

Habitats for Inhabitants



ABSTRACT

With the expansion of the population of Peru and specifically the population of Lima which has sharply risen, the government has been unable to provide housing for its citizens. The extensive areas of Peru are not easily habitable. The population is strongly concentrated in relatively limited areas. This is while adequate housing was recognized as part of the right to an adequate standard of living in the 1948 Universal Declaration of Human Rights. In order to gain a better insight into the possibilities for improvement of the condition, this thesis apart from climate analysis of the city of Lima which has unusual weather conditions due to its location, based on literature review tries also to define housing deficit which is the reason of forming slums and squatter settlements. In addition in urban scale analyzes four social housing projects constructed in Lima from 1954 onwards as a response of the government to the shortage of housing and also on building scale, investigates on the construction of self-built shelters and houses as an answer by people living in peripheries in order to compare them. The results and conclusions gained from these studies have underlined the necessity of self-help housing and been led to introduce guidelines by which people can construct their own houses in

the first stage of sheltering as a quick response. Therefore, this thesis uses a qualitative method and uses documentary data to make an analysis upon this matter. The objective of the thesis is to understand housing as a human right. To re-conceptualize housing and see that as a process rather than a product. A process in which by identifying a new prototype dwelling and proposing a system of modular-prefabricated, individuals can participate in it. People who have difficulties in finding housing and low-income households are our target Group. It is obvious that the human-right based approach should be at the center of housing policy. According to the objectives of this thesis, among the criteria of adequate housing, the fields that are being intervened are: Affordability, and cultural adequacy.



Figure 01. Aerial view of *San Cosme* hill in Lima, 2010. © Photo: Evelyn Merino Reyna Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984. *CLARA*, No4.

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CHAPTER 1 - Introduction

What are the goals and objectives of this thesis?

What are the issues that need to be considered in design regarding the climate condition of Peru and specifically Lima?

INTRODUCTION

OBJECTIVES

Housing improvements, mainly those constructed for low-earnings families, often do not adopt or rarely adopt recommended practices and perpetuate a standard design version and frequently are not adjusted to particular geographic and social circumstances[1]. The problems of housing in developing countries are not only qualitative but also quantitative because of the rising rate of urbanization and the extensive gap between the demand and supply of houses. What is evident is that the social production of low-income housing, a noteworthy portion of the built environment has got to be examined in different contexts in order to comprehend the best housing policy intervention. Housing is one of the most fundamental human needs although the process of having a house and the encouragement for realizing housing differ. The residence and its surroundings layout are inseparable from its economic, social, political, and cultural setting. A house is not just a physical boundary we live in; It must provide an environment that devotes to our physical, mental, and social prosperity.[2] With the Expansion of the population of Peru and specifically the population of Lima which has sharply risen, the government has been unable to provide housing for its citizens[3].

Broad zones of Peru are not effectively livable. The population is emphatically concentrated in generally restricted zones like the tropical lowlands, the high alpine parts of the *Andes* and the coastal deserts and has been so indeed during prior periods even if they have had small centrality for human settlement and yet have been the principal human habitats[4]. For many decades, the unceasing economic outbreak in Peru's economy, loss of education, healthcare and employment, and the ceaseless underdevelopment of infrastructure, in the Andean cities, caused extensive migrations to coastal cities and became one the foremost vital issues in Peru. Lima, the country's capital city, experienced a proceeded development of squatter settlements and faced the housing crisis most severely[5]. The estimated population of Lima in 2020 is more than 10 millions[6], "making it the second-largest city in the Americas after San Paulo. Around 70 percent of the population lives in slums – known as *pueblos jóvenes* or young towns – with limited access to water, electricity, and educational opportunities"[7]. This thesis addresses the challenges regarding the housing deficit in Lima with a human rights-based approach.

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Therefore, the general goal of this thesis is to understand housing as a human right. To re-conceptualize housing and see that as a process rather than a product. A process in which by identifying a new prototype dwelling and proposing a system of modular-prefabricated, individuals of urban global south can participate in it. A system that allows tenants to easily expand the shelter and add more rooms according to their necessities and budget.

Specific objectives are explained in following:

- 1- Design of a sustainable, modular, replicable dwelling prototype as an immediate shelter which is affordable and self-constructible in a short period of time and helps the economy of families
- 2- Design a scalable system unit which is adaptable to the need of a growing or shrinking family and is flexible to personalization and can be a source of rental income or commercial uses
- 3- Prototyping an aesthetic envelop that helps to light quality change, environmental control, and balancing the comfort.

The structure of the thesis is based on the analysis in different scales starting from country (Peru) to the city (Lima) and finally to the squatter settlements and self-built shelters. This chapter explores the climate condition of Peru as

one of the most vulnerable countries in the world to climate change impacts and then more specifically explains the climate condition in Lima. The second chapter focuses on defining different types of slums and their characteristics in Peru followed by an overview of Lima's growth and development and concludes with the fact that everyone has a fundamental human right to housing. The third chapter underlines the importance of the human right based approach and explores the human right to adequate housing. The fourth chapter will analyze the development of squatter settlements in Peru and improvement programs followed by the same analysis in the scale of Lima and will be continued by introducing the case studies in urban scale by analyzing four social housing projects constructed in Lima from 1954 onwards as a response of the government to the shortage of housing and also on building scale, investigates on the construction of self-built shelters and houses as an answer by people living in peripheries in order to compare them. The sixth chapter will explore the selected site and neighborhood analysis and finally, in the last chapter, there will be introduced the guidelines to construct the modules.

INTRODUCTION



Figure 02. Lima's geographical location

INTRODUCTION

SPECIFIC CLIMATE CONDITION OF PERU

“Peru is one of the most vulnerable countries in the world to climate change impacts, with seven of the nine climate vulnerability characteristics recognized in the 1992 United Nations Framework Convention on Climate Change (UNFCCC), including low coastal zones; arid and semi-arid areas; exposure to floods, droughts, and desertification; zones prone to natural disasters; areas of high urban pollution; fragile mountain ecosystems; and significant economic dependence on the production and export of fossil fuel”[8], “But one of the smallest contributors to greenhouse gas emissions (GHG)” [9]. According to Sotto “Peru can be divided into three basic climate regions:

- The desert coast
- The mountains/highlands
- The eastern lowlands

In General, the extremely dry conditions of the Peruvian coast is due to:

- 1-The Humboldt current in the ocean
- 2-The prevailing surface winds (trade winds)
- 3-The walker circulation in the atmosphere”[10].

Humboldt current is “an eastern boundary current that brings cold water from the Southern

polar region into the mid-latitudes, including northern Chile and Peru. The Gulf Stream brings warm water to eastern North America while the Humboldt current brings cold water to western South America”[10]. National geography encyclopedia defines Prevailing Winds as “winds that blow from a single direction over a specific area of the earth. Areas, where prevailing winds meet, are called convergence zones. Generally, prevailing winds blow east-west rather than north-south. This happens because Earth’s rotation generates what is known as the Coriolis effect. The Coriolis effect makes wind systems twist counter-clockwise in the northern hemisphere and clockwise in the southern hemisphere. Trade winds are the powerful prevailing winds that blow from the east across the tropics”[11]. The Walker circulation “is seen at the surface as easterly trade winds which move water and air warmed by the sun towards the west. The western side of the equatorial Pacific is characterized by warm, wet, low-pressure weather as the collected moisture is dumped in the form of typhoons and thunderstorms. The surface winds and Humboldt current work together to generate the upwelling of deep cold ocean water[10] explained in figure 3.

