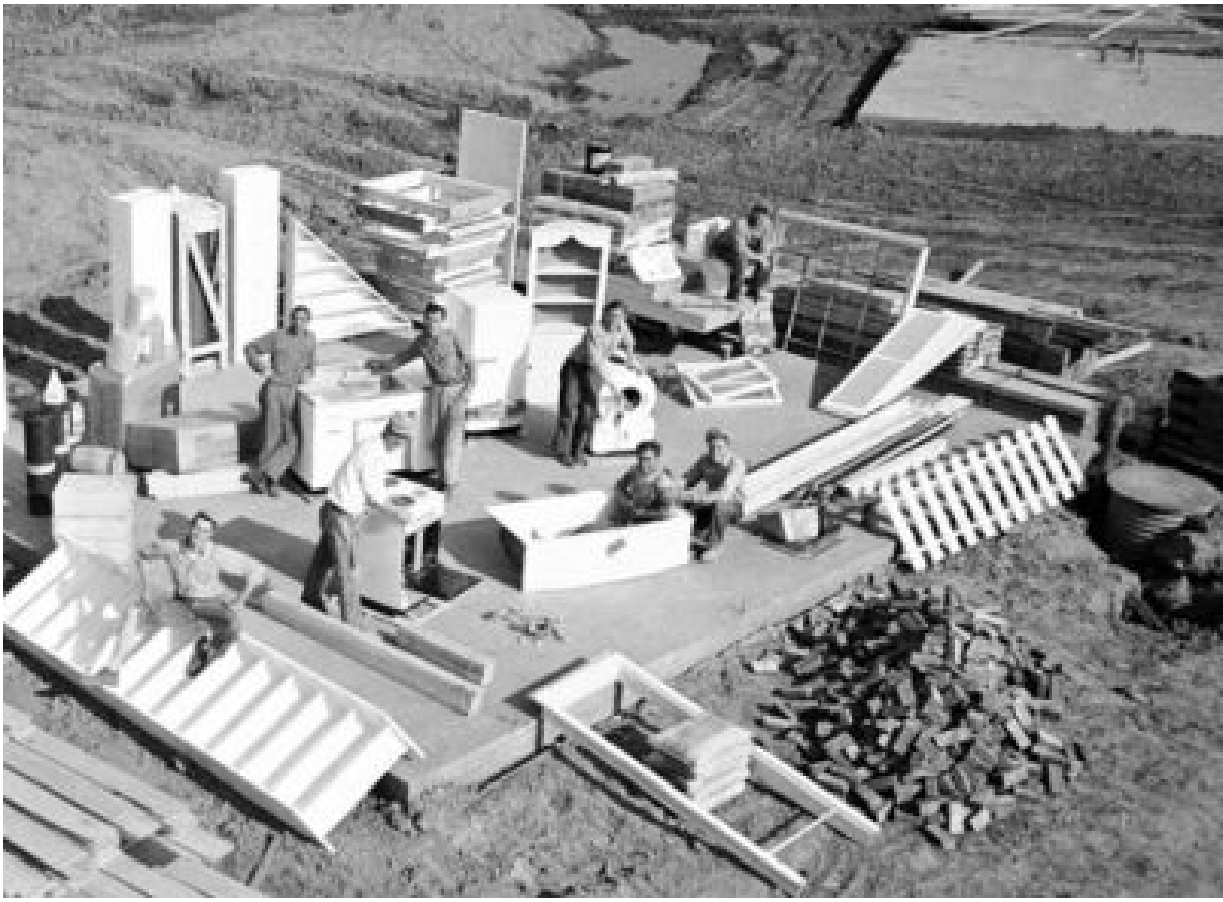


Fig.80 Levitt 1, Levittown 1949

Assemblies:

The idea of assembled homes is not new; it is as old as 'Levittown' (1949) designed and developed by Abraham Levitt and his two sons (Fig.80). One of his son's William Levitt was coined the father of modern suburbia. He essentially improved the building process by utilizing an assembly-line-like system. In this system each component was precut, numbered, and assembled (Fig.81).[18]

Fig.81 Levitt 2, Levittown 1949

Also, Levitt used off the shelf components, such as cabinets, stairs, toilets, doors, windows and so forth. 'Levittown' is not necessarily the solution to solving the crisis of affordable housing, but rather sets a precedent for the possibilities of prefabrication within today's advanced techniques and technology.[19]

What then are the processes necessary to begin developing new ideas and possible solutions for affordable housing? Prefabrication is one of these solutions, and if utilized then we must ask what possibilities are there to make an efficient and cost-effective way of prefabricating building components to be self-assembled into someone's future home?

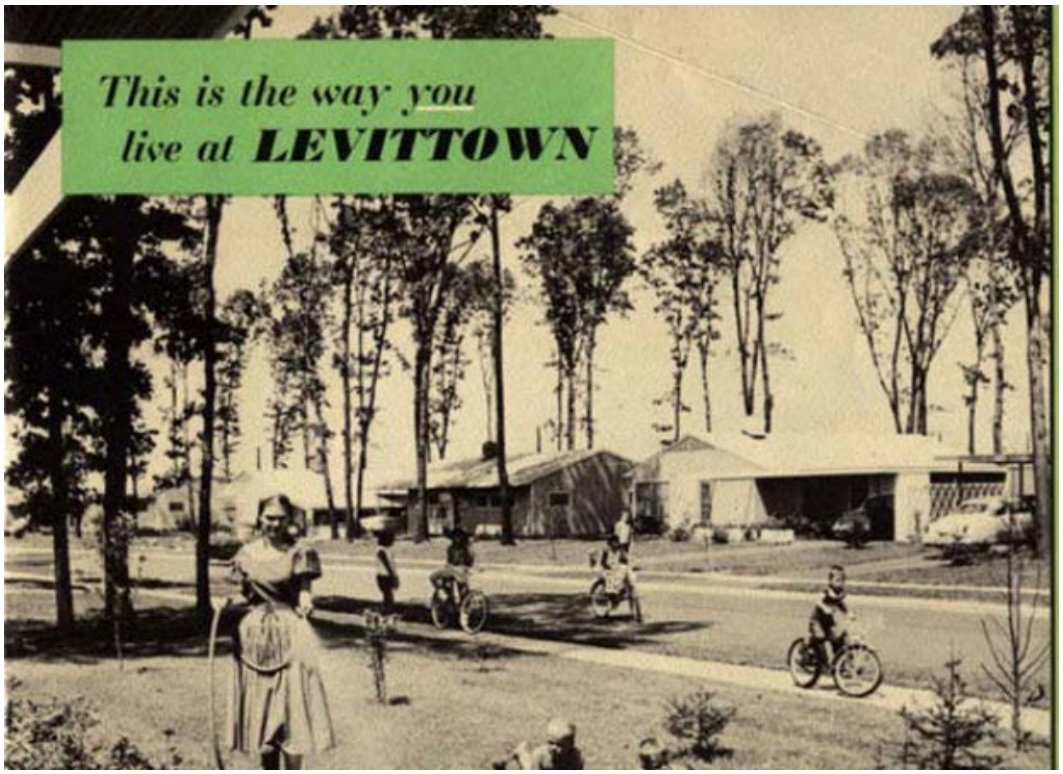


Fig.82 Levitt 3, Levittown 1949

Prefabrication Explorations

Prefabrication is one of the main sources for emergency shelters, and certainly is growing in the housing market. The two are similar in prefabrication, but not in component breakdown and assemblies. Emergency shelters tend to come either fully assembled or flat packed components that can be assembled easily. Emergency shelters usually only have basic necessities as they are a temporary measure, but prefabricated homes are more complex in nature as they usually include that is needed to make a permanent building.

> "Non-displaced disaster-affected populations should be assisted on the site of their original homes with temporary or transitional household shelter, or with resources for the repair or construction of appropriate shelter. Individual household shelter for such populations can be temporary or permanent, subject to factors including the extent of the assistance provided, land-use rights or ownership, the availability of essential services and the opportunities for upgrading and expanding the shelter. Displaced populations who are unable to return to their original homes often prefer to stay with other family members or people with whom they share historical, religious or other ties, and should be assisted to do so. When such dispersed settlement is not possible, temporary communal settlement can be provided in planned or self-settled camps, along with temporary or transitional household shelter, or in suitable large public buildings used as collective centres." [20]
>
> *The Sphere Project: Humanitarian Charter and Minimum Standards in Humanitarian Response.* Rugby: Sphere Project, 2011.

The above extract from 'The Sphere Project: Minimum Standards' is stating that populations or residents who have lost their homes due to natural or unnatural disasters are to be assisted with building new homes temporary or permanent in

nature to be constructed on the same site they have lived on before the disaster and or repairing their existing homes. Some of the assistance includes infrastructure, access to civil services, sanitation, land tenure, and use, and opportunities to expand in the future. If the former is difficult or not possible to achieve, other measures are to be implemented such as temporary communal settlements, public centers, or assisting self-settled camps. In short, the extract is including the possibility of prefabrication and self-building strategies.

It is safe to assume that prefabrication today is advancing in techniques and construction methods as any industry would advance in such a manner due to technological advancement over time, and also it is safe to assume that professionals or certified builders are needed to assemble the buildings. How then to develop a newer approach to prefabrication strategies?

> "Shelter solutions should be adapted to the geographical context, the climate, the cultural practice and habits, and the local availability of skills as well as accessibility to adequate construction materials in any given country." [21]
>
> *The Right to Adequate Housing*. Geneva: Office of the United Nations High Commissioner for Human Rights, 2009.

Below is an exercise matrix outlining some, most or all the line items needed to be implemented in a successful prefabricated strategy for affordable home assemblies to be used globally.

UNHCR & The Sphere Project Standards	Cost Effective & Affordable	Easy to Construct / Assemble	Allow for Food Cultivation
Generates its Own Energy	Fiber Reinforced Composites & Plastics	Self Built By the Population	Able to Collect and Store Water
Adequate Openings For Daylight Illumination	Self Sustaining Techniques & Strategies	Minimum use of Fastners	Account for Cultural and Regional Flexibility
Create Jobs for The Population	Mass Produced by the Population	Adjustable and Allow for Expansion	Long Lasting and Durable

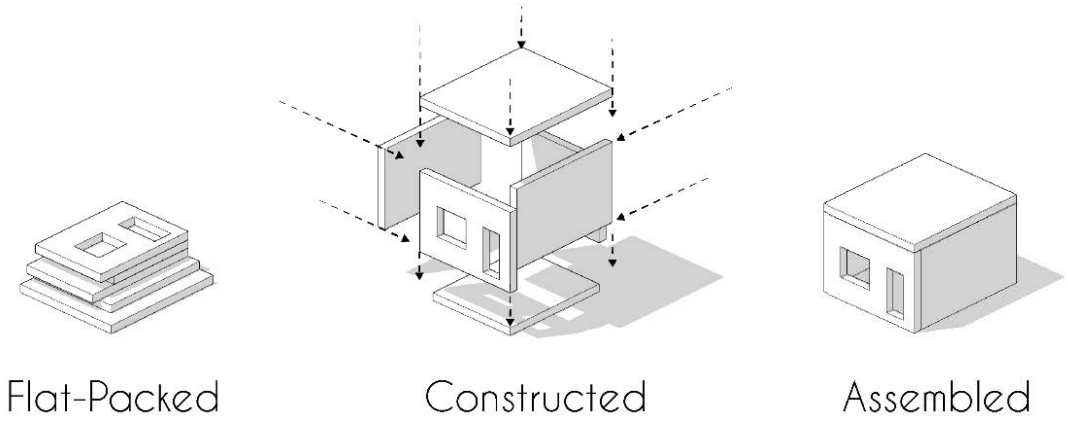


Fig.83 Prefabricated Home Strategy Matrix

In order to come up with a strategy to meet some of the line items listed in the matrix, a possible solution might be a prefabricated insulated paneling system. This system would have to be light and most likely made of fiber reinforced composites, in order to reduce costs and weight. In this system, the idea is to allow for the home to be mobile in nature to combat land tenure issues and sudden migrations due to disaster-prone areas. Also, the system does not utilize or at least minimizes the number of fasteners needed to assemble it. This leads to a building that can be easily assembled and disassembled by the resident. The statement above is the process of developing a possible assembly (Fig. 84).

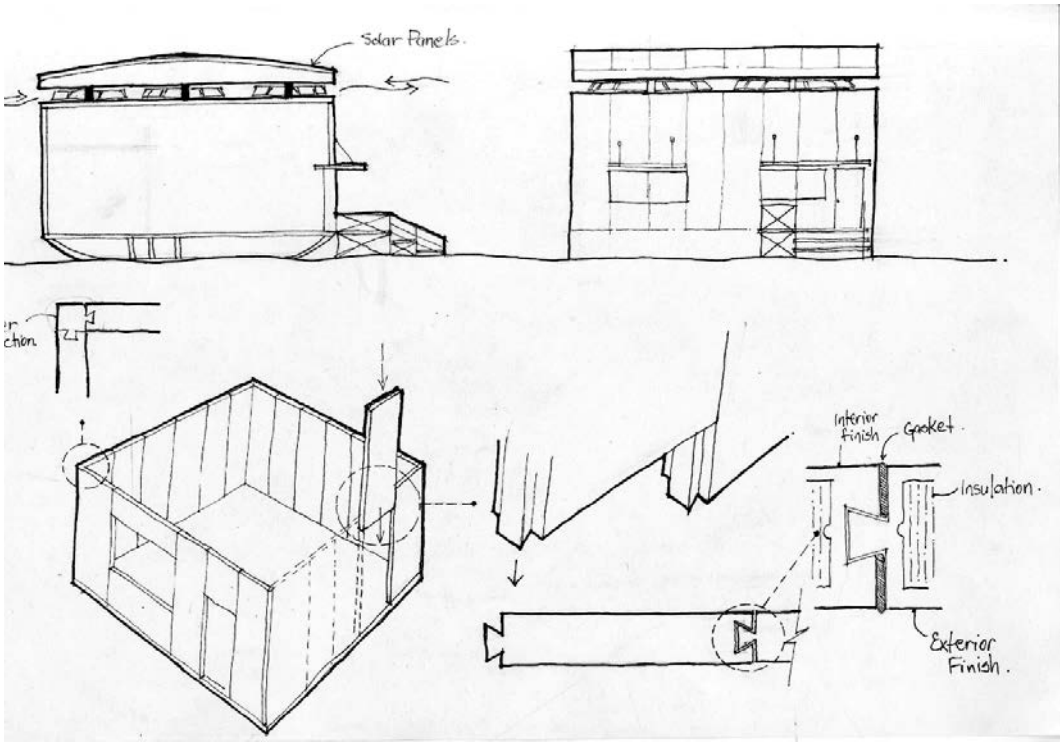


Fig.84 Modular Concept Sketch 1

To further meet some of the matrix requirements set in our proposed assembly system. the homes or building assemblies need to account for the possibility of power generation. The roof can be clad with solar cells to harness as much of the sun's energy whilst the roof can also house horizontal wind turbines to further produce more energy (Fig.85) The building takes on a circular shape to reduce the number of corners needed, thus reducing the number of joints. This, in turn, reduces overall costs and construction time. Also, a different type of approach can be taken when connecting the structure with piles increasing its mobile capabilities? These are early stages of conceptualization of modular prefabricated systems.

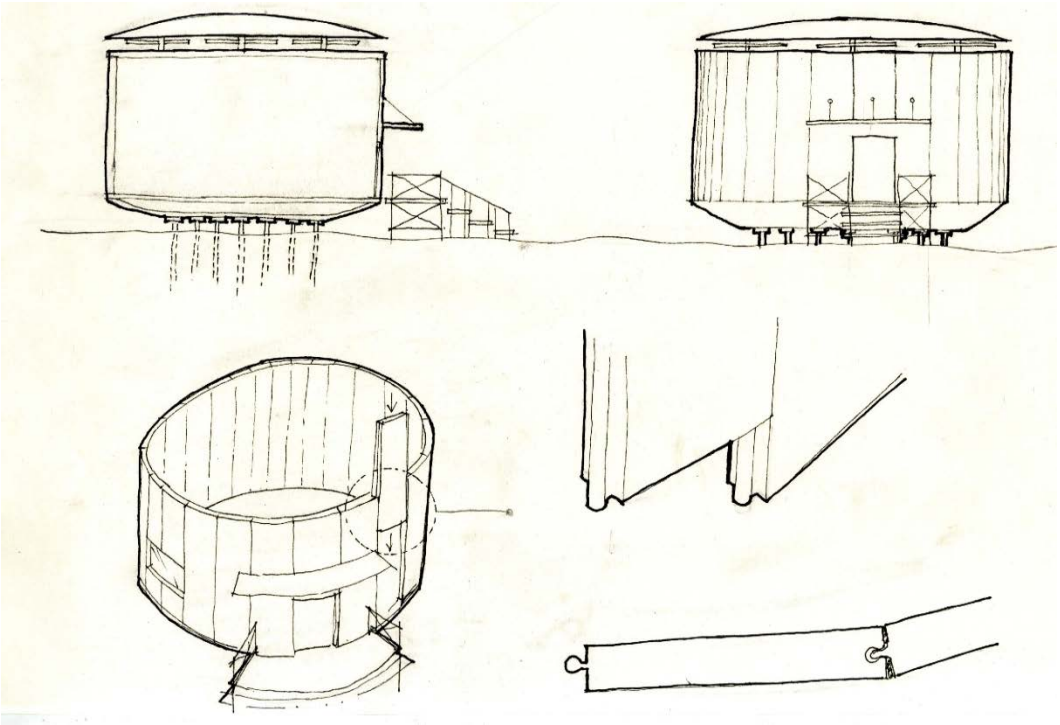


Fig.85 Modular Concept Sketch 2

Combining the previous two concepts yields a more traditional rectilinear design, which allows for more efficient use of space. By removing the mobility aspect of the modular system, but maintaining the minimal use of fasteners, allows the user to easily disassemble the building (Fig.86).