INTRODUCTION

As a consequence of these three movements of the Humboldt current, the Prevailing Surface Winds, and the Walker Circulation, cold, dry air will be delivered to the Peruvian shores and its desert coastal lands and in general in western shores of the mid and southern coasts of South America[10] shown also in figure 4. According to NASA Earth Observatory, “El Niño is the largest natural disruption to the Earth system, with direct impacts across most of the Pacific Ocean”[12]. National Ocean Service explains “The term El Niño refers to the large-scale ocean-atmosphere climate interaction linked to periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific”[13]. When El Niño occurs, the trade winds debilitate in the western and central Pacific, and in consequence, the clouds and rainstorms related to warm ocean waters also moves toward the east. Since there is less upwelling of the cold water from underneath to cool the surface, the surface water temperatures warm up in South America. El Niño causes the weather changes all over the planet because the warm waters discharge so much energy into the atmosphere.[14] Peru is one of the nations that's frequently struck by flooding and the El Niño event.

Note 1:

Humboldt current brings cold water to western South America.

Note 2:

The surface winds of the southeastern pacific and ocean currents follow a similar path.

Note 3:

“The surface winds and Humboldt current work together to generate upwelling of deep cold ocean water”.

Note 4:

“The Peruvian coast is the northernmost region that has desert coastal land due to this delivery of cold, dry air” [10].

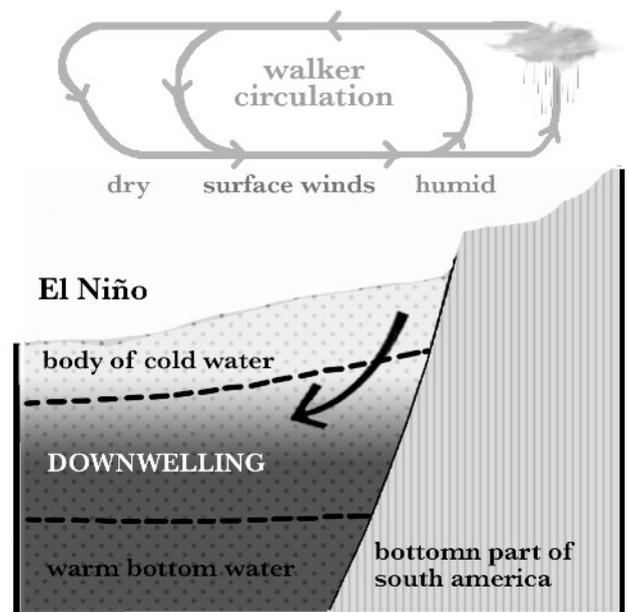
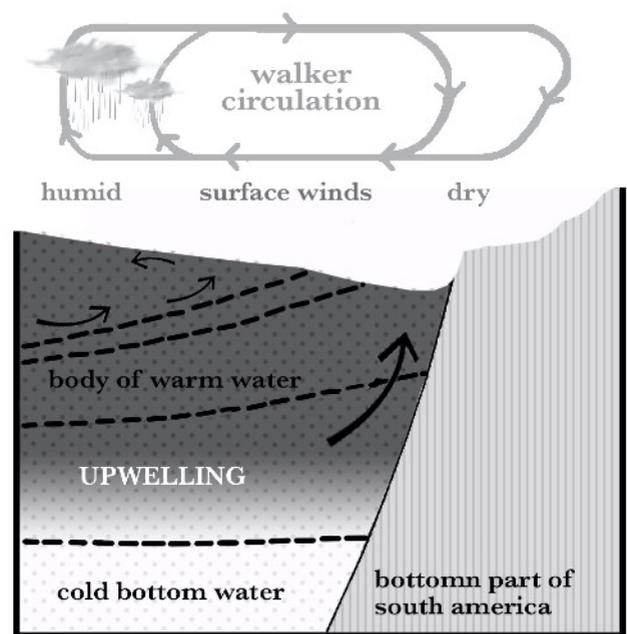


Figure 03. Visual understanding of Walker Circulation and El Niño

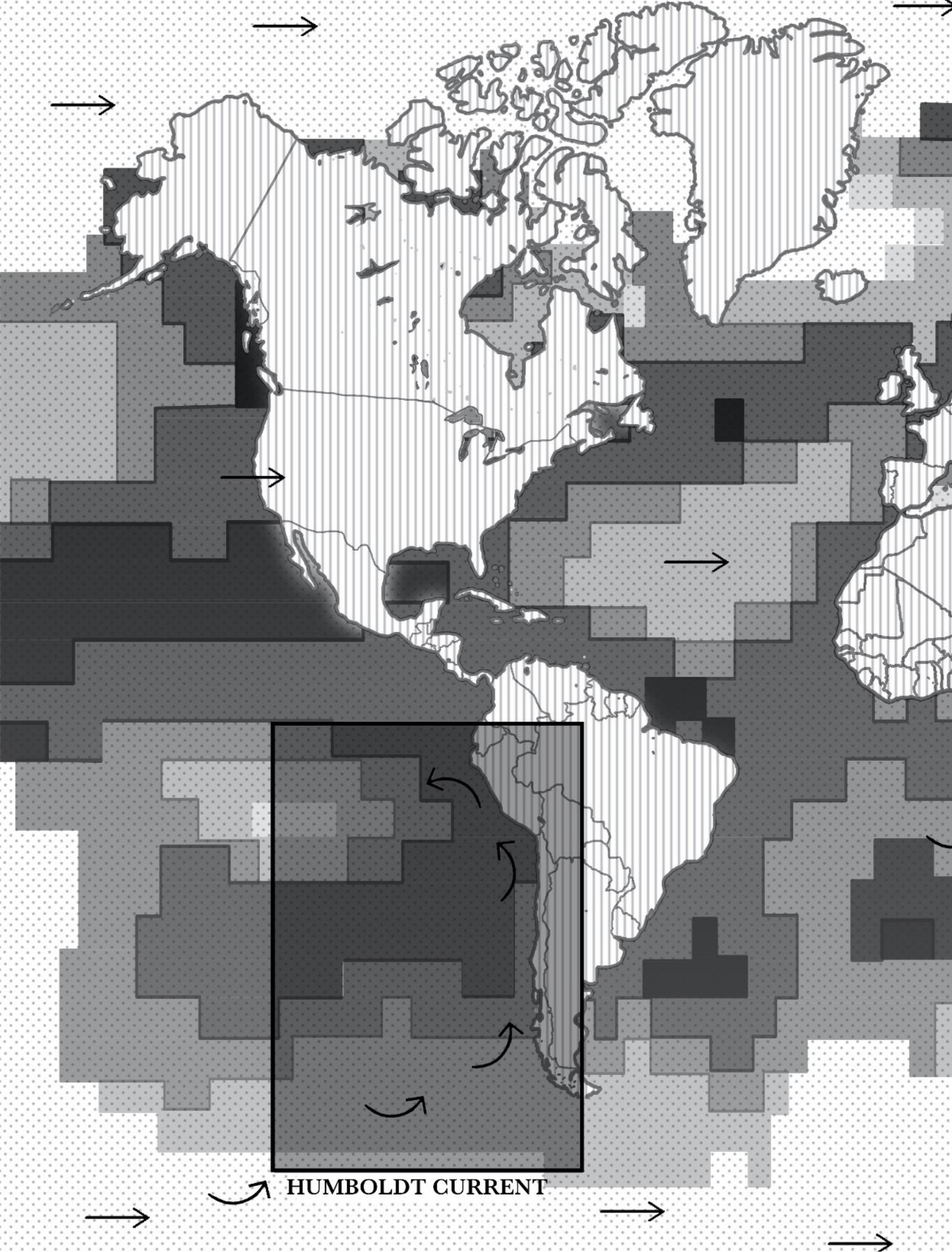
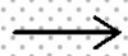
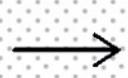