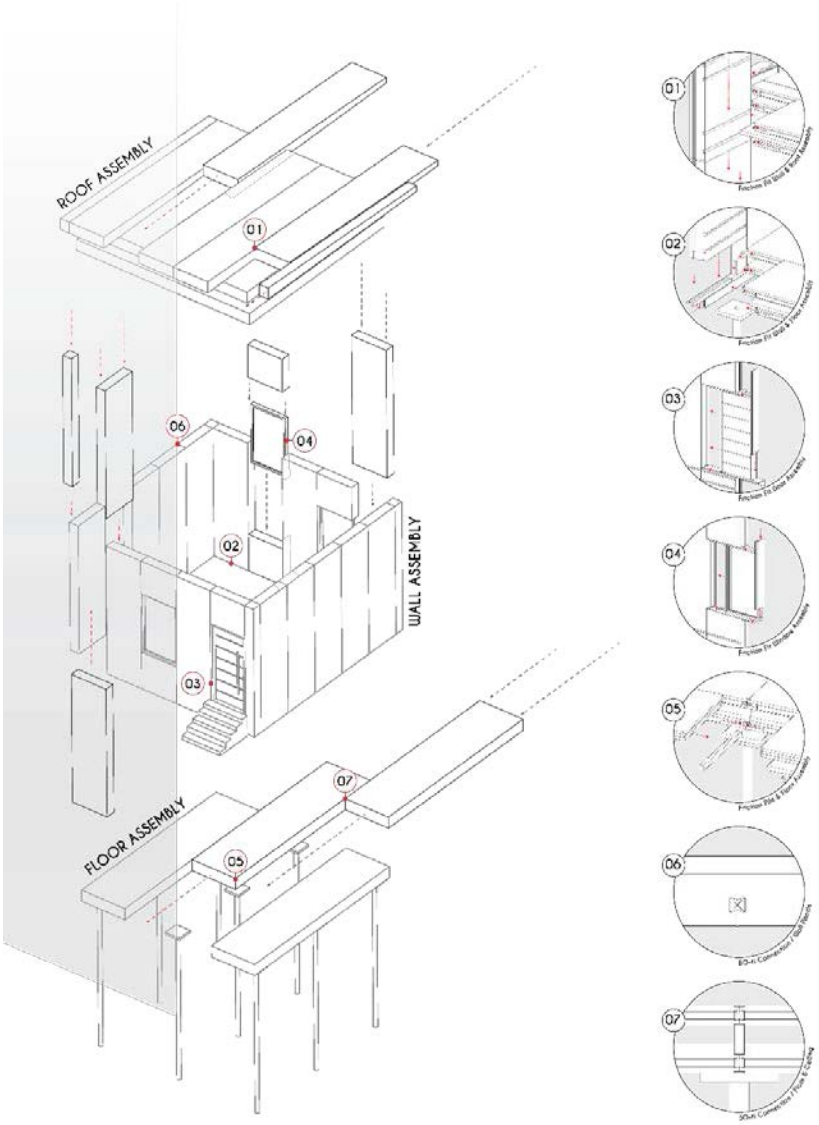


Fig.86 Modular Concept & Details

The following illustration (Fig.86) illustrates what an assembly might include in terms of materials and accessories. A typical wall assembly, except that it is assembled without the use of any fasteners. Simply put, the system of components that make up a wall, floor, or roof/ceiling is assembled through the use of opposing joint designs that are friction fit and locked into place. Thus, there is no need for glue, fasteners, or any traditional methods of connecting components.

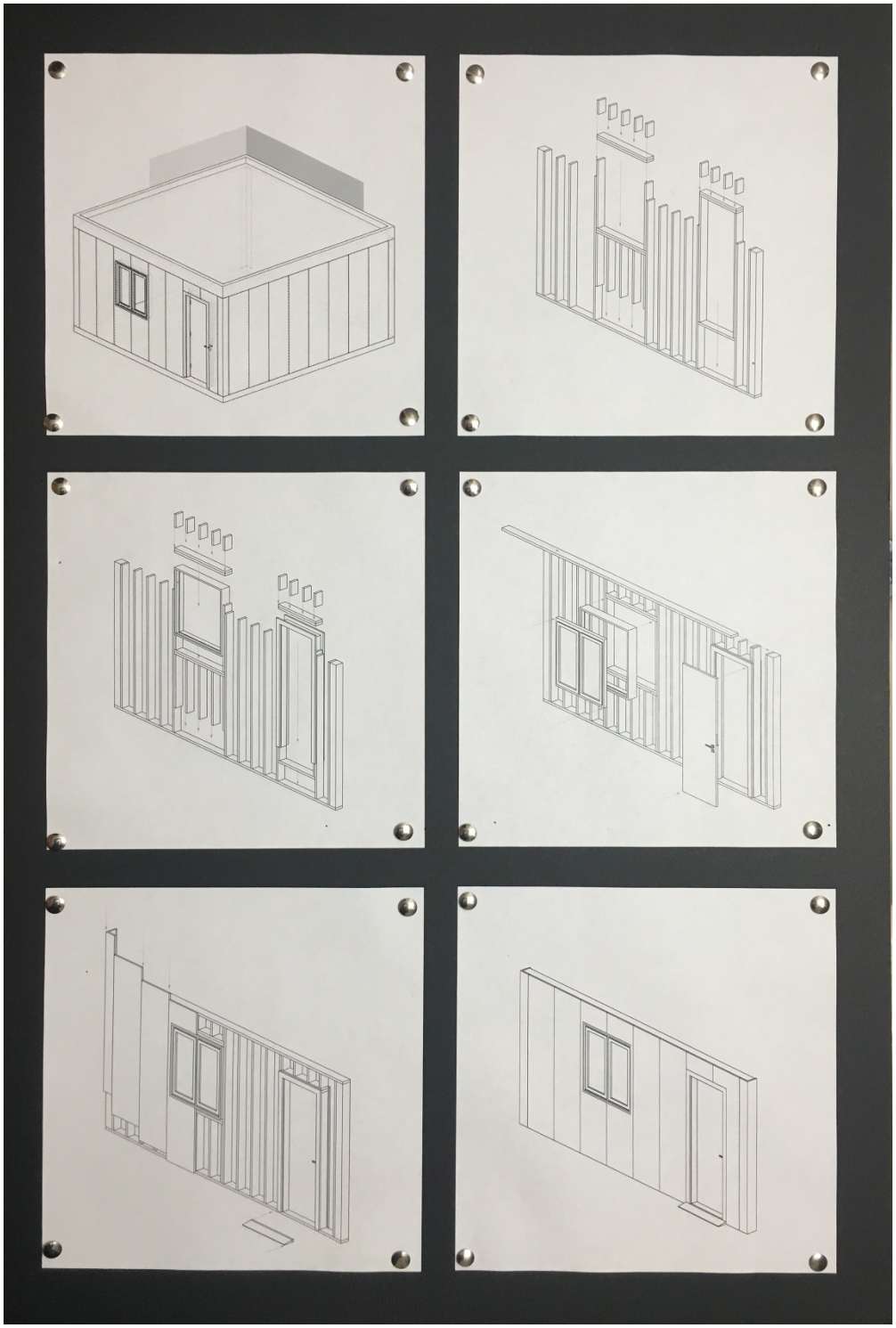


Fig.87 Modular Wall Assembly

Abstract Assembly Explorations

Here we transition between the prefabricated mentality and the realm of random assemblies. This shift is important in helping the mind move from the known to the unknown. To begin to understand the concepts behind assemblies, one needs to consider how materials, patterns, and rhythm generates forms and structure. The following is a series of exercises sketching out the variety of materials and the nature of assemblies. Reassessing the possibility that assemblies do not have to necessarily follow a specific structure, pattern, or material set is important. This allows for open systems to include cultural differences in building typologies, and choice of material when it comes to the fabric of the built environment.

These following sketches demonstrate the incremental possibilities of assemblies and the process of a variety of materials coming together to defines the space created. Materials begin to produce rhythm, pattern, orientation, and connections. Space here is marked through the organization of shapes, with the built environment incremental in nature. Here one shape follows another and is organized in such a manner to define the creator or self-builders implied architectural intent. These pieces organize shapes and materials to create illusions of practical space, volume, and place (Fig.88, 89, 90).

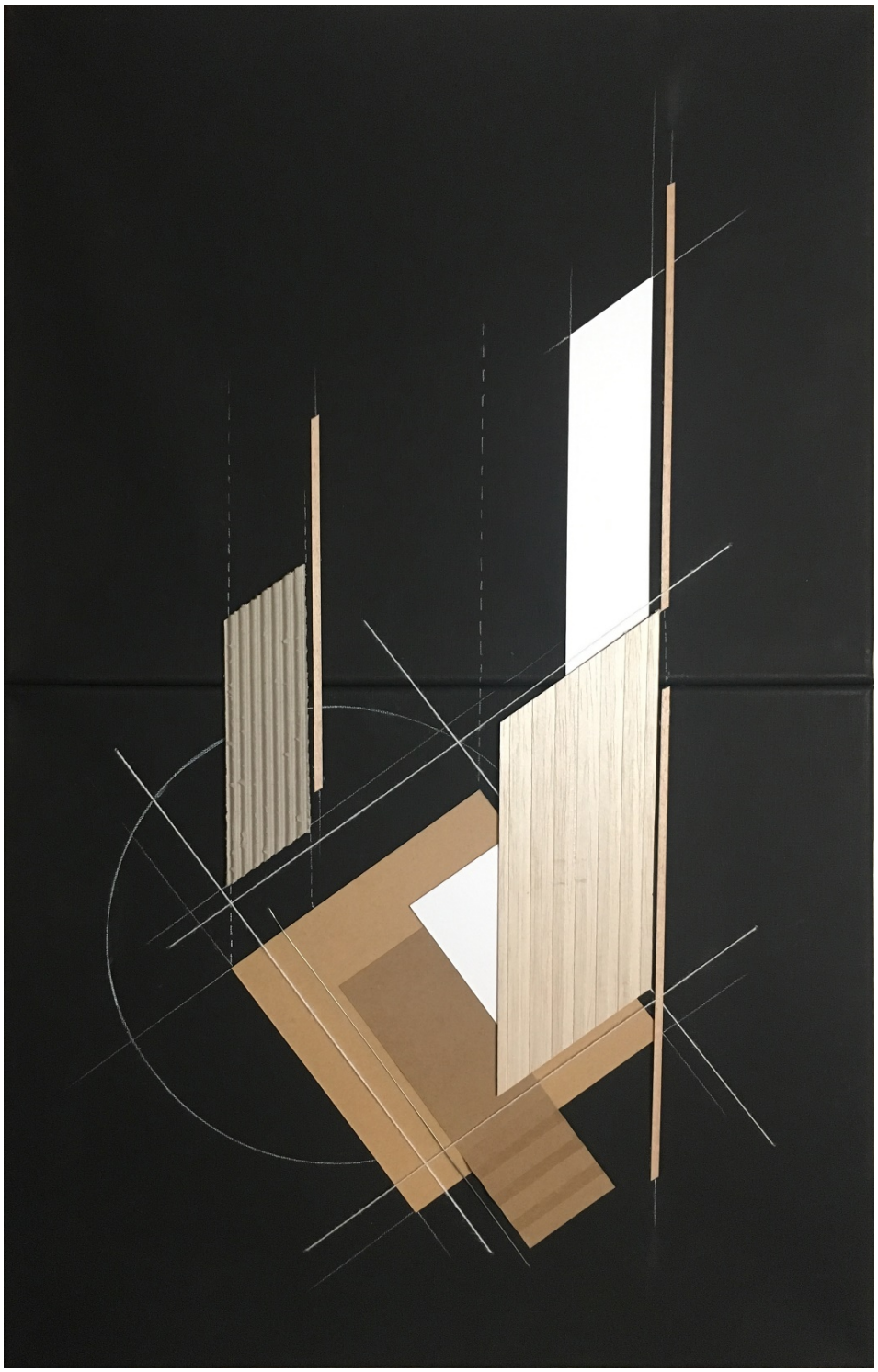


Fig.88 Assembly Ver.001

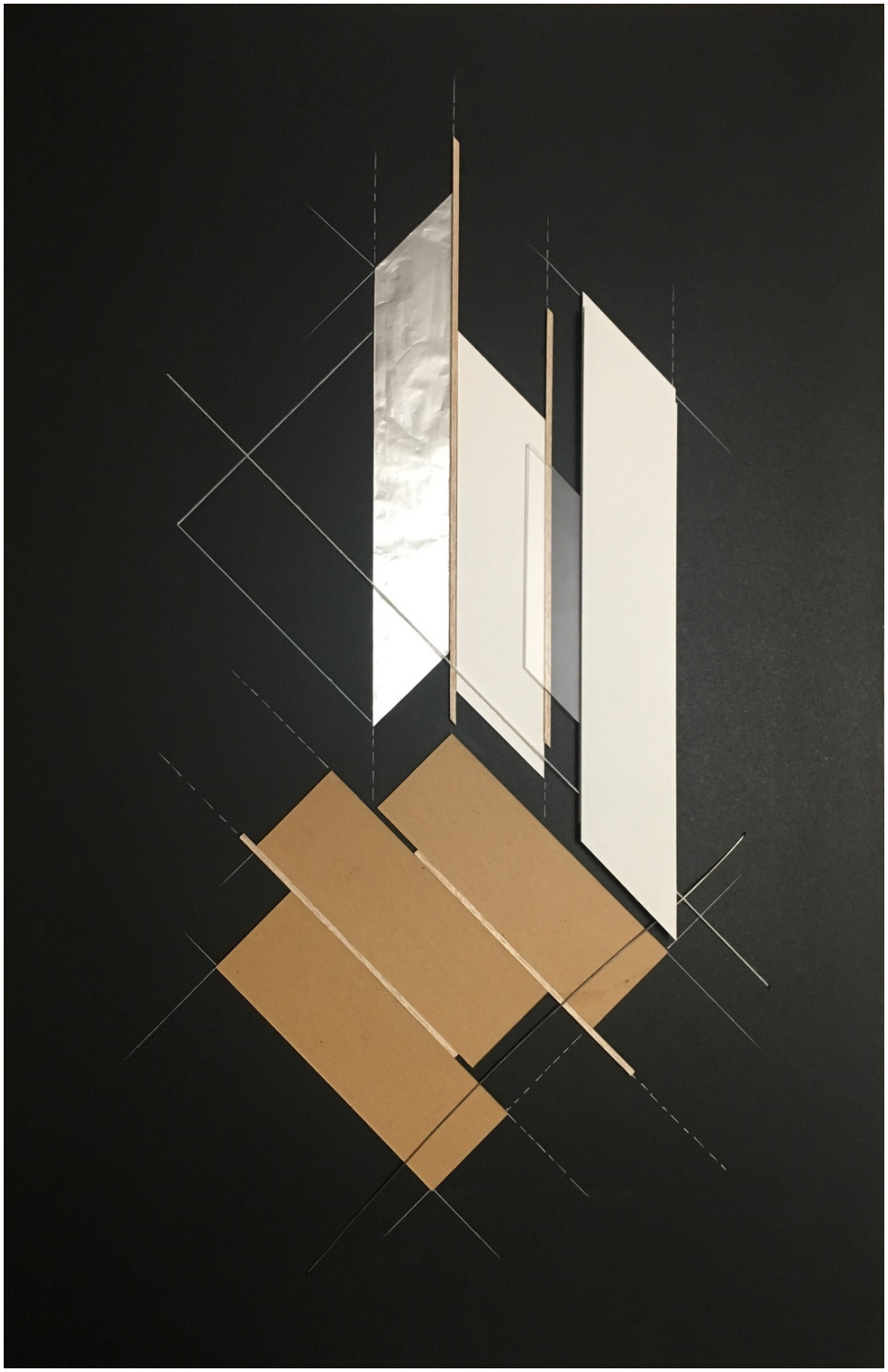


Fig.89 Assembly Ver.002

Fig.90 Assembly Ver.003

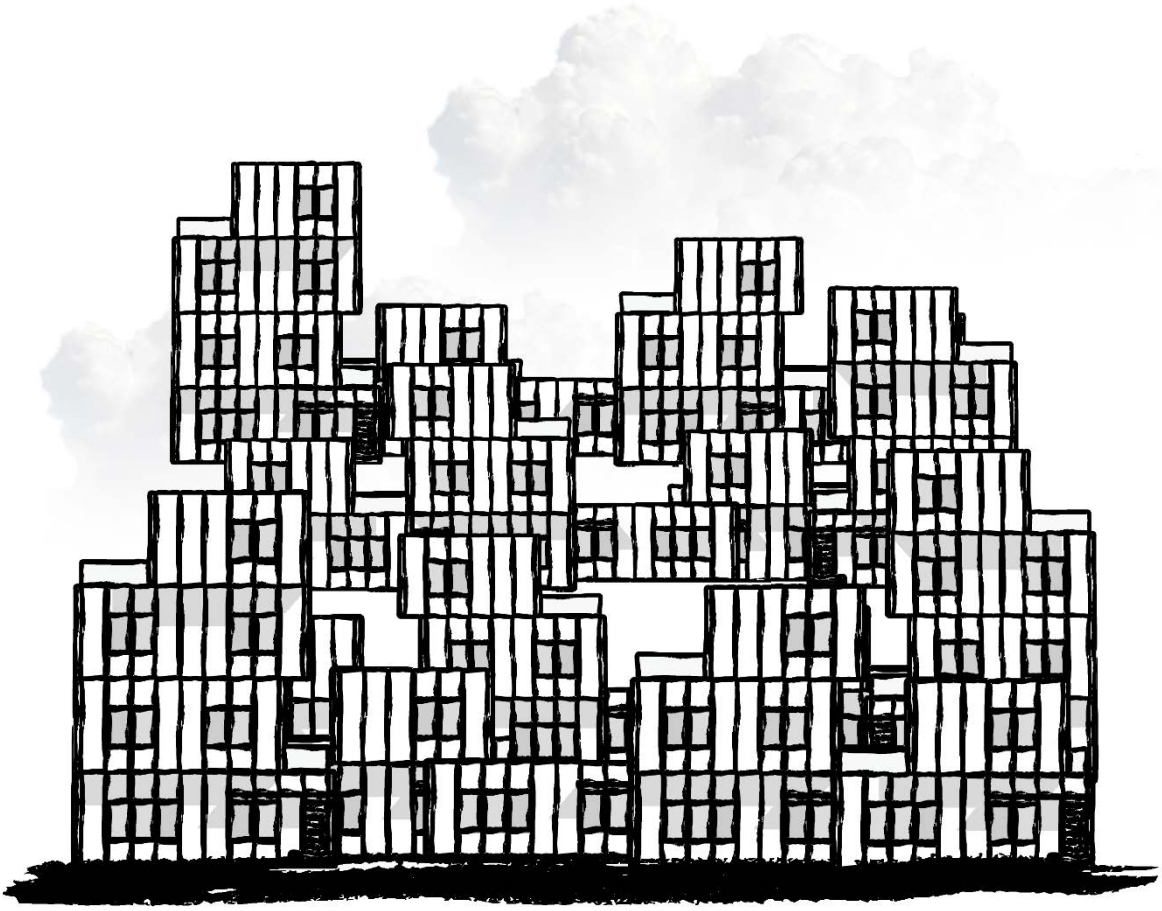


Fig.91 Stacked

Housing possibilities & Typologies

In 'Prefabrication Explorations' we explored the possible strategies for modular paneling systems, and the diverse options they may afford to building typologies. In order to reduce costs, a system of panels with minimal fasteners should be utilized. This thinking of panels coming together with ease through friction joints should carry through to how housing building systems are assembled, allowing for the possibility to expand on a one storey building to two, three, or four storey buildings with ease as well (Fig.92, 93). The building assembly then can be spoken of in terms of adaptive or flexible housing.

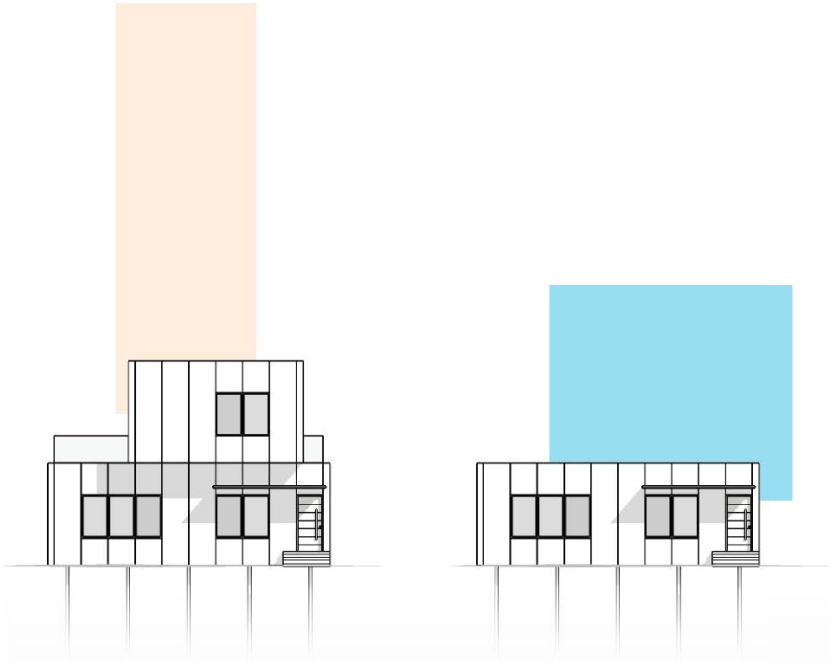


Fig.92 Home Stacking 1

Fig.93 Home Stacking 1

The building assembly also needs to account for cultural differences, where the spaces designed serve the needs of indigenous inhabitants of the chosen region. The design should also account for user-defined spaces as not only an inclusive process that empowers the individual resident but afford opportunities for self-growth through *smart* design.

The following illustrations (Fig.93-99) show possible housing assemblies, each assembly accounting for climatic conditions, energy performance, material availability, and cultural backgrounds in order to be successful in delivering livable and affordable spaces.