Figure 04. Visual understanding of ocean's temperature on June 2015 and Humboldt current



Trade Winds



Recorded warmest



Much warmer than usual



Warmer than average



Near average

INTRODUCTION

SPECIFIC CLIMATE CONDITION OF LIMA

Lima is built on largely flat land and is extended both north and south, among the North Central Andes and Southern Andes are shown in figure 5 and within the valleys of the Chillón and Lurín Rivers shown in figure 6. The Peruvian coastline is a wasteland crossed by fifty-two rivers that carry drinking water from the Andes, but just in the summer days. The community is situated on the banks of the Rímac River, near the mouth of it in the Pacific Ocean, and also somewhat less than 100km from the Andean Cordillera[7]. Thermal inversion happens within the winter season (June - September) characterized by low clouds held on by Andes Mountains which means instead of the temperature of the air eventually decreasing as it goes up, the temperature of the air near the surface decreases compared to the air above it and is also denser. An occurrence that identifies a reversal decrease of atmosphere heat with value to altitude. In consequence within the cold layer in the lower part and the colder layer above is created. a layer of warm air trapped in between which causes the effect of Lightbox. An effect that filters the sun's rays as well as creates diffuse, intensive lighting. This specific trend partly dissipates and results in hot, sunny damp weather within the summertime

days (December - March).

The closeness to the Humboldt Current prevents the improvement of rainfall clouds. Which translates to almost zero amount of rainfall during the year. Typical rainfall, nonetheless, is 6.4 mm per year, producing Lima among the driest urban areas within the world. Therefore, the city has a mild marine climate during the year, and with relative moisture, the lack of wind flow as well as rainfall [7].



Figure 05. Lima's Andes Mountains

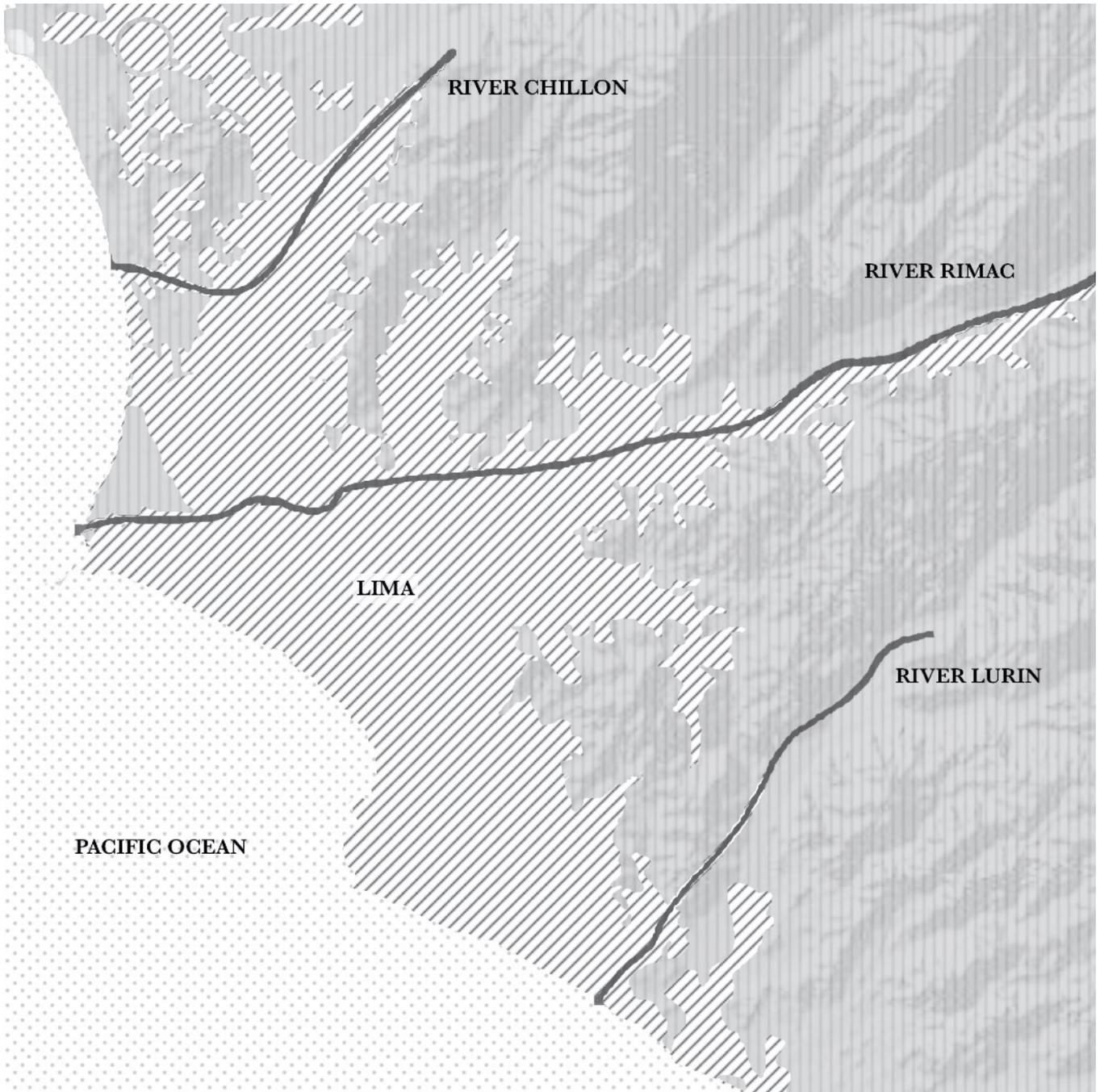


Figure 06. Lima's Rivers

INTRODUCTION

The temperatures oscillate between 14 and 20 °C in winter, and between 18 and 30 °C in summer. In Lima, summer is from December to March and winter from June to September. As can be seen in figure 7 the Hottest Month is February. In 2019 the temperature in February accelerated between:

The maximum and minimum temperature in summer:

31 °C (15 Feb) and 22 °C (23 Feb)

The maximum and minimum humidity in summer:

95% (23 Feb)

48% (16 Feb)

While the coldest month is August. In 2019 the temperature in August accelerated between:

Maximum 19 °C (21 Aug) and minimum -14 °C (5 Aug)

While maximum and minimum humidity was:

98% (25 Aug)

70% (21 Aug)