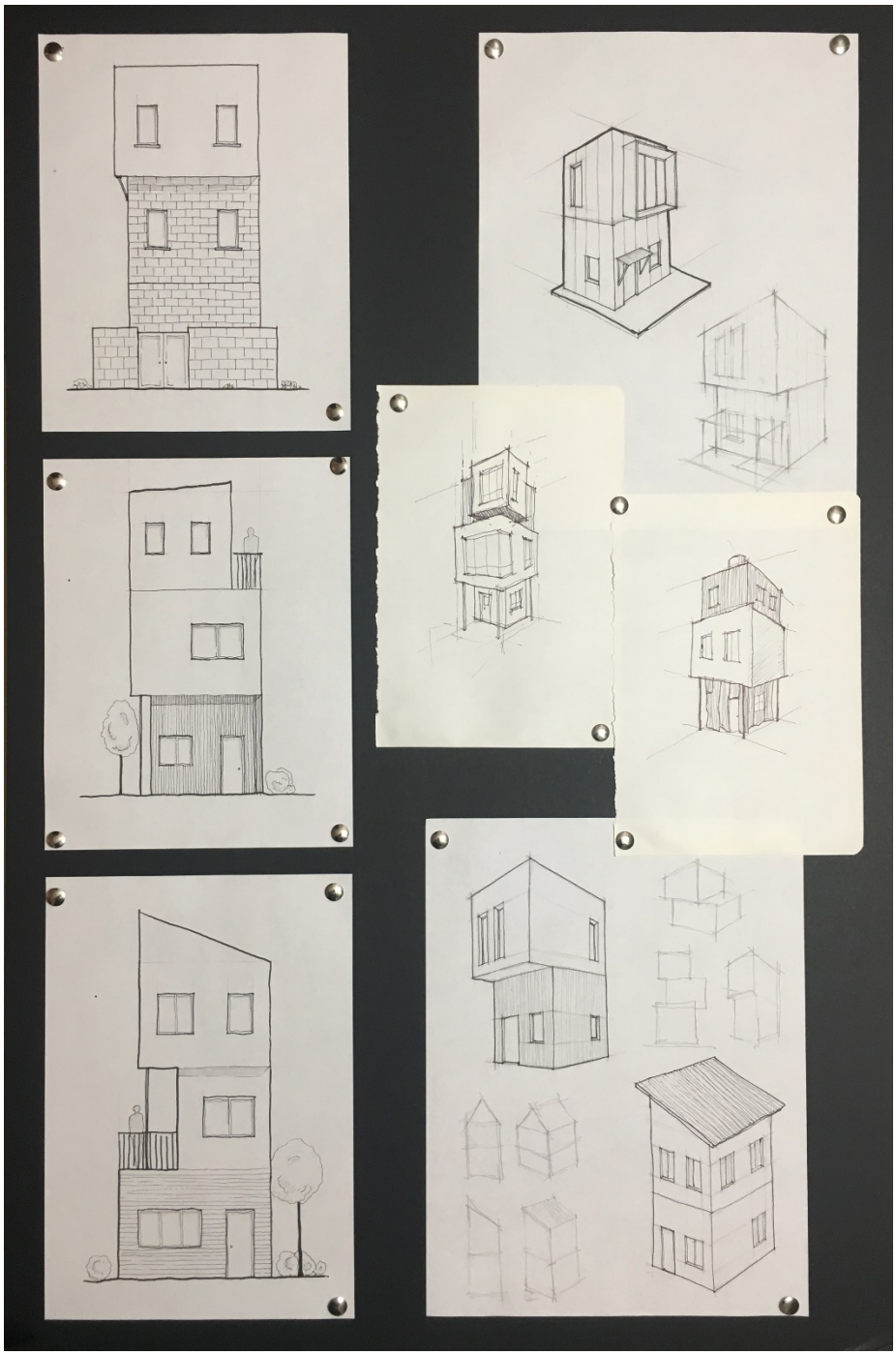


Fig.94 Housing Variations Ver.001

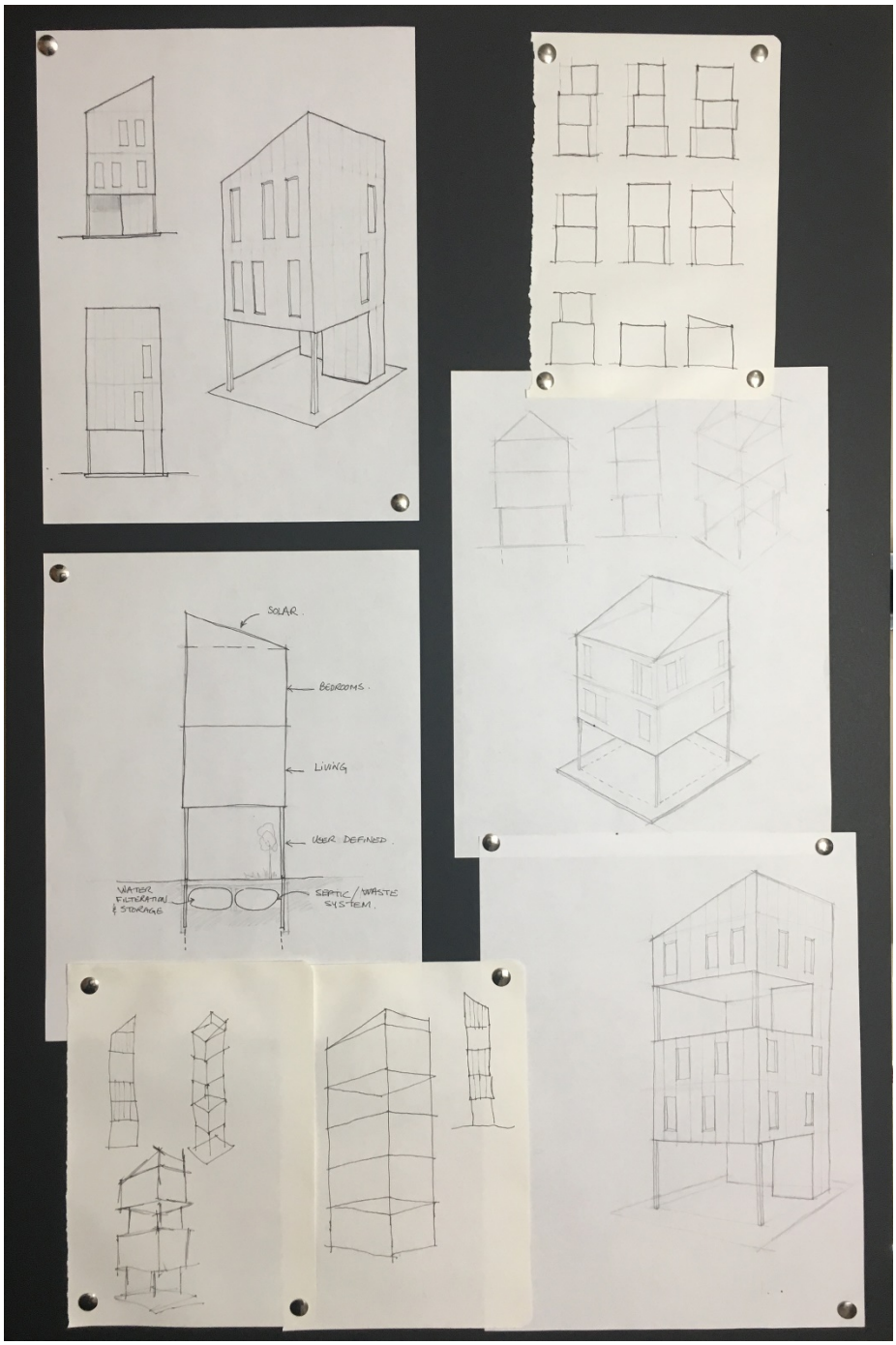


Fig.95 Housing Variations Ver.002

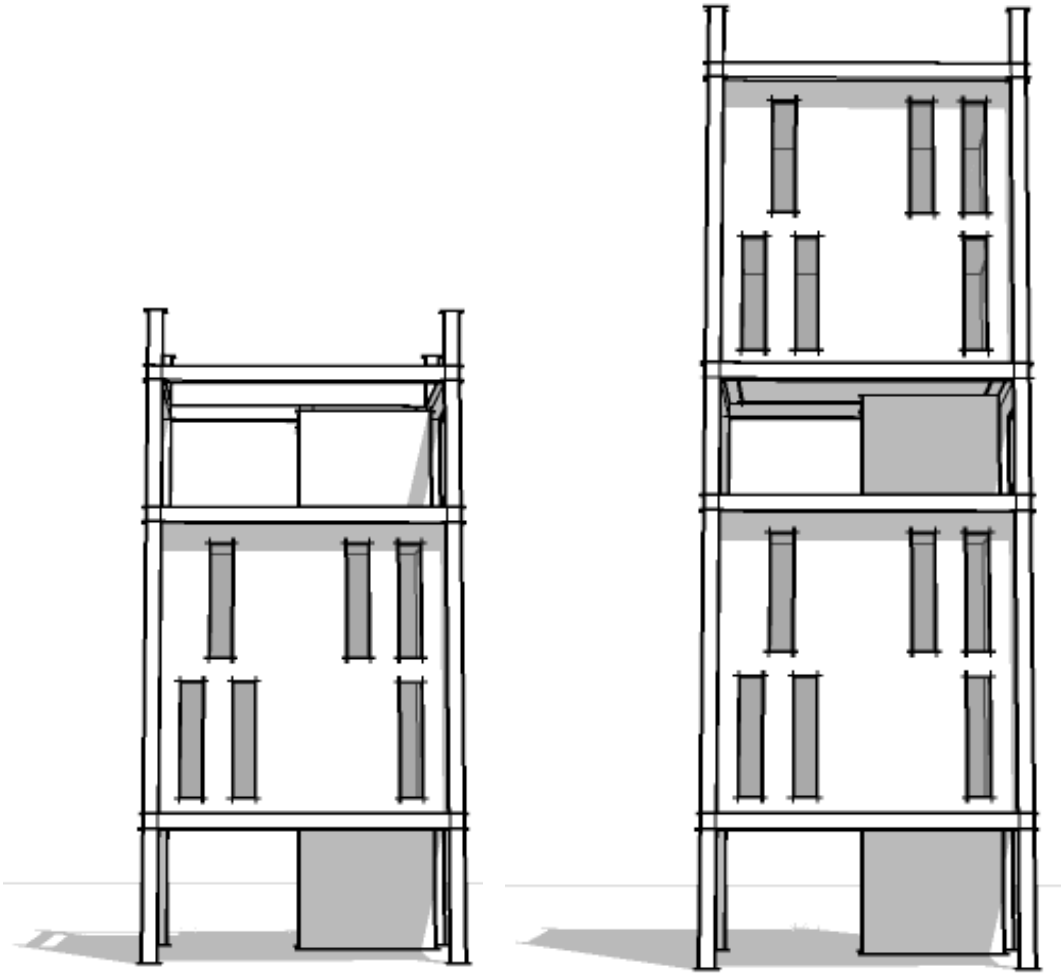


Fig.96 Housing Variations Ver.003

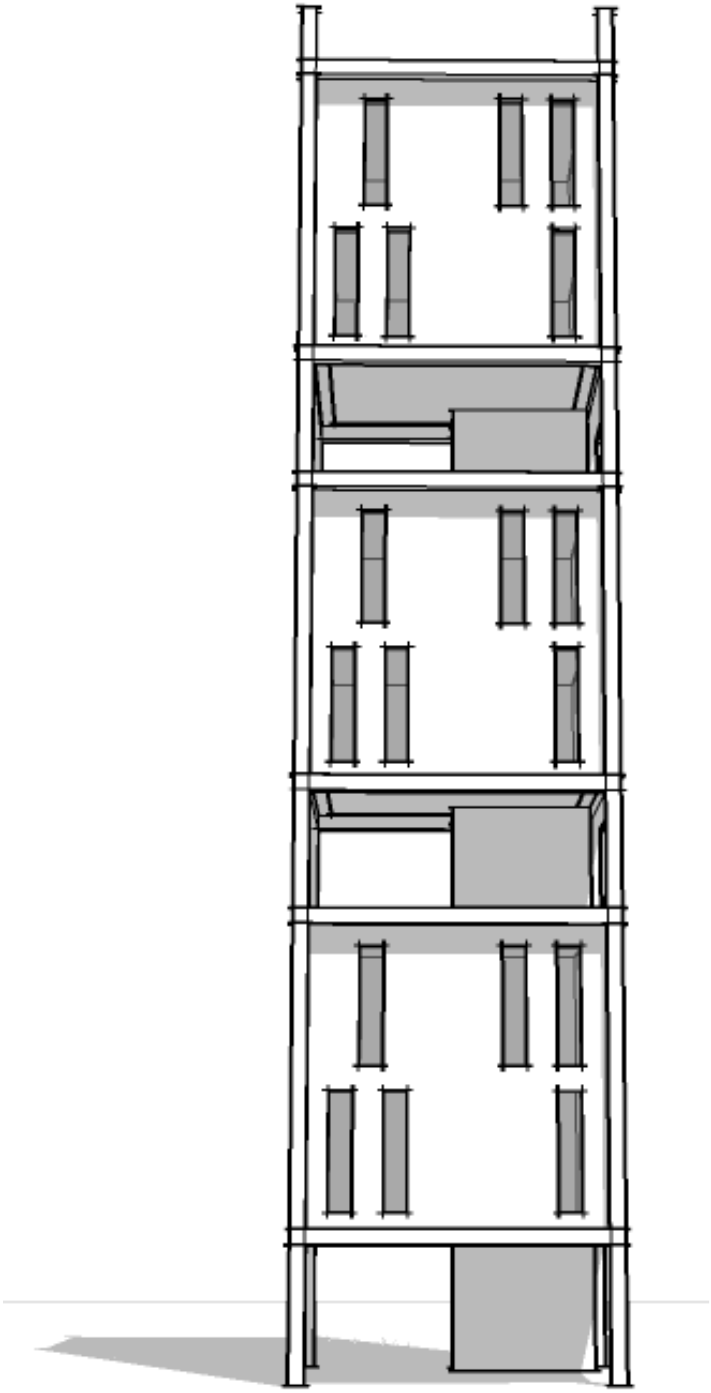


Fig.97 Housing Variations Ver.004

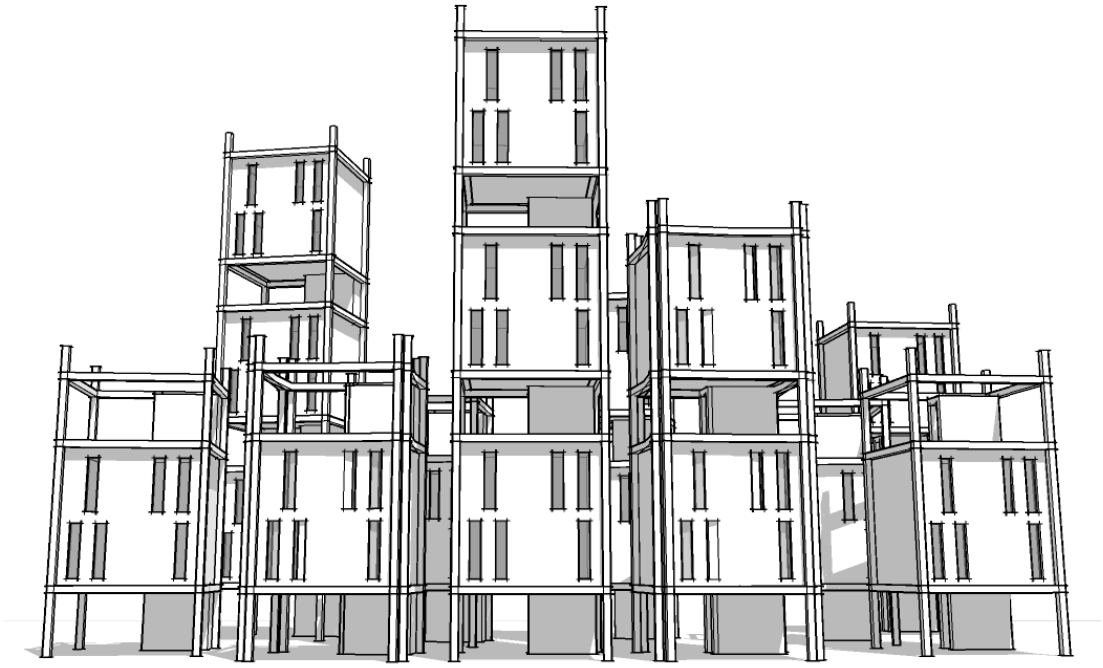


Fig.98 Housing Variations Ver.005

Project Incremental:

In the previous section, we have explored possible ideas of a global housing assembly kit, which is a self-build/ assembled kit. In this section, we will identify all the aspects of what is included in the kit, the various components, how it is assembled, and the types of housing models/ variations able to be constructed using the kit.

Housing Systems 'The Global Kit'

The kit is comprised of 15 component categories, and all of the components are fabricated from fiber reinforced composites preferably, but also are designed with standard dimensions similar to rough lumber so that each component can be constructed using traditional materials. The unique approach here is designing a set of building components that are fitted together using friction and only locked in place using an exoskeleton/ exterior structural post and beam system. The rationale in designing the kit in such a way is to allow for the ease of assembly and disassembly when necessary, and to reduce the need for expensive hardware such as bolts, screws, or even glues to assemble the kit. In turn, the kit is more cost-effective, adaptable, flexible, and has the potential for expansion in the future, more on the possibilities of expansion in the final section.

The Components:

1. Solar Panels: Plug-in panels to help offset the electrical costs. And reduce the need for initial infrastructure in the early stage of construction.
2. Wall Panels: Fiber reinforced wall panels, panel A has the tongue/ male portion of the connection and panel B has the groove/ female portion.
3. Floor, Ceiling and Roof Panels: Similar in composition as the wall panels, but part A and B Varey in length.
4. Window Panels: The window panels include a pre-installed double pane glazing, that is operable to allow for air circulation.
5. Door Panels: Include a pre-installed door and varies in type of door due to either exterior or interior applications.
6. Kitchen Module: This module includes a basic kitchen, with a stove, fridge, cabinets and a sink.
7. Bathroom Module: Includes a sink, mirror, cabinet, standup shower, and a washer/ dryer combo. It also includes the interior walls with a pocket sliding door to save space.
8. Internal/ External Stairs: The stairs are made of fiber reinforced composites and are used in the internal circulation access to the units, they are a set of part A and B depending on the application. Such as grade access and roof access, because of the railing application Varey.

9. Internal Loft Stairs: They are used in the two storey units for internal circulation and access to the second/ upper level of the unit.
10. Beam: Fiber reinforced horizontal beam which comes in two parts, A and B matching in length to the floor/ceiling/roof panels. They are part of the exoskeleton.
11. Columns and Brackets: Fiber reinforced structural columns and their associated brackets, part of the exoskeleton and the columns/ beam are the only components that get fastened together using the included hardware.
12. Caps: Fiber reinforced column and beam caps that come in three sizes to fit over the structural elements.
13. Helical Piles: Steel screw/helical piles to serve as the foundation for the exoskeleton.
14. Water Storage Tanks: Included to store collected rainwater, again to reduce initial costs, and need for infrastructure.
15. Septic Tank: Included to collect and process waste, to allow for early access to sanitation and reduce the need for initial infrastructure.

The 15 components are to be part of a semi-flat packed modular building system, to be possibly fabricated in the region it might be used in or imported from external manufacturing facilities. They are illustrated in the following pages (Figs. 99-113). Also (Fig.114) illustrates the composition of how the components come together in a typical one storey house.

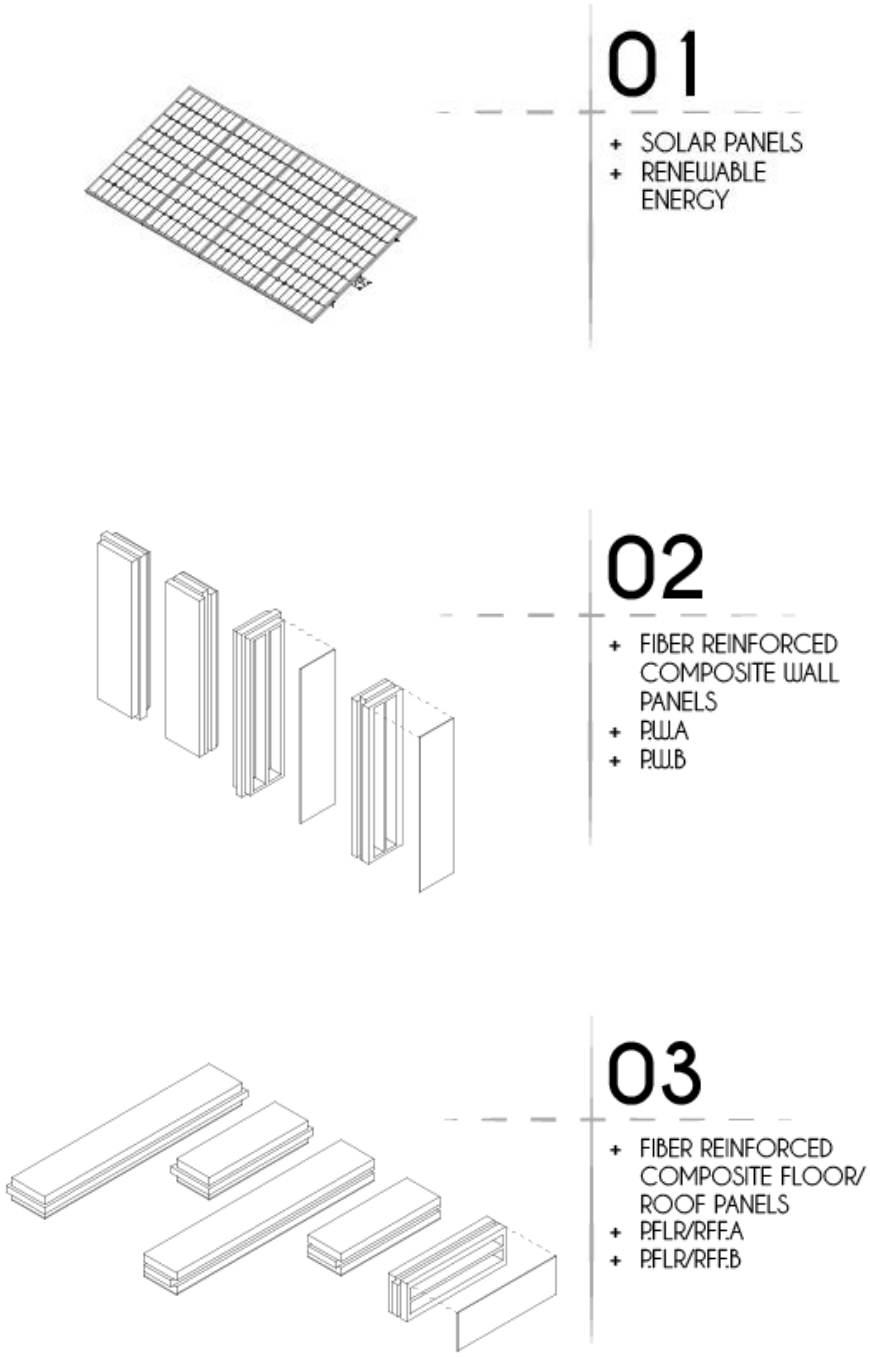
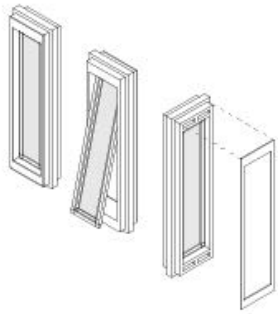
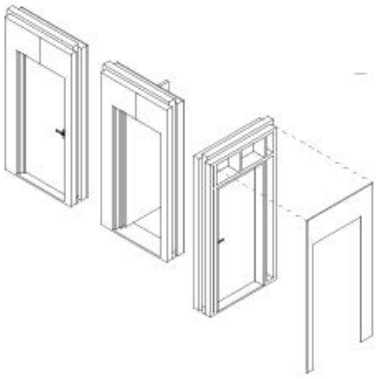


Fig.99-101 Kit Components



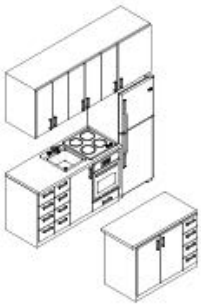
04

- FIBER REINFORCED COMPOSITE WINDOW PANELS
- P.WND.A 1



05

- FIBER REINFORCED COMPOSITE DOOR PANELS
- P.DR.A 1



06

- KITCHEN KIT
- STOVE
- FRIDGE
- SINK
- CABINET SET

Fig.102-104 Kit Components

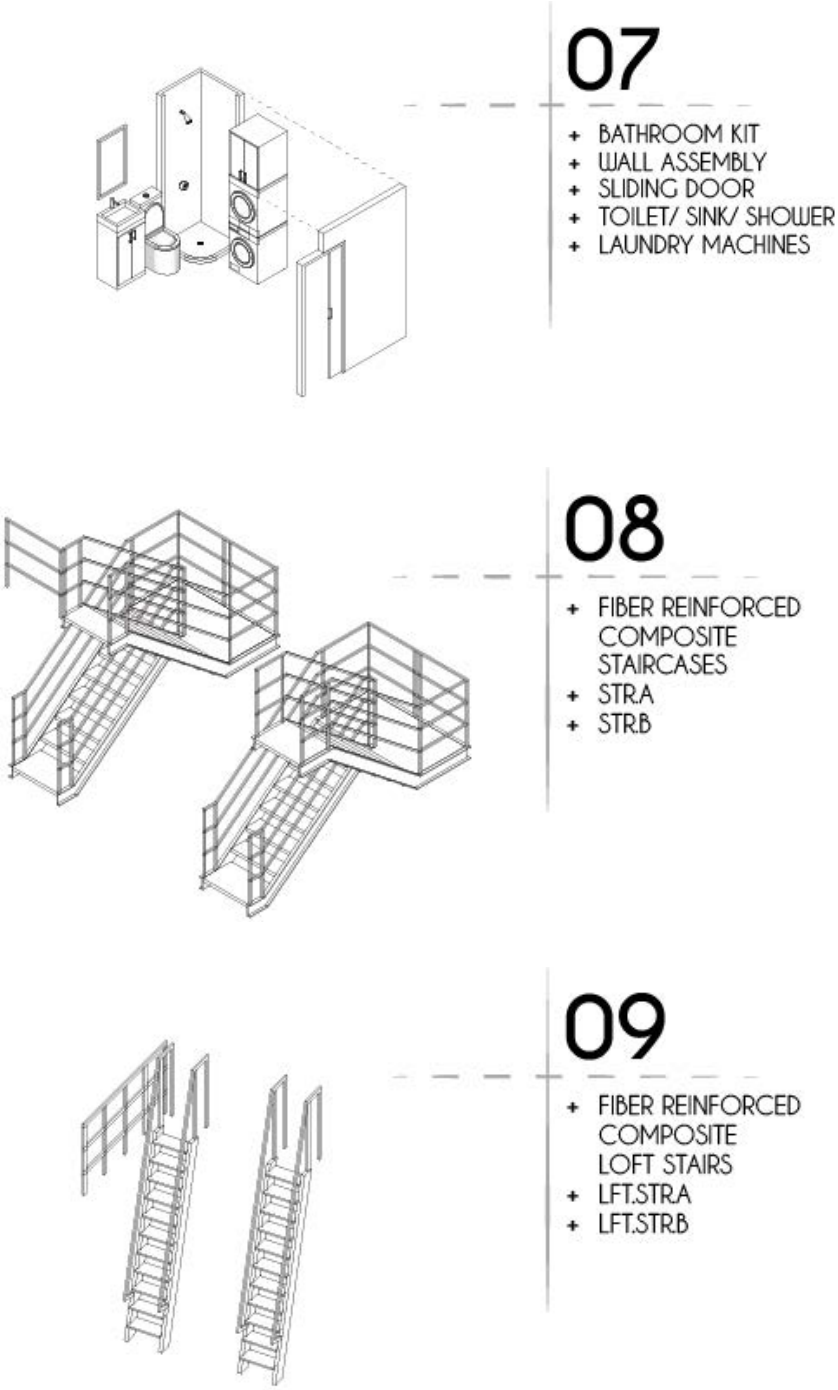


Fig.105-107 Kit Components

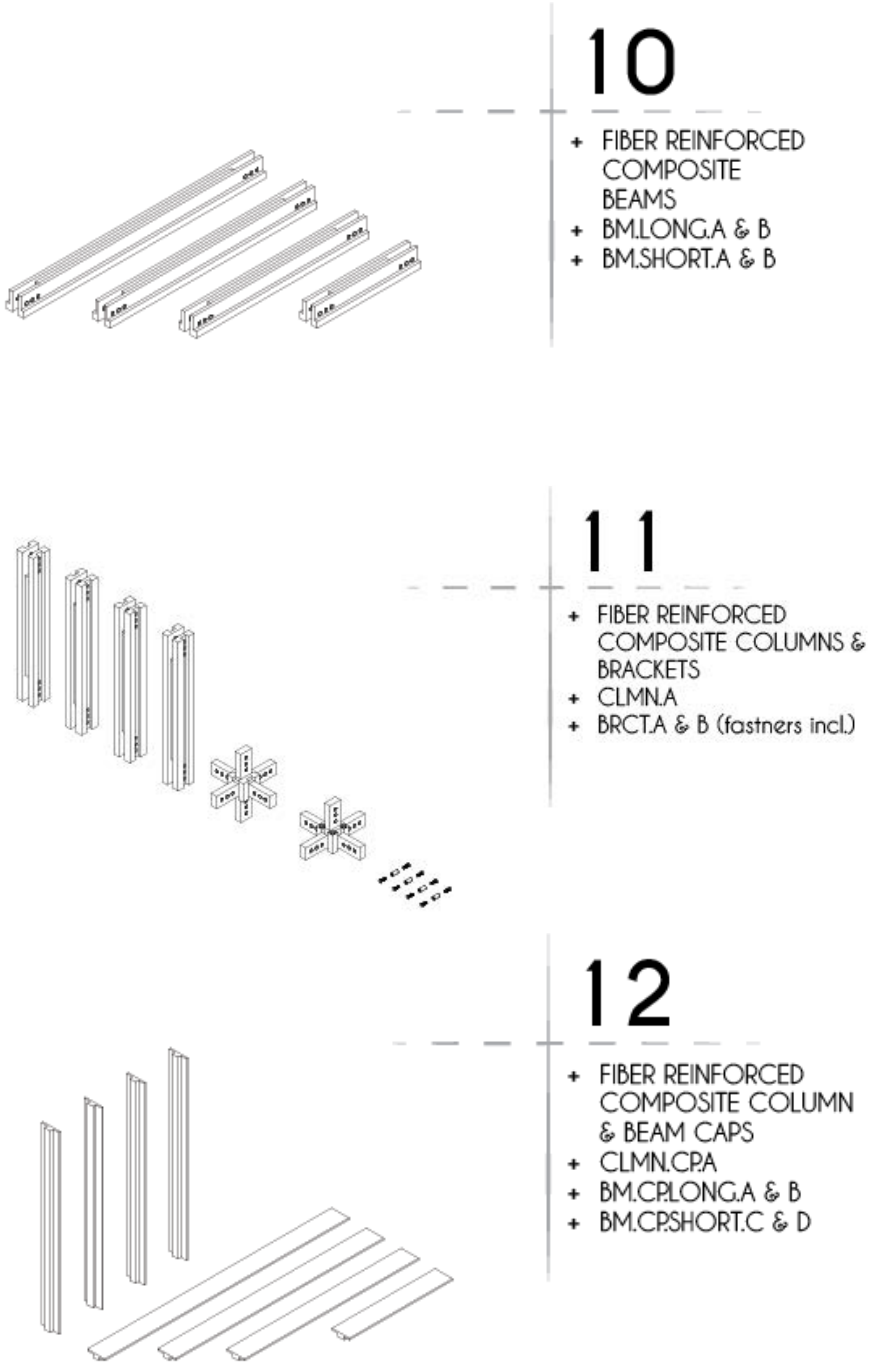


Fig.108-110 Kit Components

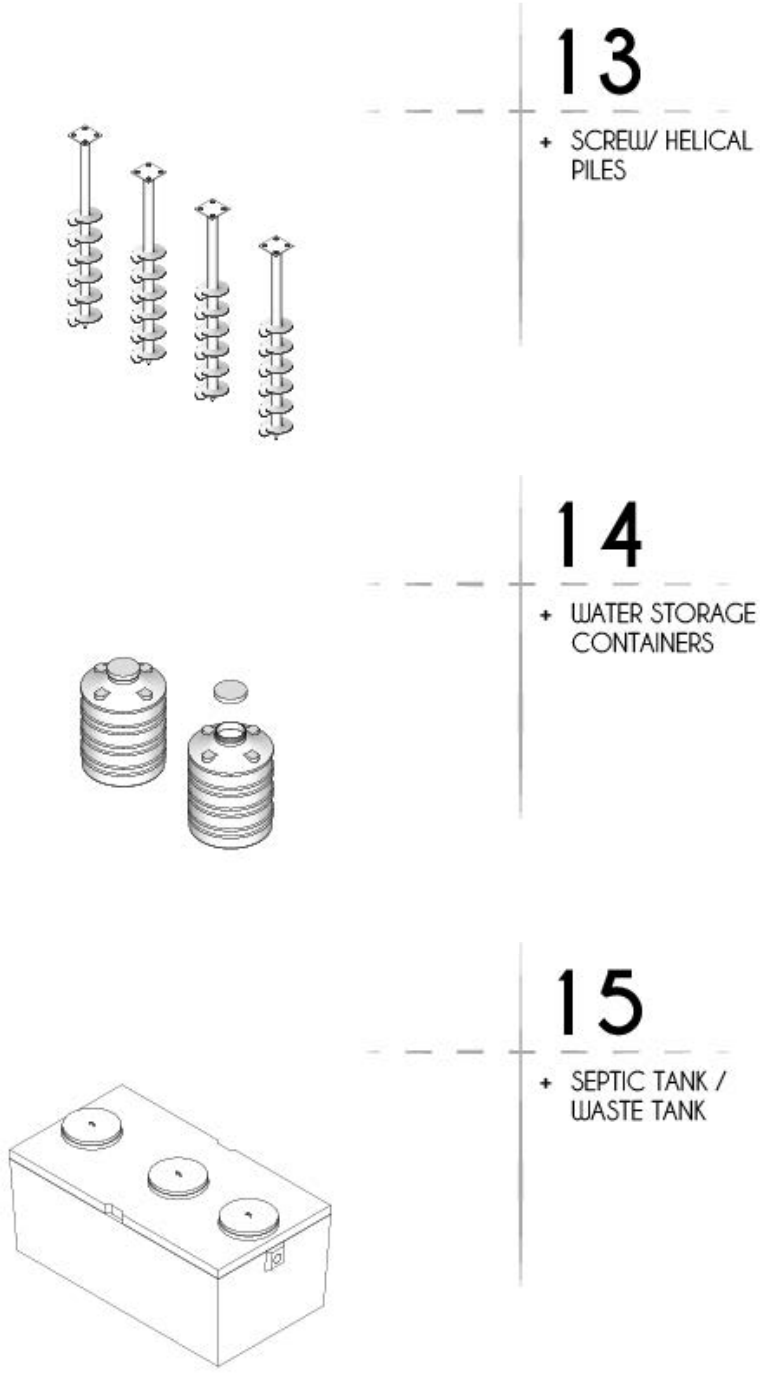


Fig.111-113 Kit Components

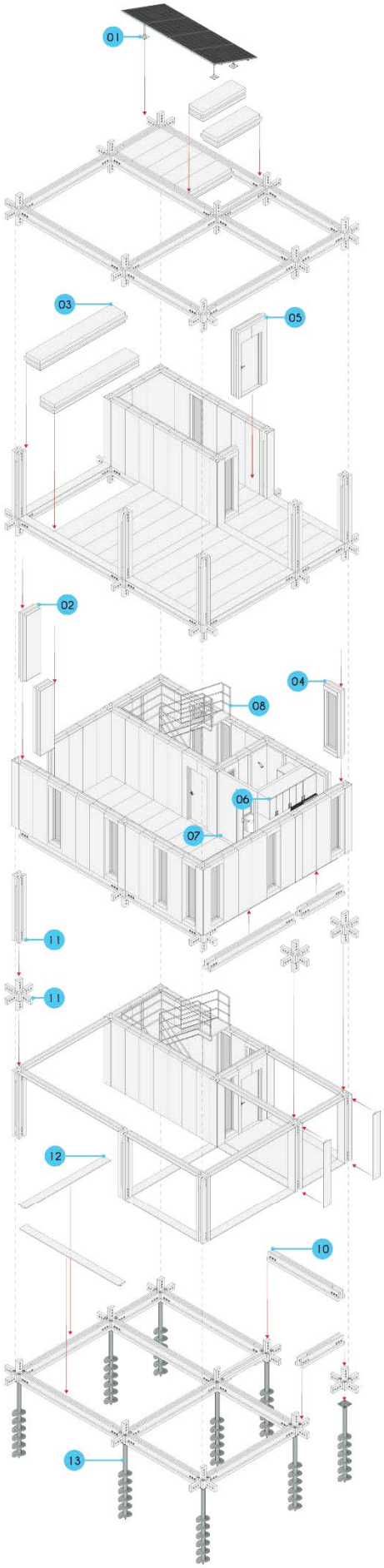


Fig.114 Kit Assembly

As illustrated the kit includes easily assembled components but in order to design a successful housing assembly, services such as electricity, water collection and filtration, and waste management. Thus, as listed above the kit includes a set of solar panels to harvest energy providing basic electrical needs, water filtration and collection tanks, and a septic tank/ system to help manage the waste and improve sanitation located at grade, and an open side/front yard at grade for possible agriculture, or outdoor activities such as cooking (Fig. 115). It is very important to account for these important necessities of life to help provide a safe and viable sustainable housing strategy.

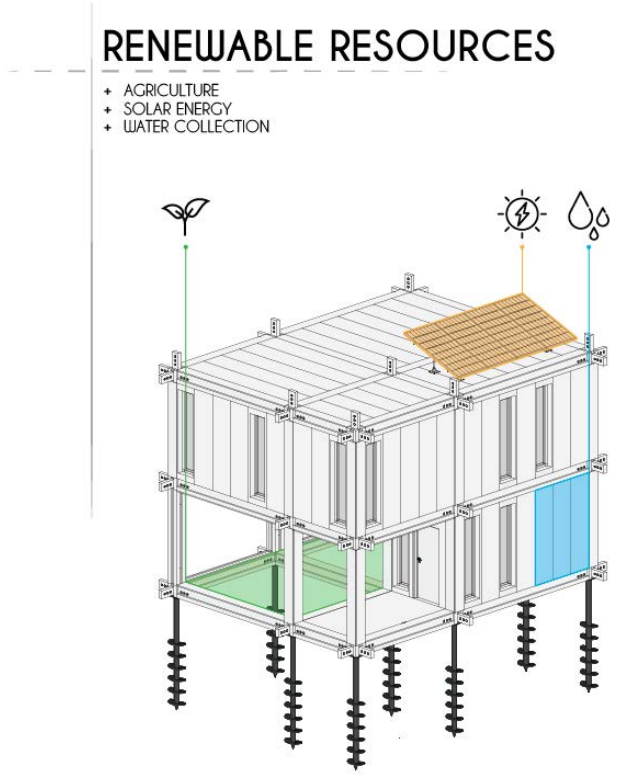


Fig.115 Sustainable Home

The housing strategy allows for the kit to produce a variety of models in housing units not only to provide the right accommodations for several family types and sizes but also allow for the ease of vertical expansion in the future which will be further detailed in the final section.

Housing Models (Figs. 116-119):

1. Model H.2: This housing model is a basic entry level house, what it includes is the exoskeleton structure, all components except the loft stairs, and solar panels. It includes a studio apartment unit.
2. Model H.3: Similar to H.2, what it includes is the exoskeleton structure, all components except the loft stairs and finally it houses a studio apartment unit and access to a roof area to be defined by the user.
3. Model H.4: Is similar to H.3, but rather than a bachelor unit, it includes a two storey unit which includes the internal loft stairs and larger kitchen area.
4. Model H.6: Is the combination of joining H.2 with H.3.

The housing models are the starting point where prospective residents get to choose from the various models to fit their need. But the models are interchangeable in terms of unity assemblies, the possibilities are open to personal, economic, cultural choices and to be arranged in the resident's best interest for the habitable, safe and comfortable space.

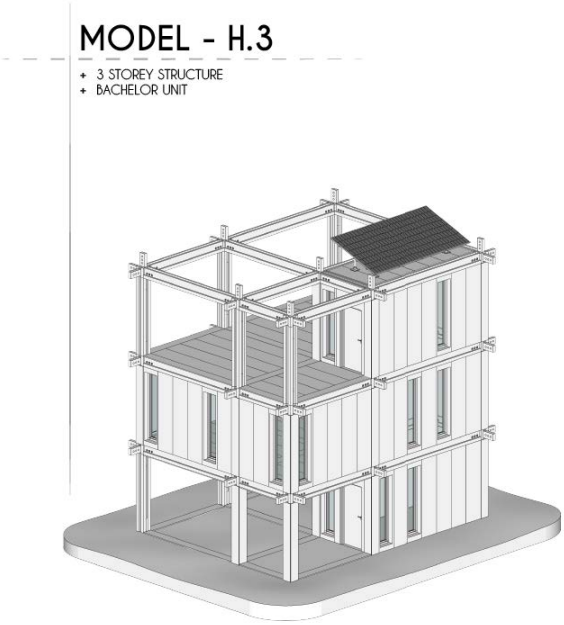
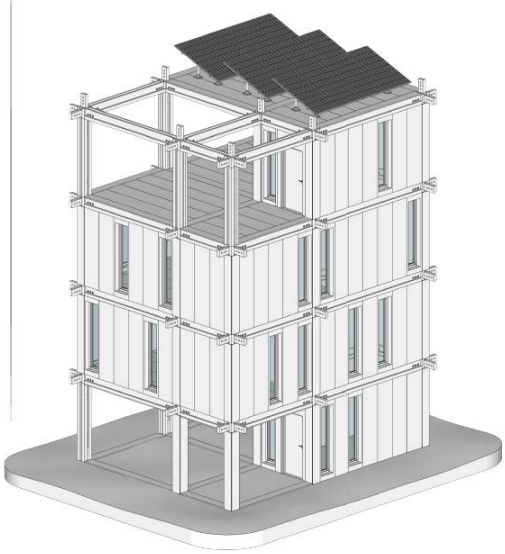


Fig.116-117 Housing Models

MODEL - H.4

- 4 STOREY STRUCTURE
- 2 STOREY UNIT / 2 BEDROOM



MODEL - H.6

- 4 STOREY STRUCTURE
- BACHELOR UNIT
- 2 STOREY UNIT / 2 BEDROOM

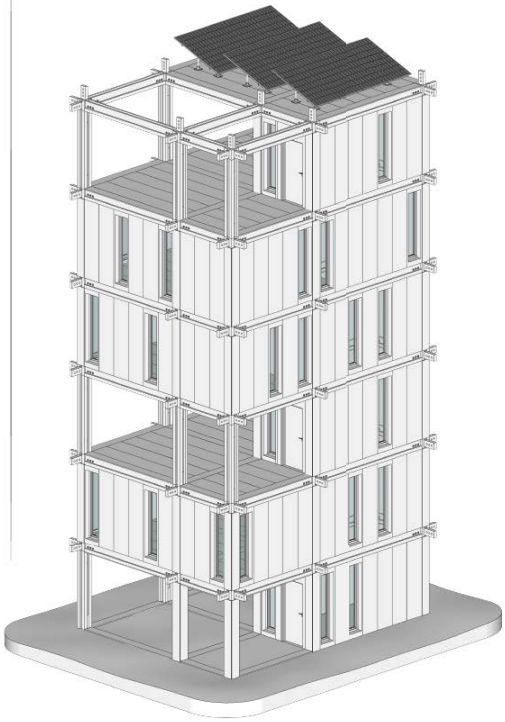


Fig.118-119
Housing Models

Housing Typology

As we explored the global kit in the earlier section, we discovered from the construction point of view that it is flexible and is able to adapt, but in this brief section, we will identify what the finished housing model/ assembly might look like when constructed. For the purpose of visualization, we will utilize one of the housing models defined in the previous section 'Model H.6' a six storey housing assembly.

The housing model or 'The Kit' has the option to come in plain white finish, or in a variety of colors. This option is more of an aesthetic option to help encourage the end user to personalize the look of their home as part of the inclusive initiative of such housing projects that include the end user as part of the design and build process. This approach is empowering for the population who utilizes such a system.

The H.6 Model shown in the elevations illustrations below showcases the possible variety of colors and finishes applied to the skin of the building. When fully assembled the building provides open spaces on the grade level, third, and roof to be user-defined. The front and side elevations show the possible glazing arrangements to help maximize daylight illumination for the livable space and circulation, but the rear elevation eliminates any glazing because of the possibility of close proximity to other buildings and increasing privacy (Fig. 120-123).