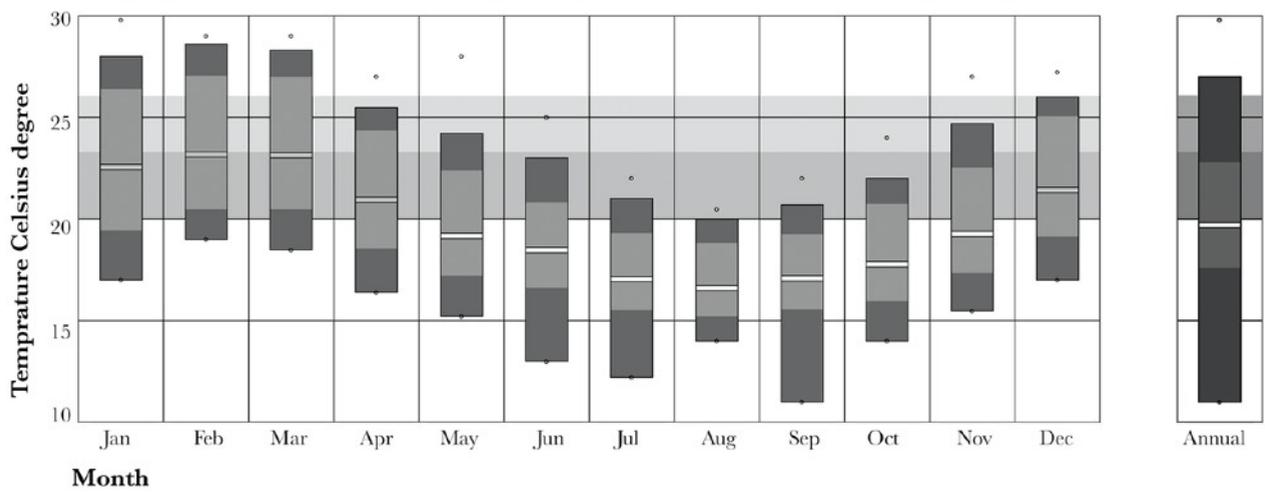


Figure 7. Temperature graph, 2019
 Source: Climate consultant Software

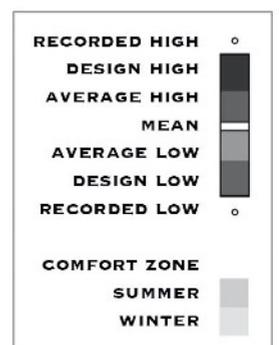
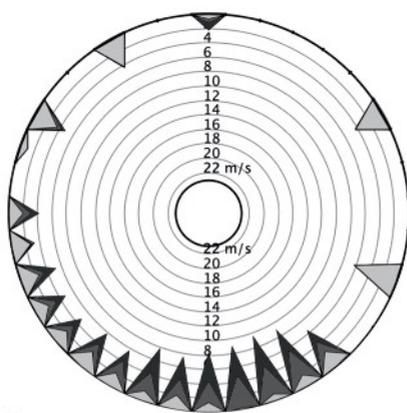


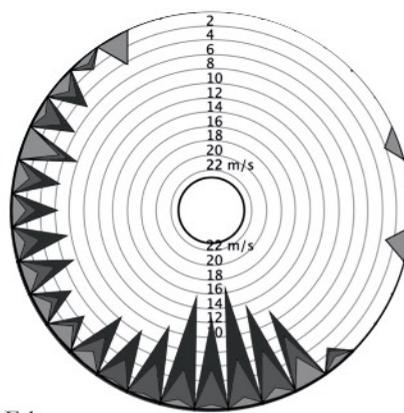


Figure 8. Lima's foggy weather in slums of Lima. Retrieved January, 2020 from <https://medium.com/@UNITAID>

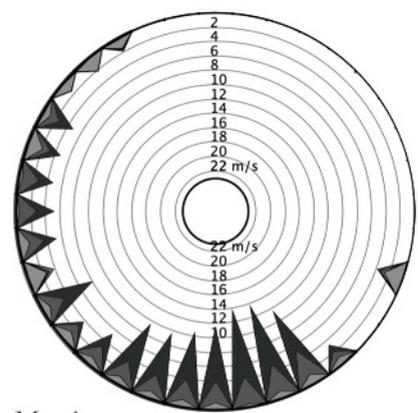
INTRODUCTION



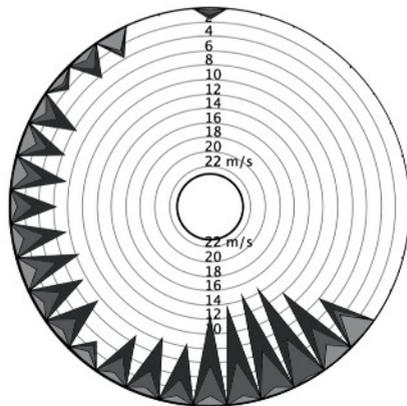
January



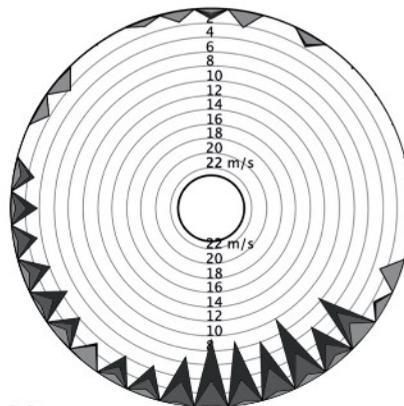
February



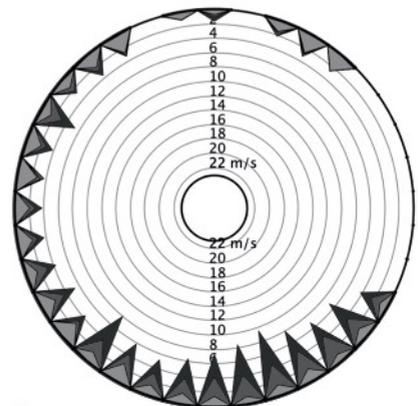
March



April



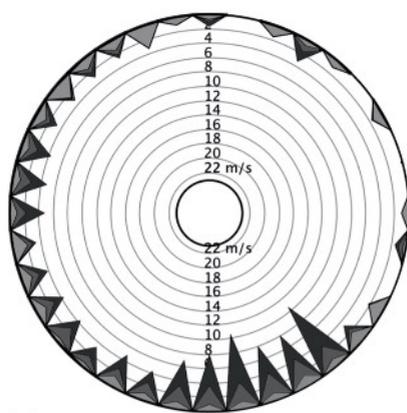
May



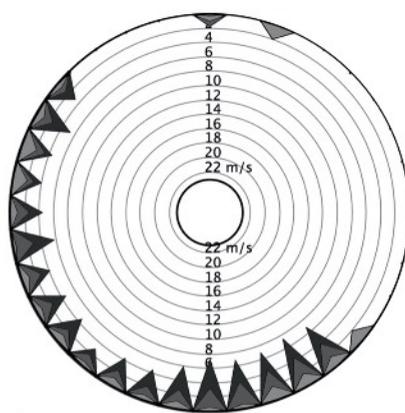
June

The wind flows are broadly constant and soft the entire year, generally in the morning calm. With noon the principal direction is South-West (where lies the sea) with gentle winds. In the afternoons the main direction is South-

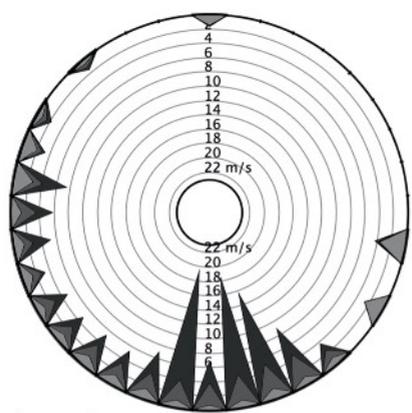
West (where lies the sea) with gentle winds. In the afternoons the main direction is South-East. Winds between December and February, are extensive which are shown in figure 9.



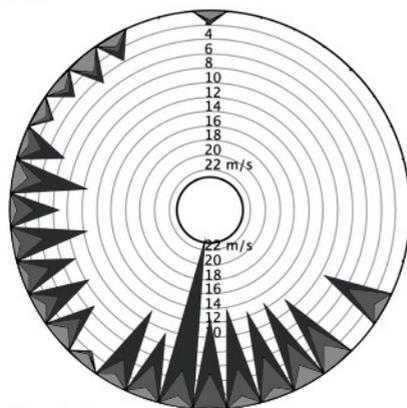
July



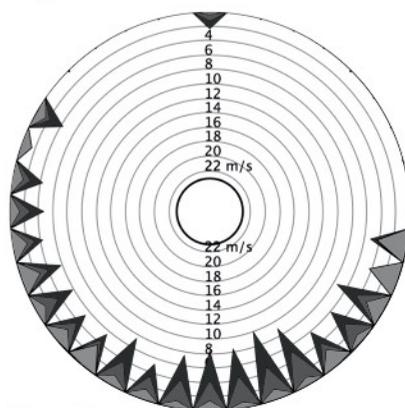
August



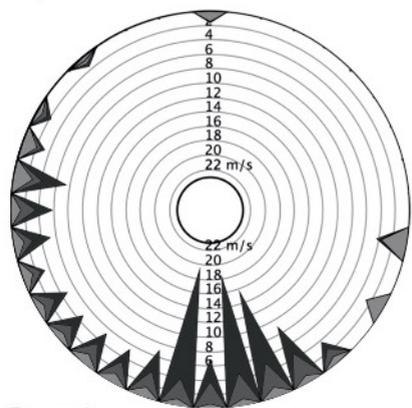
September



October



November



December

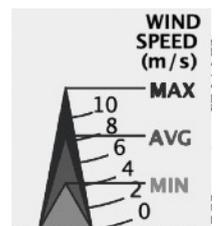


Figure 9. Wind wheels 2020
 Source: Climate consultant Software

INTRODUCTION

CONCLUSION

The specific climate condition of Peru and in particular Lima has made it difficult for people and the government to provide suitable housing. Among the rivers, there are swathes of the desert that have created a kind of land bank utilized by the state since the 1960s for constructing social housing for low-income households, and therefore, the land has a reasonable price. This phenomenon aside from informal urbanization, which reached its peak point from the 1960s explains the reduced density of the local community likewise its huge extension. To the direction of the east, the low-income settlements of *pueblos jóvenes* were created in the mild slopes of the Andean foothills. These settlements are now being constructed in upper parts of the hills, with higher slope and even poorer living conditions while to the direction of west, Lima combines into the city of Callao [15]. The population of Lima from 1940 to 1972 enhanced through approximately 660 000 to 3 420 000 dwellers by about 500%. Since the start of the 1950s, an enormous population in Lima is living in squatter settlements in peripheries, who tries to find vacant land and invade the deserts by pushing their homes. This problem was stated in the 1940s by politicians, journalists, and architects, although the initiatives created were

not proficient at fixing the developing issue and sizable migration from countryside areas was happening spontaneously particularly to Lima. [5] The vast majority on the squatter settlements happen to be allowed to continue to exist because of the Peruvian government' s failing to supply replacing houses in the form of resettlement for the dwellers. [16] Giving these people the opportunity of constructing their own house by introducing them a guideline in which also climatic issues are solved can be a great help to their need for housing as well as helping the future form of urbanization. Therefore, by analyzing the climate, some general strategies can be applied for the new settlements as are explained in the following.

INTRODUCTION

GENERAL ENVIRONMENTAL DESIGN STRATEGIES

- Due to the specific climate condition of Peru, the introduced modules should be able to cool down the building passively in the summer month using natural ventilation and proper shading strategies while keeping the unit in comfort level in winters.
- West facing glazing should be minimized or eliminated to reduce summer and fall afternoon heat gain.
- Shaded outdoor buffer zones (porch, patio, lanai) should be oriented to the prevailing breezes which can extend living and working areas in warm or humid weather
- Using a long narrow building floor plan can help maximize cross-ventilation in temperate and hot humid climates.
- In order to capture natural ventilation, openings should be placed towards summer breeze which comes from southeast and southwest.
- In order to facilitate cross-ventilation, door and window openings should be located on opposite sides of the building with larger openings facing up-wind if possible.
- Screened porches and patios can provide passive comfort cooling by ventilation in warm weather and can prevent insect problems.
- Using open-plan interiors can promote natural cross-ventilation, or using louvered doors, or instead use jump ducts if privacy is required.
- To produce stack ventilation, even when wind speeds are low, vertical height between air inlet and outlet (open stairwells, two-story spaces, roof monitors) can be maximized [17].

CHAPTER 2 - Literature review

What is the meaning of the concepts of housing deficit, squatter settlements, and slums?

LITERATURE REVIEW

HOUSING DEFICIT

The meaning of the concept housing deficit is been translated as unaddressed demand for dwelling in a certain location. However, the term is articulated into two different types of quantitative and qualitative. The qualitative term refers to households whose qualitative inadequacies are screened by dwellings, like an absence of fundamental sewage disposal, dusty flooring, or a precarious place, while the quantitative term implies to the number of households who don't have housing as a consequence of family growth or overcrowding [18]. The reasons that housing deficit can occur are different. There are a manifestation of the assortment of forces within the marketplace and also the culture which complicates the provision of settlement for people. Therefore housing deficit is not simply a quantity or an academic term. Migration to a metropolitan region, lack of rental choice, or absence of inexpensive land can force dwellers to construct temporary, often qualitatively lacking dwellings. These dwellings are mostly built with poor materials that dwellers have saved up during a long period which is the consequence of lack of financial system and is an answer to an instant need. This is while in many cases these temporary dwellings finally end up being permanent and long-lasting dwellings or in

contrary they may remain unimproved or uninhabitable[19]. “Data from the 2005 Census reports that there are about 200,000 more households in Peru than there are dwellings, representing, in simple terms, the quantitative deficit. Analysis of data from 2004 indicates that over one million households may live in overcrowded conditions, defined as more than 3 family members per room”[20]. According to the assessment of the Peruvian Population as well as the Housing Census was done by Garcia and Conthe in 2005, 13.7% of all the settlements within Peru and more than 800,000 settlements lack minimum living requirements with precarious circumstances. These circumstances have been described as a structure of rush, straw, or palm leaves. While the dwellings with the minimum living conditions have been described as those settlements which not have accessibility to city electricity or drainage system or have a lack of sewage disposal. They have been reported as 32.29% of all of the settlements within Peru or more than 1,800,000. The deficit might reach more than two million or in other words, it can reach 30% of all dwellers.