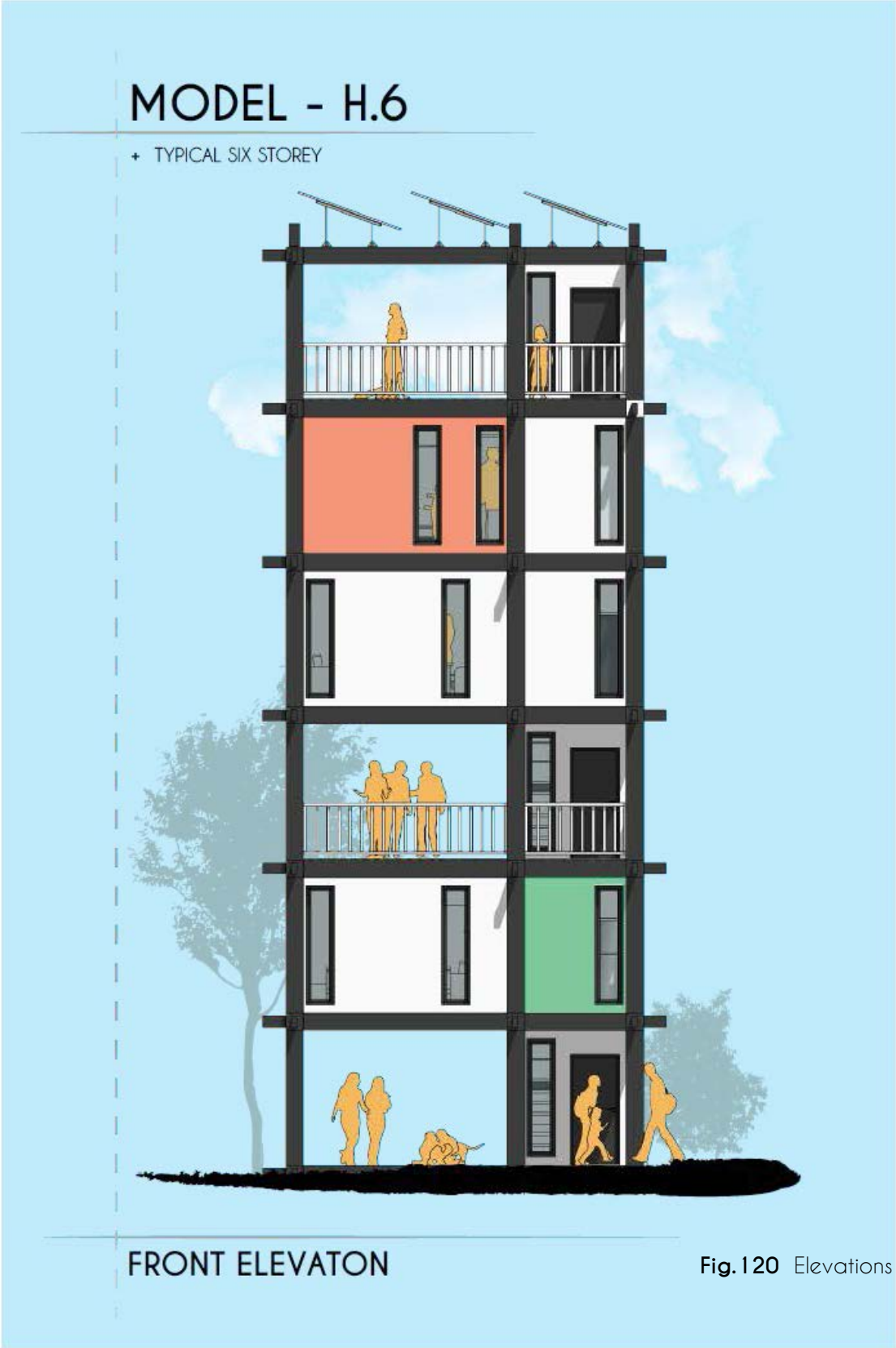


Fig.120 Elevations

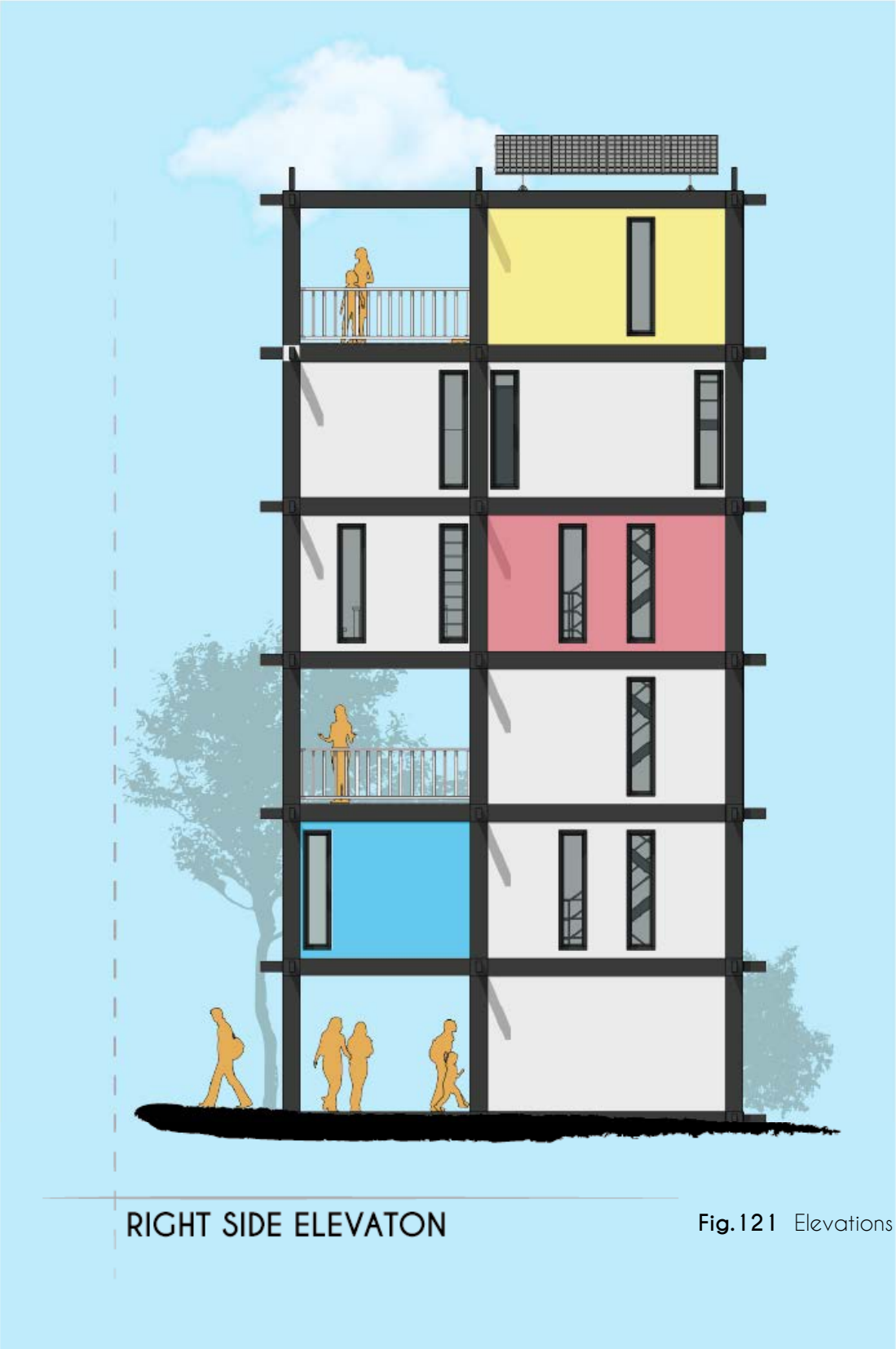


Fig.121 Elevations

Fig.122 Elevations

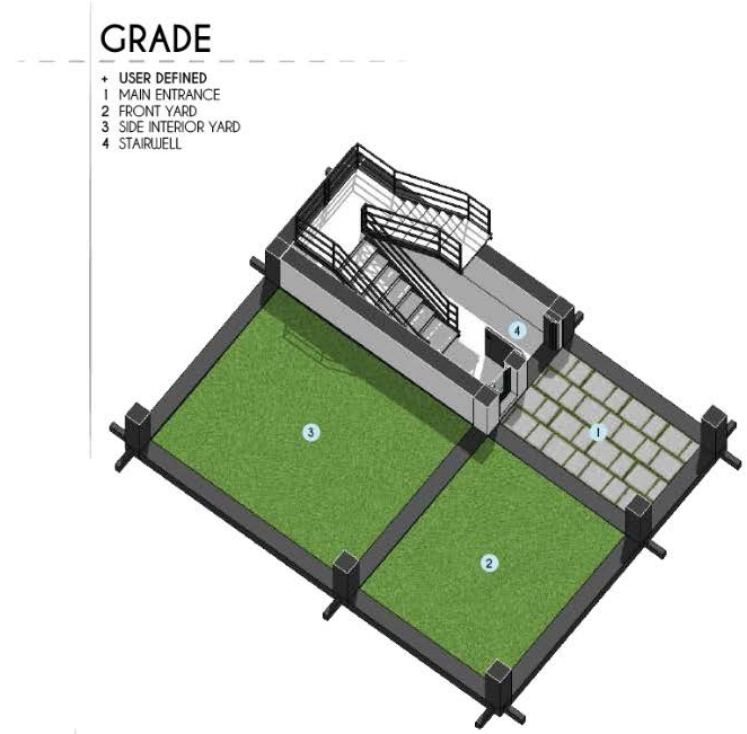
Fig.123 Elevations

Also, the elimination of glazing on the rear side of the building helps improve unit layout design, as such to include a flat unobstructed wall for a bedroom to place the headboard against, or a living room where a media center is abutted to it. Certainly, the user will ultimately have the final say or choice to arrange where the glazing might be placed according to their preference or need. Below is an example of possible unit arrangements that might fit within the H.6 Housing Model.

Model H.6 Typical Build/ Layout (Figs.124-126):

1. Grade Level: Main entrance, front/ side green space user-defined.
2. Second Level: Studio/ Bachelor unit, possible layout. Small kitchen and full bathroom.
3. Third Level: Middle terrace to be defined by the user.
4. Fourth Level: 1st level of a two storey unit, housed living/ dining space, full kitchen, and loft internal stairs.
5. Fifth Level: 2nd level of a two storey unit, includes a master bedroom, children's room, and a full bathroom.
6. Sixth Level: Roof terrace to be defined by the user.

Model H.6 is a typical or possible six storey building (Fig. 127) that showcases the potential of the building assembly or 'The Kit'. It does not necessarily illustrate the only option, but an option out of many.



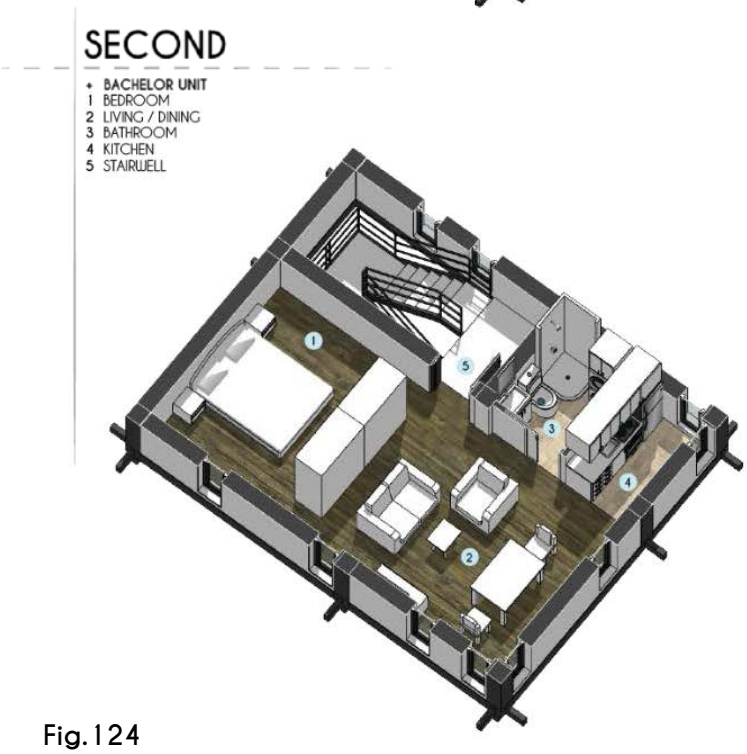
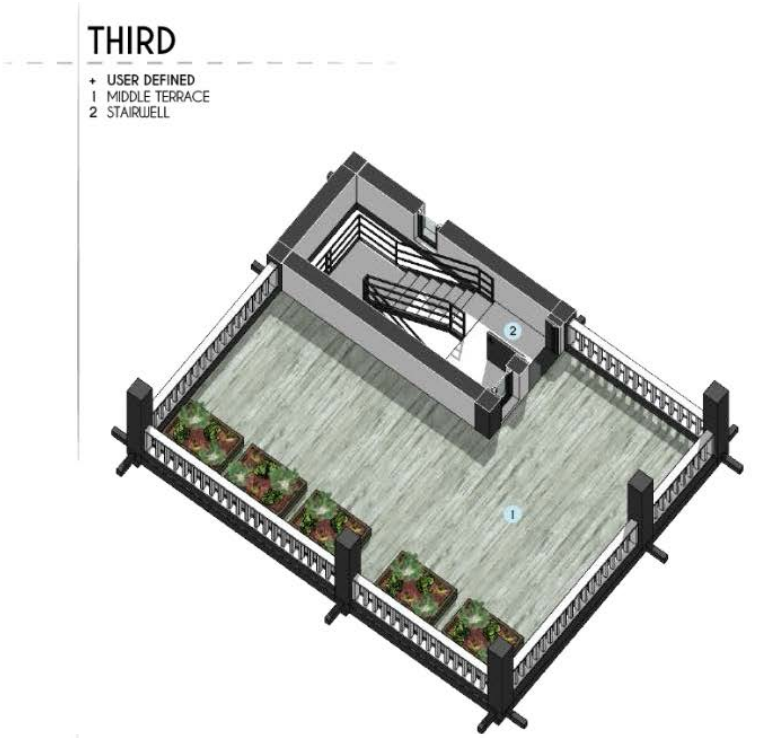


Fig.124
Layout/ Plans



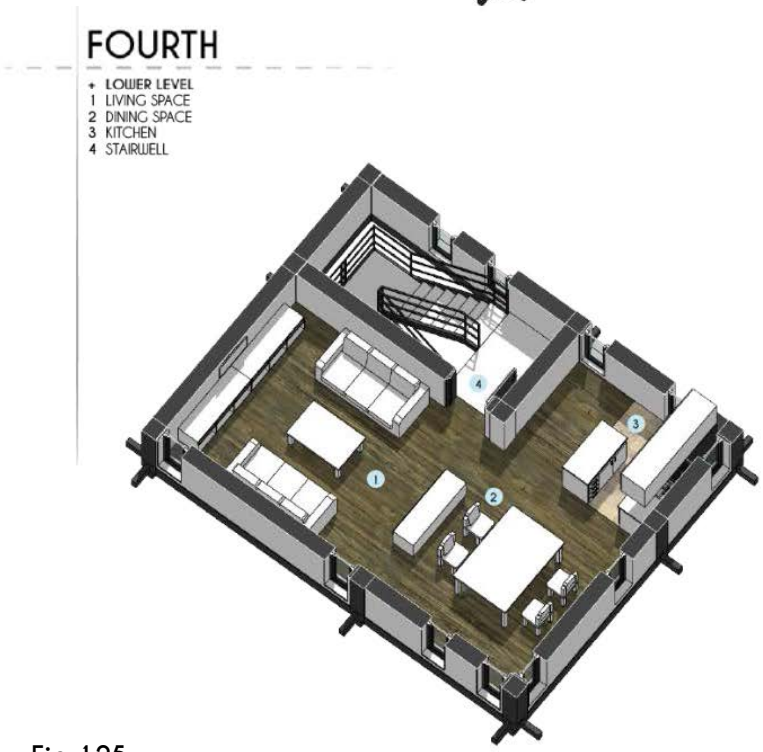
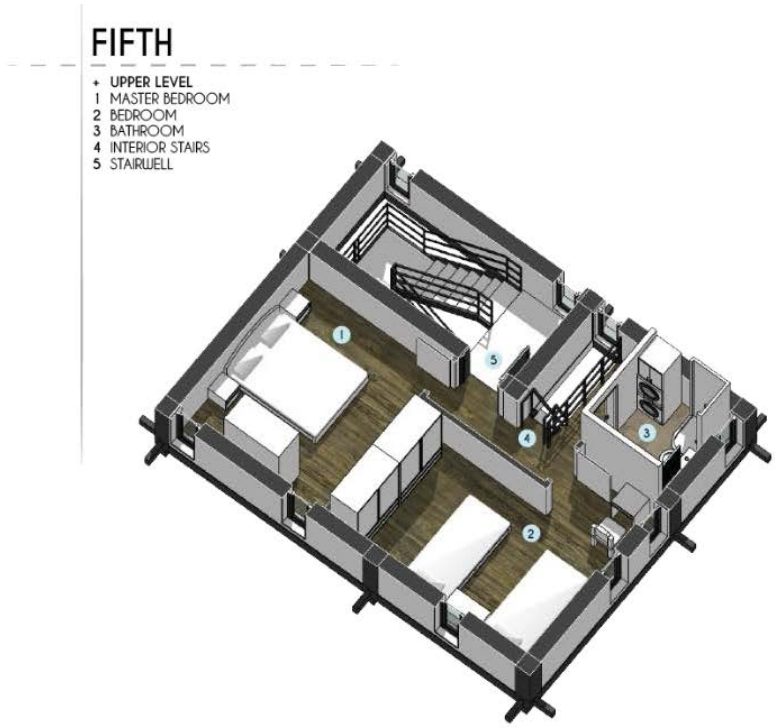