LITERATURE REVIEW

Barriadas, are neighborhoods that supplied a mean for low-income households in the peripheral areas and shaped throughout the second one-half of the 20th century. Settlers had free of charge entry lands to the area since they were occupied unofficially. While *barriadas* were an answer to a definite demand, these kinds of neighborhoods had been mostly unofficially planned, self-built with poor quality as well as resource-dependent. Initiatives for regularization and enhancement of these settlements by government or inhabitants proved to be time-consuming and costly. Accommodating the low-income settlers within provided shelters caused the generation of hundreds of self-help low-rise sprawl at the peripheries of Lima and occupied every buildable land on edges of the city [21]. Since the poverty rate in Peru is high therefore it faces more housing deficits, much higher compared to other Latin American countries. Though housing is not the sole issue. The majority of significant problems are related to slums. The World Bank's Sustainable Development Department reported that in Peru 'the environment-related problems with the highest costs are, in decreasing order, inadequate water supply, sanitation, and hygiene, urban air pollution, natural disasters, lead pollution, indoor

air pollution, soil degradation, inadequate municipal waste collection and, deforestation.' (World Bank, 2006, p. 9) Therefore, the United Nations has declared "housing" to be a basic human right (UN-Habitat, 2002). "Since land constitutes an important component of any housing project, the right to accommodation and shelter is equivalent to the right to land, because houses cannot be constructed without land" (UN-Habitat, 2003). *Barriada* or *Pueblo Joven* is a Spanish term to describe slums in Peruvian terminology. and are mostly used to describe a type of settlements built with poor materials like wood, plastic, corrugated metal with restricted simple infrastructures including electricity [16].



Figure 10. Chédel, M. (April 2004) A new *pueblo joven* in the desert at the northern end of Peru's capital Lima, near Ancón



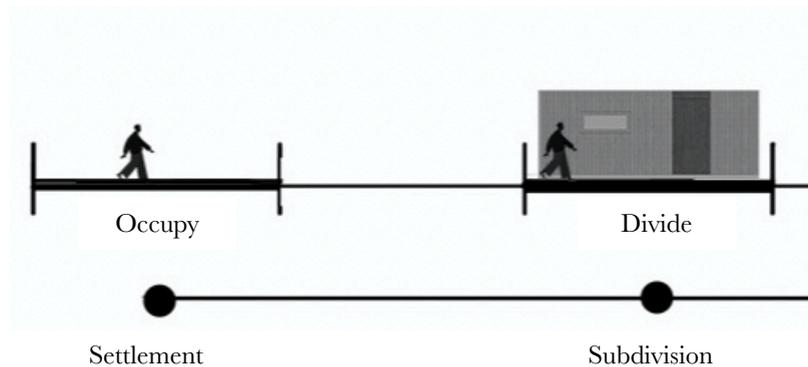
LITERATURE REVIEW

SQUATTER SETTLEMENTS

United Nations Expert Group defines squatter settlements as “an illegal neighborhood with the following of characteristics: a) no access to potable water supply and electricity; b) inadequate infrastructures; c) poor housing conditions and d) illegal tenure status” (UN-Habitat, 2007; Nyametso, 2012.). Squatter settlements may also be referred to as a start of action against eviction and deficit in the very first phase of urbanization. Moreover, according to urban planners population in squatter settlements have settled within the area prior to the urbanized created program as well as houses that are constructed before fundamental solutions are supplied. This is why urban planners recognize squatter settlements as a reverse procedure of urban development (see Fig. 11) that might be discussed within the following steps:

- 1- Settlements are established in illegal occupied lands within straw tents;
- 2- The land is divided into smaller portions for families in order to create provisional settlements;
- 3- Subdivisions are still being done on the area of blocks while constructions altered for durable materials;

- 4- Provisional materials are replaced with durable materials and the urbanization starts in the area by developing facilities including health clinics as well as shops and school;
- 5- Settlements continue to urbanize and become communities who effort to acquire adequate infrastructure in order to be included within the urbanized cities [16].



Therefore, housing and urban development for these settlers is a process that starts with an immediate answer to the need for houses and improves gradually where there will be felt the need for doing so. This is why there needs to be taken into consideration what are the real needs of these people and try to understand their priorities in order to be able to give the right response.

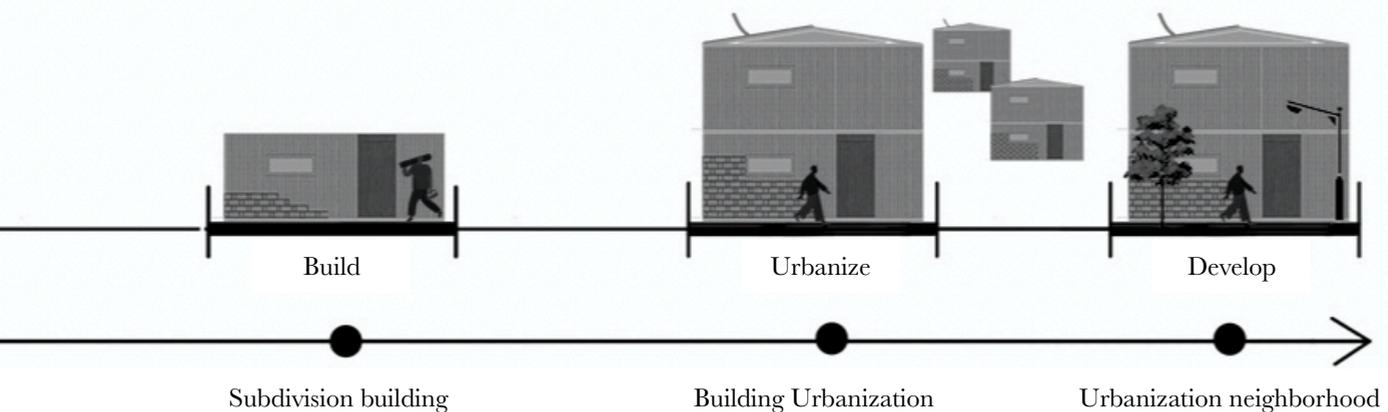


Figure 11. Inverse process of urban development
 Rodriguez, C. (2015). *The Transformation of Squatter Settlements into Urban Cities through the Effects of Tenure Security in Housing and Infrastructure Investments : The Evidence of Three Squatter Settlements in Lima, Peru*, pp. 42.

LITERATURE REVIEW

DEFINING AND MEASURING SLUMS

There is not an agreed definition of the term slums. The general meaning defines slums as "...contiguous settlement where the inhabitants are characterized as having inadequate housing and basic services. A slum is often not recognized and addressed by the public authorities as an integral or equal part of the city" (Jargowsky, 1996a; 1997.) Slums are recognized with different titles like tugurios, kampungs, as well as favelas or bidonvilles and they vary from high density, squalid main community tenements to impulsive squatter settlements with no authorized rights or recognition, extended within the limits of urban areas in peripheries.

There is numerous reason for which is better to have a common definition for slums rather than a specific one due to the fact that slums are extremely complicated to explain based on a particular criterion and alter too quickly. In one city one criterion might be defined as criteria of slums while in another might be defined as adequate housing. However, slums are the only accessible and affordable solution for individuals in case they've minimal earnings or have no other choices. Slums are greatly populated urbanized regions with inadequate housing and the vast majority of the settlers comprise emigrants, rural migrants, or foreign workers

with illegal/unstable jobs. Considering the spatial and physical aspects of slums, they have minimum standards and are heavily populated and dense. While considering social aspects they can be defined as a squirrel. Even though 'slum' is viewed as a very easy to understand the term, however, it contributes to a wide range of different concepts.