Fig.125
Layout/ Plans



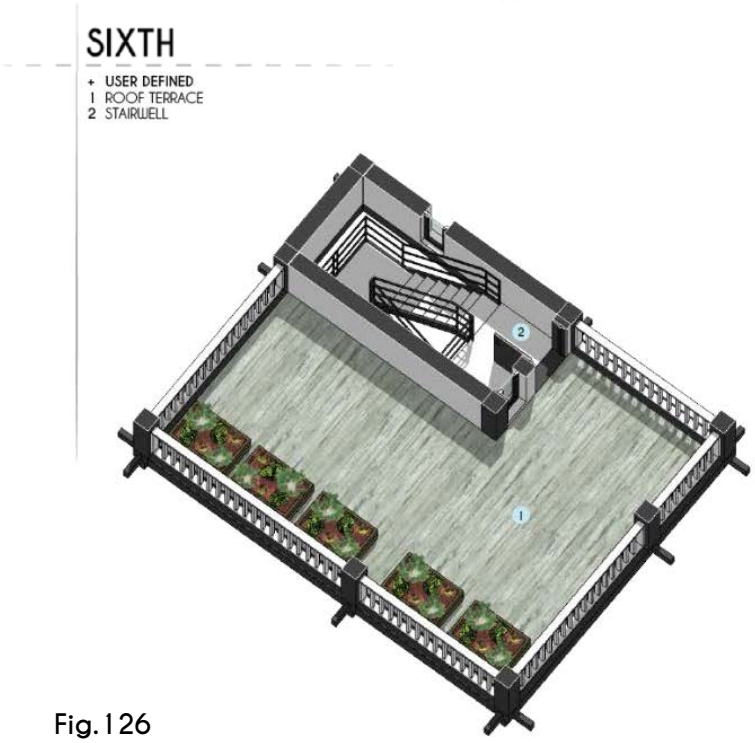


Fig.126
Layout/ Plans

Fig.127
Model H.6

Housing Increments

In the previous two sections, we identified 'The Global Kit' and the possible housing models and types included in the kit. In this section, we will identify the possibilities of expansion, build implementations in phases over time, and the flexibility of the build space defined by the user/ resident. Finally, if all is well then, we can imagine what such a kit could transform over 10 years.

The nature of the 'Kit' is that it is incremental at its core, where piece by piece it is assembled into a habitable and livable space defined by its user/ resident. Floors/ Levels are added on as needed and expanded upon over time. As one housing unit rises fairly quickly, then another will follow without displacing anyone in the process because it is self-built by the resident on their own sight.

As time passes and the needs increase in terms of space for a growing family, or a growing populous, then most certainly the built environment should follow suit as well. This is why it is important to implement a self-build easy to assemble strategy for a collective of residents to choose how their neighborhood, village, town or city should grow. 'The Global Kit' has this flexibility to accommodate the needs of many, especially the ones who do not have access to adequate housing as we have discovered in earlier sections of this thesis. The 'Kit' is incrementally adaptive and flexible to expand over time with ease, add another

level without affecting the one below. It starts with low-rise, but it can become a cluster of mid-rise buildings (Fig. 128).

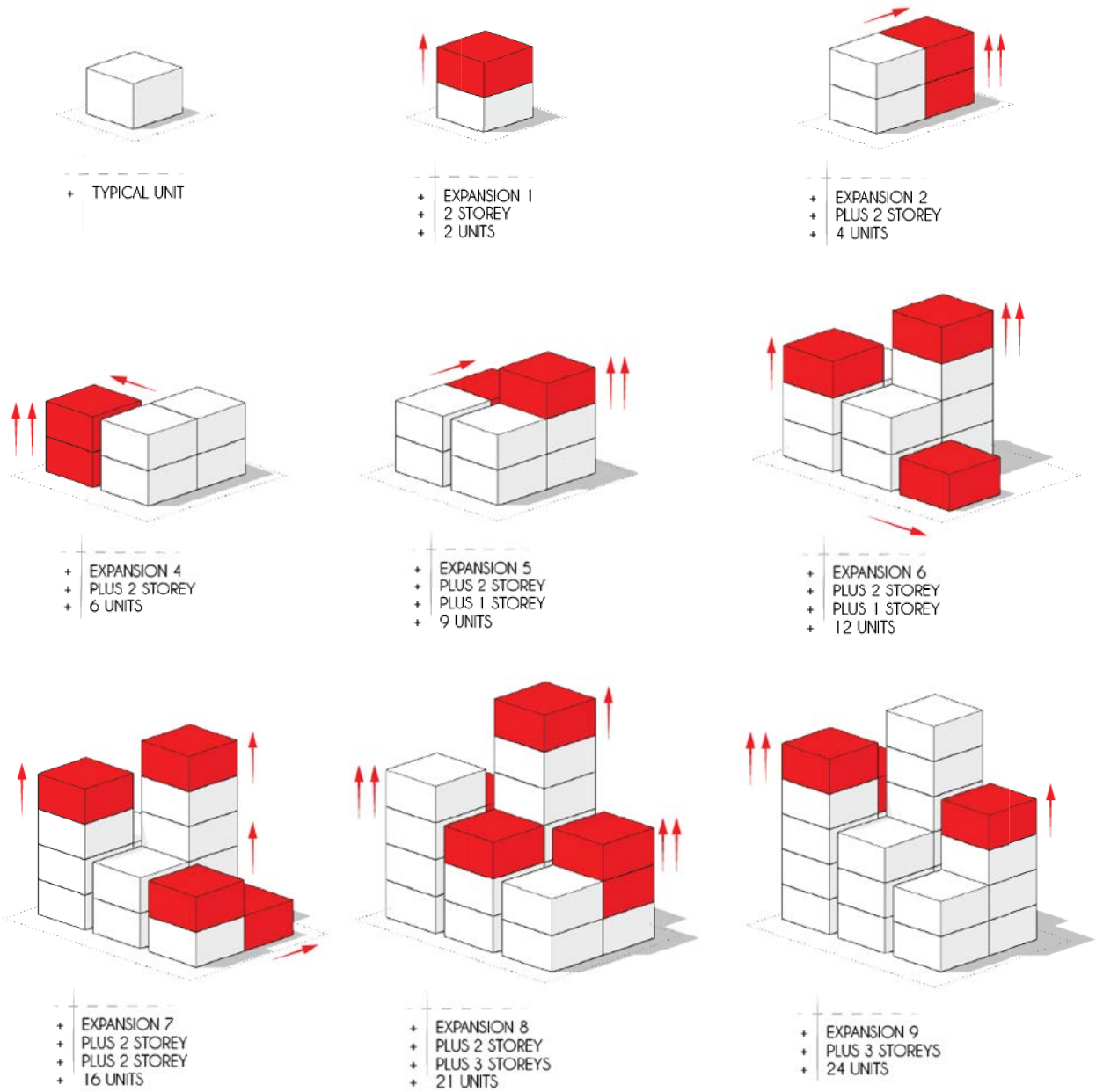


Fig.128 Increments

To implement such a housing project, planning is needed to be considered for each specific region the 'The Global Kit' to be used. It does not necessarily mean that without a plan for how the housing arrangement will be positioned on the site, or account for building proximities, but it is safe to assume with an appropriate plan will yield better results for residents and allow for efficient use of labor, time and resources.

The purpose of illustration, in this thesis we imagine the project would be implemented in phases, four to be specific.

Phases (129-132):

1. Phase 01: Initial stages of planning involving the community as a whole.
2. Phase 02: Construction commencing, training for self-builders. Low-rise two storey builds.
3. Phase 03: Continued phase 02 implementations, Low-rise builds, but early stages of expansion through additional levels/ storeys.
4. Phase 04: Accelerated expansion, due to a large number of well-trained residents/ community members to help implement further additions and begin new builds.

It is safe to imagine for the sake of visualization what might this project look like in 10 years' time. Considering that the first 4 phases of the project should not take more than 5 years if not less, because the 'Kit' allows for a speedy

PHASE 1

+ **INITIAL PLANNING**
+ COMMUNITY ORGANIZATION
+ SCHEMATIC PLANS

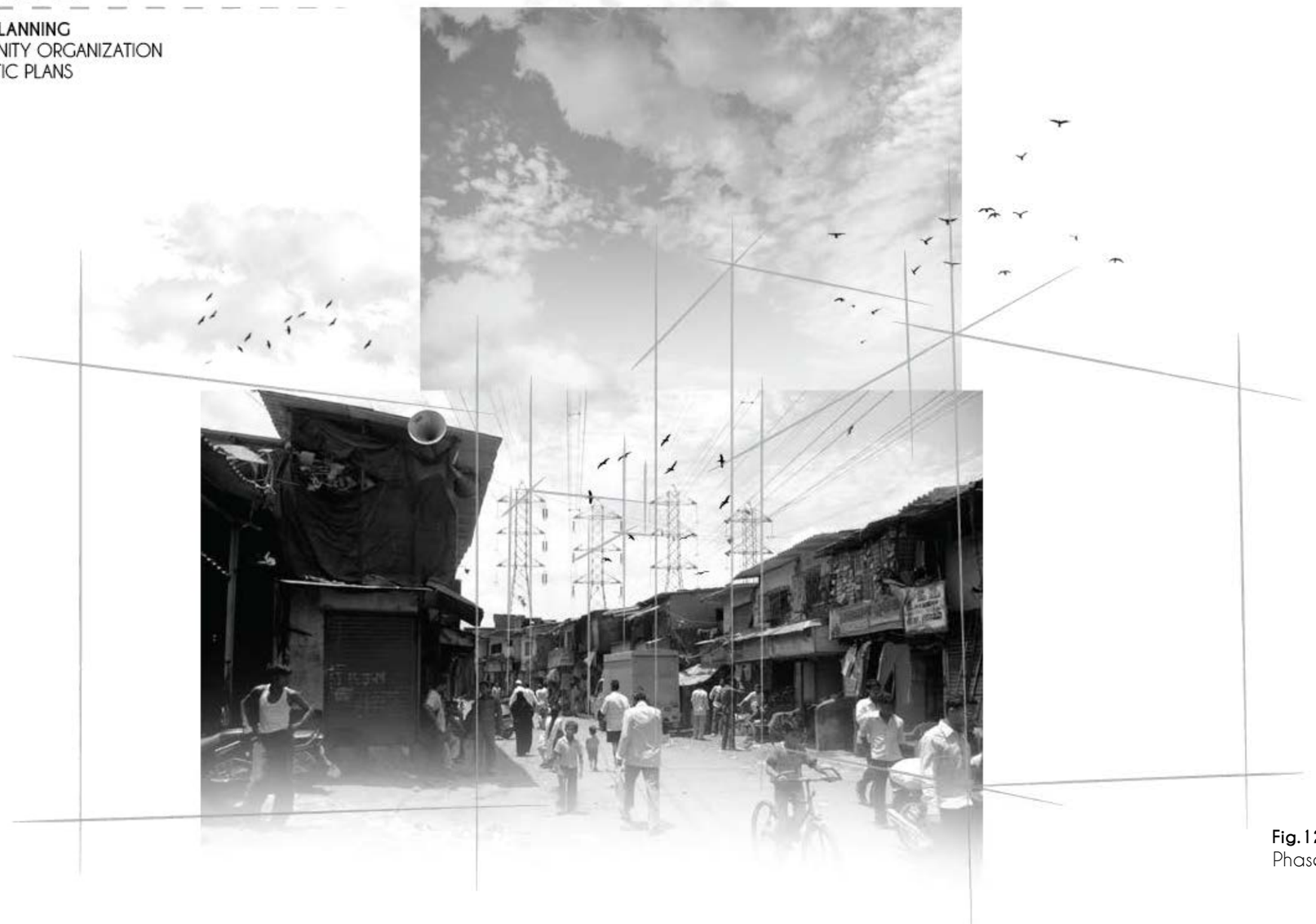


Fig. 129
Phases

PHASE 2

+ INITIAL CONSTRUCTION
+ COMMUNITY TRAINING
+ 2 STORY BUILDS

Fig. 130
Phases

PHASE 3

+ **INITIAL EXPANSION**
+ ADDITIONAL STOREYS
+ PREPARATION FOR PHASE 4

Fig. 131
Phases

PHASE 4

+ ACCELERATED EXPANSION
+ FURTHER IMPLEMENTATION
+ PHASE 2, AND 3

Fig. 132
Phases

construction and implementation of housing models. The flexibility the 'Kit' provides in expansion options is unique to it because of the ease of adding a second, third, fourth and so on floors. Thus, it is not far-fetched to assume in these types of housing conditions the community will begin to expand upwards and outwards.

More importantly, the design of 'The Global Kit' or the housing models/ types illustrated in the previous section show that each house assembly includes undefined or user-defined spaces (open spaces). What might these open spaces afford to their residents? As a speculative and explorative exercise, we imagine what might these houses look like in the next 10 years, and what their residents might convert these open possibilities to.

The flexibility of the 'Kit' provides not only opportunities to expand livable space through the addition of self-build units within the open spaces, but this also provides the opportunity of the residents to generate income as well. At grade, we can imagine that the homeowners might provide commercial spaces for themselves or tenants, and community services as well such a daycare, a clinic, and much more. Finally, the character of the building will inevitably become unique to each resident's preference and material availability. The following images illustrate some of the speculative possibilities afforded to the residents and how they might generate a new urban fabric and a unique aesthetic to each home (Figs. 133-136).

Fig.133 Overtime

Fig.134 Overtime

Fig.135 Overtime

Fig.136 Overtime

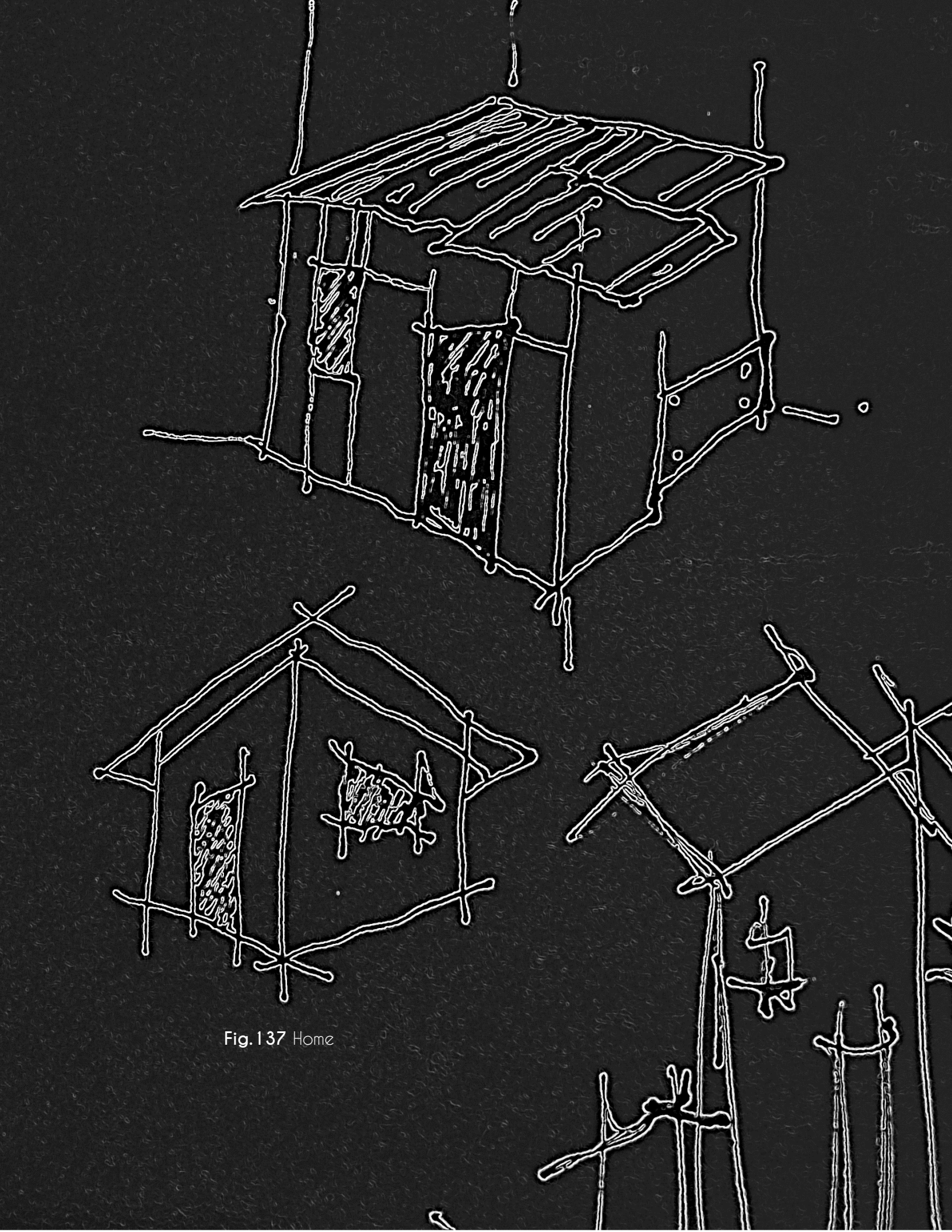


Fig.137 Home

Reflection:

> *"The project emerging designs and develops a 'Building Assembly' system of parts and connections which can be utilized by those who need to survive their present difficult realities."*

The statement above was made early in the thesis, as to direct the main question of the thesis. Can we design and develop a housing building system that will meet the needs of many across the globe? Which then, we can consider as 'The Global Kit', a low-cost prefabricated system of components, easy to self-build, and flexible to adapt to a myriad of conditions and expands with increasing demand.