The Cities Alliance Action Plan defines slums as: "neglected parts of cities where housing and living conditions are appallingly poor".

According to the United States Agency for International Development, slums are divided into two categories: *Slums of hope* and *despair*.

1- Slums of hope: self-built illegal settlements in the procedure of advancement and progress.

2-Slums of despair: self-built illegal settlements in the procedure for declining and decay. [8]

Due to the complexity of the definition of the slum, in order to find a solution adjusted to particular geographic and social circumstances it is essential to study the context and the culture of the inhabitants of the place.

LITERATURE REVIEW

There are two different perspectives regarding slums. The negative perspective describes severing deficit and poverty, lawlessness, starvation, high rate of fatality along with precarious health issues as immediate implications of livelihood inside these casual circumstances. While the positive perspective instead of undervaluing these communities focuses on the financial, political, and social power of these dwellers. [22]

The reason why slums are neglected part of the city and the government ignores them is the fact that they mostly consider the negative aspects of the slums and positives aspects are being denied. Housing deficit will never be solved if the underlying layers of information of slums will not be studied.

LITERATURE REVIEW

CONSLUSION

Government has had different approaches regarding these settlements during history. At first, according to the government's mindset, these slums were temporary settlements that would vanish instantly with future urban development, and therefore, the existence of these settlements was neglected by the government. However, in the 1950s and 1960s, it had turned out to be very apparent that the settlements somewhat compared to vanishing had been actually growing faster than the population growth. [26].

As has been mentioned before, if we consider the positive perspective of slums, by having specialized managing and convenient guidance, these low-income settlers can act as catalysts to change the urban. They are effective at enhancing social values including the feeling of the local community, producing possibilities to get into the latest financial market segments, as well as producing innovative community characteristics for the entire community. With a participatory and inclusive policy, we can enhance the existing circumstances by providing them a method for self-constructing low-income housing. In this way also more job opportunities will be provided and it helps the provision of

infrastructure, and prevents insecurity. The research of the settlements is of severe worth in case it's meant to design and program a lot more renewable towns within the future. Out of an optimistic perspective of mind, we ought to reconsider the functions of slums over and above their physical and aesthetic look, because of their influence on the broader economical condition of the cities. In spite of the casual economies of theirs, slums can work to lessen unemployment and poverty. Since the government has an indifference approach regarding them therefore, in order to conquer the vicissitudes of their life, they have to work continuously and tirelessly.[22] What has been neglected by the government is that adequate housing is a human right and people are also not aware of their rights. Therefore, it is important to find out the reason behind this matter by studying the criteria of adequate housing and understand a human based approach.

“In today's dynamics, those who are commonly categorized as ‘poor’ are in fact regular individuals who happened to dwell in an environment lacking opportunities. Donating these people a home of their own is simply donating the opportunity to improve their living conditions, a model for the foundation of their future.”

Elisa Montalti and Simona Fabbri



Figure 12. Slums in Peru. Retrieved June, 2020 from https://gogetfunding.com/community-support-volunteering-in-peru/?show_desktop=1

CHAPTER 3 - Approach

What is the human right based approach and why are human rights important?

What is the human right to adequate housing?

APPROACH

HUMAN RIGHT BASED

By 2030, UN-Habitat estimates that 3 billion people, about 40 percent of the world's population, will need access to adequate housing. This translates into a demand for 96,000 new affordable and accessible housing units every day. Additionally, an estimated 100 million people worldwide are homeless, and one in four people live in harmful conditions to their health, safety and prosperity. Access to housing is a precondition for access to employment, education, health, and social services. In order to address the current and future housing challenges, all levels of government should put housing at the center of urban policies by placing people and human rights at the forefront of urban sustainable development [27].

In order to successfully apply a human rights-based approach to housing and slum upgrading, first, there needs to be a basic understanding of key concepts, key legal instruments, and the relevance of these to [our] work [28].

Adequate housing was recognized as part of the right to an adequate standard of living in the 1948 Universal Declaration of Human Rights and in the 1966 International Covenant on Economic, Social and Cultural Rights. Other international human rights treaties have since recognized or referred to the right to adequate

housing or some elements of it [29]. [figure 13]. “Despite international legal provisions many individuals across the world are not aware of their rights or do not have the means to implement them. The human right for housing should not be considered only in words that describe these rights but also should be integrated to the physical state of housing and the meaning behind is not four walls and a roof only but ‘includes within it the physical and material aspect of space as well as the emotional, mental and spiritual dimensions[30]’”. A right to life, right to culture, right to a safe environment.