We have investigated the unfortunate existing conditions that many people are facing today in informal settlements, but out of that we discovered hope. These settlers have proven to us that they hold a vast wealth of knowledge and experience in building their own homes and communities. This phenomenon was utilized by organizations to implement strategic housing strategies, as we have observed in Masoro Village in Rwanda, Empower Shack in South Africa, Kambi Moto Housing in Kenya, and Iquique Housing in Chile.

Taking what we have learned from this information collected, we began to explore the possibilities of such building system and what it might be comprised

of? And the answer to the problem is to develop the system of building components that are preferably fabricated out of fiber reinforced composites to reduce weight and cost. The system minimizes the use of hardware and glues for cost reduction, but more importantly is the ease of assembly and disassembly it provides. The system needed to account for and include an energy harnessing strategy, water collection and filtration, waste management, and open spaces to be utilized and defined by the user. As we have learned that residents in informal settlements do not have the luxury or sufficient access to basic services and necessities of daily life, thus accounting for such lack of access and providing the access as part of 'The Global Kit' is key to its success.

Finally, the process of implementing such housing projects needed to be incremental from the micro scale at the joints and connections to the macro scale of building houses a level at a time ready to be expanded upon overtime.

Throughout the thesis, the main goal was to include the people as part of the solution to the problem, and self-building becomes self-sustaining, thus, leading to self-empowerment. This is key to solving the contemporary housing crises across the globe, let the people become part of their own solution. Otherwise, we will end up repeating the same problem over and over, and many will be left homeless. An architect's delusion of solutions, might be the dream to an affordable future.

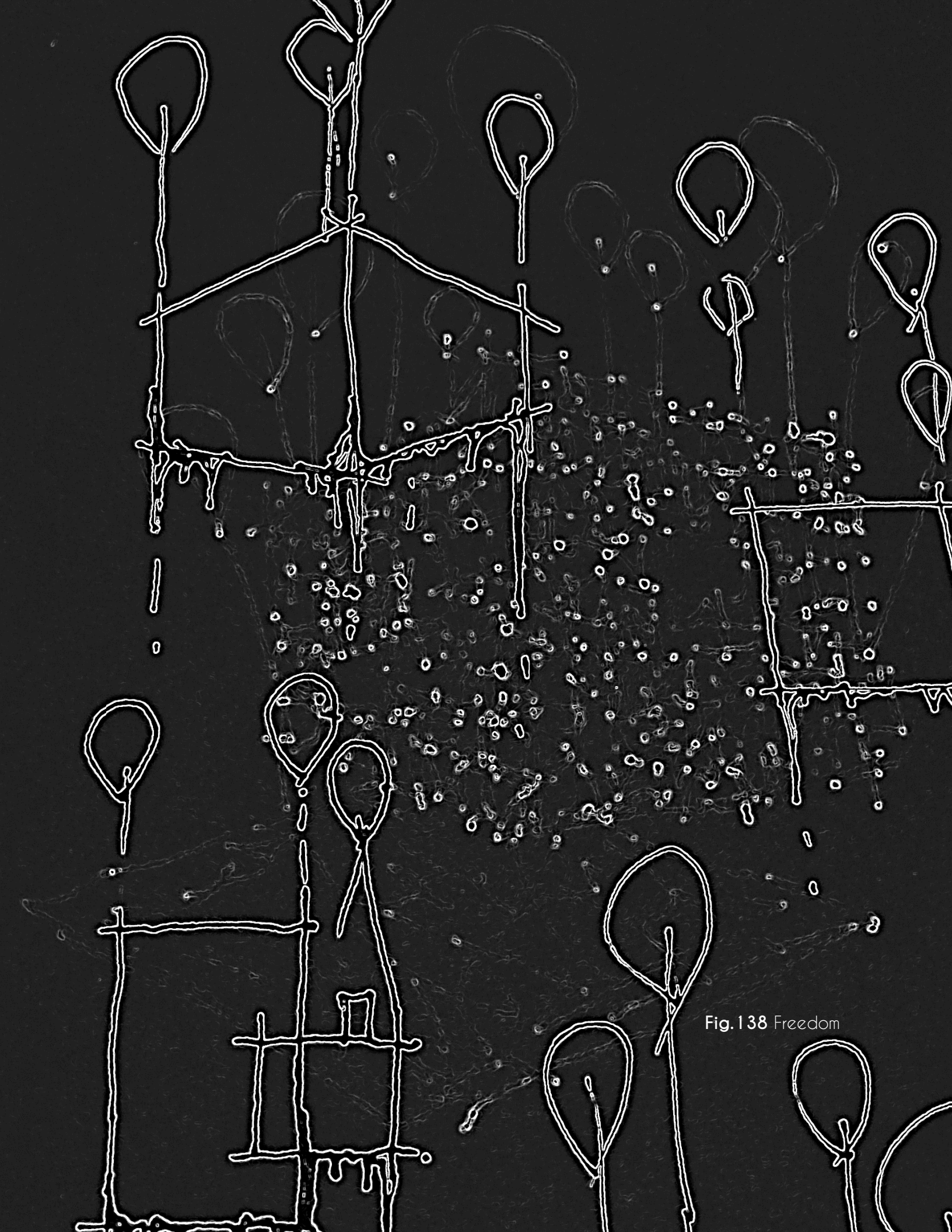


Fig.138 Freedom

Notes to Sources Used (Endnotes)

1. *The Right to Adequate Housing*. Geneva: Office of the United Nations High Commissioner for Human Rights, 2009.
2. *Habitat III Issue Papers*. Version 2.0. Quito, Ecuador: Habitat III, 2016, Page 1.
3. Parsons, Adam W. *The Seven Myths of Slums: Challenging Popular Prejudices about the Worlds Urban Poor*. London: Share the Worlds Resources, 2010.
4. Ibid.
5. "SLUMS: The Problem." LEBBEUS WOODS. December 30, 2011. Accessed November 11, 2018. https://lebbeuswoods.wordpress.com/2008/01/18/slums-the-problem/.
6. Doris C.C.K. Kowaltowski, Silvia A.Mikami G. Pina, Regina C. Ruschel, Lucila C. Labaki, Stelamaris R. Bertolli, Francisco Borges Filho, Édison Fávero, *A house design assistance program for the self-building process of the region of Campinas*, Brazil: Evaluation through a case study, Habitat International, 2005, Volume 29, Issue 1, Pages 95-111.
7. Majale, Michael. *Enabling Shelter Strategies: Design and Implementation Guide for Policymakers*. Nairobi: United Nations Human Settlements Programme (UN-HABITAT), 2011.
8. Parsons, Adam W. *The Seven Myths of Slums: Challenging Popular Prejudices about the Worlds Urban Poor*. London: Share the Worlds Resources, 2010.
9. Benson, Michaela. *Self-build Homes: Social Discourse, Experiences and Directions*. London: UCL Press, 2017.
10. Franco, José Tomás. "Proyecto Aldea Masoro: Empoderando a Las Comunidades a Través De La Arquitectura." Plataforma Arquitectura. July 30, 2014. Accessed November 10, 2018. https://www.plataformaarquitectura.cl/cl/624830/proyecto-aldea-masoro-empoderando-a-las-comunidades-a-traves-de-la-arquitectura.
11. Ibid.

12. Frearson, Amy, and Amy Frearson. "Urban-Think Tank Develops Housing Prototype for South African Slums." Dezeen. March 20, 2018. Accessed November 11, 2018. https://www.dezeen.com/2014/03/07/empower-shack-urban-think-tank-housing-south-africa-slums/.

13. Ibid.

14. "Technical Team Planning for Self-Help Housing in the Kambi Moto Community." World Habitat. Accessed November 11, 2018. https://www.world-habitat.org/world-habitat-awards/winners-and-finalists/technical-team-planning-for-self-help-housing-in-the-kambi-moto-community/.

15. Ibid.

16. Nuijsink, Cathelijne. "Less money, more creativity." Mark Magazine, Aug/Sept 2008, issue #15, pages 174-183. Accessed December 1, 2018. http://www.elementalchile.cl/wp-content/uploads/080814_QM_Mark_Magazine_HQ.pdf

17. Ibid.

18. Marshall, Colin. "Levittown, the Prototypical American Suburb – a History of Cities in 50 Buildings, Day 25." The Guardian. April 28, 2015. Accessed January 27, 2019. https://www.theguardian.com/cities/2015/apr/28/levittown-america-prototypical-suburb-history-cities.

19. Ibid.

20. *The Sphere Project: Humanitarian Charter and Minimum Standards in Humanitarian Response*. Rugby: Sphere Project, 2011.

21. *The Right to Adequate Housing*. Geneva: Office of the United Nations High Commissioner for Human Rights, 2009.

Annotated Bibliography:

Habitat III Issue Papers. **Version 2.0. Quito, Ecuador: Habitat III, 2016.**

In this source, the main issues of slums or informal settlements are introduced and carefully analyzed. The paper aims to define the reasons and conditions that lead to slums, and what might be the solutions to help these issues. Some strategies are presented, but not in great detail. The aim is to define, recognize, inform, and educate the readers about the problem of slums today, and how to combat this unfortunate reality.

Parsons, Adam W. *The Seven Myths of Slums: Challenging Popular Prejudices about the Worlds Urban Poor.* **London: Share the Worlds Resources, 2010.**

This book states the non-sensical ideas and believes that organizations and people alike hold about the slums. It defines ideas about the poor populations across the world and their living conditions. It discusses some of the characteristics of such informal settlements and some of the prejudices held towards them. It explores some of the options or solutions pitched to help these inhabitants of such informal settlements and what makes these propositions ineffective. Finally, the author presents case studies showcasing the inadequacies of some of the solutions attempted in the past.

Majale, Michael. *Enabling Shelter Strategies: Design and Implementation Guide for Policymakers.* **Nairobi: United Nations Human Settlements Programme (UN-HABITAT), 2011.**

The author explores the roles of governments in providing adequate shelters and affordable housing for the poor and identifies it as a human right. The author provides sources for solutions successful and not as successful as the means of a guide to identifying shelter strategies for successful outcomes.

Gilbert, Alan G. *A Policy Guide to Rental Housing in Developing Countries.* **Nairobi: United Nations Human Settlements Programme (UN-HABITAT), 2011.**

The author in this book/ guide defines the systems of the developed and developing world of tenants and landlords. The idea of which income is generated for the small-scale landlords and the mobility/ flexibility provided for the tenant. The author illustrates the importance of rental housing a means of social and national housing strategy which possibly lead to better economically viable cities.

Streets as Tools for Urban Transformation in Slums: A Street-led Approach to Citywide Slum Upgrading. **Nairobi: United Nations Human Settlements Programme (UN-Habitat), 2012.**

This publication explores the possibilities and options of the urban infrastructure of streets, public spaces and urban public services and how they play a major role in providing social prosperity, economic development and wealth generation. It looks at these aspects of urbanization as a solution for the 'slum' and upgrading them.

"Temporary Structures: Currently Available Products" UNICEF Supply Division August 2014. Accessed October 10, 2018. https://www.unicef.org/supply/files/Temporary_Structures_Information_Note.pdf

This is a UNICEF report on the available temporary emergency structures and their types. It also showcases where these shelters have been deployed around the world through graphs.

"SLUMS: The Problem." LEBBEUS WOODS. December 30, 2011. Accessed November 11, 2018. https://lebbeuswoods.wordpress.com/2008/01/18/slums-the-problem/.

Lebbeus Woods gives his opinion on the problem of rising slums/ informal settlements, and how/why they were created. He discusses the main causes for these slums, and their political/ global status, poverty, lack of economic access to global markets, access to infrastructure and so on. He further goes on to discussing that slums are a problem for the world as a whole, and they should not be tolerated because of all the suffering associated with them.

The Right to Adequate Housing. **Geneva: Office of the United Nations High Commissioner for Human Rights, 2009.**

This is a publication released to reinforce the human right to access adequate housing and defines what the minimum requirements are considered for adequate housing. It presents the rights of all the aspects of housing, such as protection against forced evictions, a house must be more than just four walls, the right to privacy and more. It also, defines who is entitled to this right, and how the authorities must play a major role in ensuring this right is achieved and maintained. Under these guidelines and requirements,

The Sphere Project: Humanitarian Charter and Minimum Standards in Humanitarian Response. **Rugby: Sphere Project, 2011.**

This is a handbook developed by The Sphere Project which presents emerging issues related to humanitarian response to impoverished communities, disaster areas, and disease-affected areas. Their core goal is right to live with dignity and prosperity. The handbook breaks down all aspects of humanitarian responses such as access to water, food, shelters, health, education, financial strategies and all other aspects of daily life items. The rationale behind this literature is to serve as a guide to help international and national organizations and whoever wishes to be part of the aid response to follow set precedents that were shown to be successful.

"Masoro Village Project / GA Collaborative." ArchDaily. September 20, 2013. Accessed December 1, 2018. https://www.archdaily.com/430409/masoro-village-project-ga-collaborative.

A project started by the GA Collaborative in Kigali, Rwanda to empower citizens by educating them on how to build a home with locally found materials such as mud and straw. The project uses uncommon building techniques like earth-bag construction stacked and coated with mud as a building skin. The project's approach is established local precedents, and utilize traditions found in the regions in new innovative ways.

Frearson, Amy. "Urban-Think Tank Develops Housing Prototype for South African Slums." Dezeen. March 20, 2018. Accessed December 1, 2018. https://www.dezeen.com/2014/03/07/empower-shack-urban-think-tank-housing-south-africa-slums/.

This is an article on a project designed, developed and built by Urban-Think Tank, where they utilize familiar materials used by South African informal settlers like corrugated steel panels and stick framing. The goal is to educate the locals on using existing materials arranged and constructed in an organized manner can yield better results. This initiative is part of the self-build strategies developed by Urban-Think

"Technical Team Planning for Self-Help Housing in the Kambi Moto Community." World Habitat. Accessed December 1, 2018. https://www.world-habitat.org/world-habitat-awards/winners-and-finalists/technical-team-planning-for-self-help-housing-in-the-kambi-moto-community/.

This article about a project initiated by The Technical Team to help establish a self-building community in Nairobi, Kenya. The goal of the project is to help procure the process of self-building in terms of planning and execution, thus letting the inhabitants gain security and land tenure. This project sets a precedent for self-building in low income and impoverished communities and showcases a possible solution for inadequate housing.

Nuijsink, Cathelijne. "Less money, more creativity." Mark Magazine, Aug/Sept 2008, issue #15, pages 174-183. Accessed December 1, 2018. http://www.elementalchile.cl/wp-content/uploads/080814_QM_Mark_Magazine_HQ.pdf

A magazine article about the innovative approach Alejandro Aravena took to solve the financial restrictions put on his firm for social housing strategies. His approach is to design and build half the footprint of the house and allowed the residents to add to the second half when they were ready.

Benson, Michaela. *Self-build Homes: Social Discourse, Experiences and Directions*. London: UCL Press, 2017.

This book is an extensive collection of self-build precedents, strategies, definitions, and practices. It also introduced thorough investigations of advancements in building technologies and planning, which have helped the self-building communities in defining what a home is.

Doris C.C.K. Kowaltowski, Silvia A.Mikami G. Pina, Regina C. Ruschel, Lucila C. Labaki, Stelamaris R. Bertolli, Francisco Borges Filho, Édison Fávero, *A house design assistance program for the self-building process of the region of Campinas*, Brazil: Evaluation through a case study, Habitat International, 2005, Volume 29, Issue 1, Pages 95-111.

This paper presents a case study and analysis of a program the helps to assist residents into self-building. The assistance is done through CAD assisted design to be distributed to self-builders.

Marshall, Colin. "Levittown, the Prototypical American Suburb – a History of Cities in 50 Buildings, Day 25." The Guardian. April 28, 2015. Accessed January 27, 2019.

https://www.theguardian.com/cities/2015/apr/28/levittown-america-prototypical-suburb-history-cities.

This article describes the history behind Levittown, designed and developed by Abraham Levitt and his two sons. It also goes into detail about the materials used, processes, costs, and time frames of construction.

Thank you...

...To all who have been part of my Journey.

Mohammad Reekan