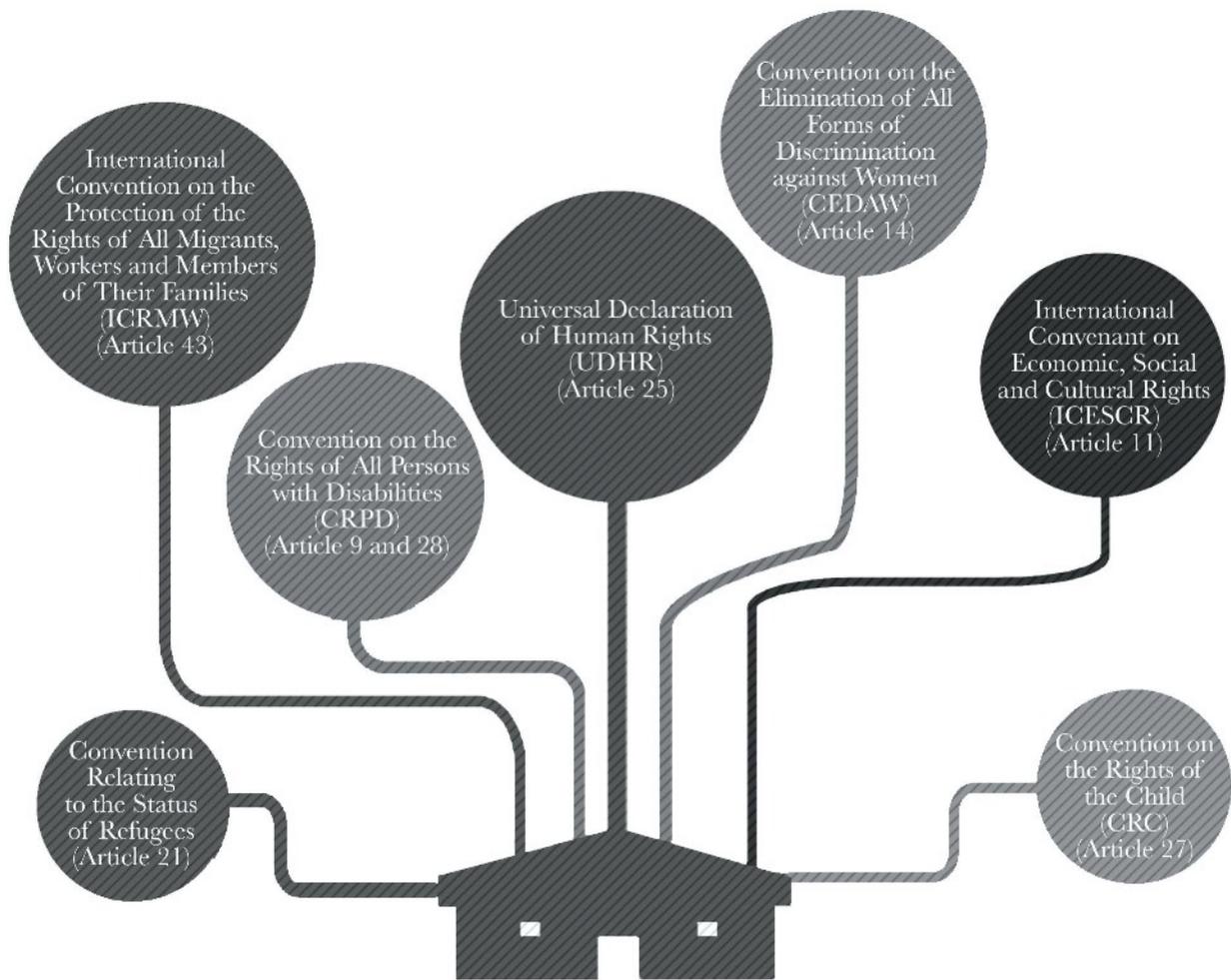


Figure 13. Human rights instruments codifying the right to adequate housing
 Retrieved June, 2020 from [http://www.ohchr.org/EN/ ProfessionalInterest/Pages/CoreInstruments.asp](http://www.ohchr.org/EN/ProfessionalInterest/Pages/CoreInstruments.asp)

APPROACH

WHAT IS THE HUMAN RIGHT TO ADEQUATE HOUSING?

Human rights offer everyone the independence of choice and interpretation and the rights to fundamental requirements needed for their complete satisfaction of their rights. Housing is a human right and everybody possesses this fundamental right which determines the least criteria which are important for individuals to dwell with equality, independence, and dignity [30] which will be explained later in this chapter. General Comment No. 4 of *The Right to Adequate Housing* states that “the right to housing should not be interpreted in a narrow or restrictive sense which equates it with, for example, the shelter provided by merely having a roof over one’s head,” but rather should be viewed as the right to live in security, peace, and dignity [31]”.

“Importantly, the General Comment recognizes that the right to housing should be available to all people irrespective of income or access to economic resources [32]”. Global Strategy for Shelter to the Year 2000 and The Commission on Human Settlements have stated: “Adequate shelter means ... adequate privacy, adequate space, adequate security, adequate lighting and ventilation, adequate basic infrastructure, and adequate location with regard to work and basic facilities - all at a reasonable cost” [32].

The idea of adequacy is relevant to the right to housing. Hence, in order to understand whether certain forms of settlements can be acknowledged as adequate housing, it needs to take into account a number of criteria.

Adequacy consists of interpersonal, financial, climatic, cultural, ecological, and other elements. According to the Committee, it is nonetheless easy to determine particular aspects of the right than can be considered for this particular objective in any specific context. Additionally, the complete satisfaction of various other rights like for instance the freedom of these settlers to be unioned with community, being involved in public decision makings, or the freedom of dwelling without forced eviction- is essential if the right to adequate housing is recognized and preserved by the individuals [32].

Human rights are interdependent and interrelated. The reason why they are interdependent is that the realization of every human right contributes towards the realization of other rights such as individuals' dignity. It happens by satisfying their psychological and physical needs. while the reason why they are interrelated is that achievement of each of them frequently is dependent, wholly or even in portion, in the achievement of various other

APPROACH

rights. Therefore, realizing the human right to adequate housing depends and is related to other rights like for instance, the right to a sufficient standard format of dwelling, the rights to sanitation and drinkable water, the right to health, food, education, work, the security of tenure and no forced eviction, and privacy. Thus, the government or decision-makers must follow an alternative strategy since contributions regarding achievements of any of the criteria of adequate housing and help the realization of an assortment of human rights.

“The right to adequate housing includes these freedoms:

Protection against forced evictions and the arbitrary destruction and demolition of one’s home; the right to be free from arbitrary interference with one’s home, privacy and family; and the right to choose one’s residence, to determine where to live and to freedom of movement;

The right to adequate housing includes these entitlements:

Security of tenure; Housing, land and property restitution; Equal and non-discriminatory access to adequate housing;

Participation in housing-related decision-making at the national and community levels. rights;

The right to adequate housing also entails protection against forced evictions:

Forced evictions are defined as the permanent or temporary removal against the will of individuals, families and/or communities from the homes and/or land which they occupy, without the provision of, and access to appropriate forms of legal or other protection[30].”

APPROACH

HUMAN RIGHTS LINKED TO THE RIGHT TO ADEQUATE HOUSING:

“ Right to water: For housing to be adequate according to international human rights law, there needs to be the availability of services such as water and sanitation.

Right to health: For housing to be adequate, it is also required that it is protected from threats to health.

Right to education: Enjoyment of the right to adequate housing can affect the right to education if housing conditions seriously undermine the capacity to study, or if housing is located out of reach from schools.

Right to expression: The enjoyment of the right to adequate housing may in this way influence freedom of expression. For instance, in some states, it may be required to have a permanent address in order to be able to register for voting.

Right to hold property: One of the seven components of the right to adequate housing is security of tenure, which is relevant for the right to hold property and national land rights.

Right to work: location of the house can affect

people’s chances to access livelihood opportunities.

Right from arbitrary interference: The right to adequate housing entails the right to not be subjected to arbitrary or unlawful interference with one’s privacy, family, home or correspondence”[30].

For housing to become adequate, it has to, in a bare minimum, come across the following criteria:

“Security of tenure: housing is not adequate if its occupants do not have a degree of tenure security which guarantees legal protection against forced evictions, harassment, and other threats.

Availability of services, materials, facilities, and infrastructure: housing is not adequate if its occupants do not have safe drinking water, adequate sanitation, energy for cooking, heating, lighting, food storage, or refuse disposal.

Affordability: housing is not adequate if its cost threatens or compromises the occupants’

APPROACH

enjoyment of other human rights.

Habitability: housing is not adequate if it does not guarantee physical safety or provide adequate space, as well as protection against the cold, damp, heat, rain, wind, other threats to health and structural hazards.

Accessibility: housing is not adequate if the specific needs of disadvantaged and marginalized groups are not taken into account.

Location: housing is not adequate if it is cut off from employment opportunities, health-care services, schools, childcare centers, and other social facilities, or if located in polluted or dangerous areas.

Cultural adequacy: housing is not adequate if it does not respect and take into account the expression of cultural identity [29]”.

APPROACH

CONCLUSION

Houses in poor areas that are provided as a response to housing deficit are hardly in line with these criteria. The reason behind might be the fact that the house is being seen as a product that acts just as a limit between outside and inside to provide a degree of privacy. These criteria are not just titles that describe adequate housing but are concepts that need to be implied practically. House is a place that humans mostly spends half of their life in it. It contributes to the physical and psychological state of each person. What mostly is neglected in housing projects is this psychological aspect which can be described also as culture adequacy.

Therefore if houses are not in line with human rights they would create further problems which later can be labeled as “negative aspects of slums”. Different housing strategies have been applied by the government but they have mostly failed whether for decreasing the rate of housing deficit or to improve and provide a better living condition. The reason for this failure should be studied and probably a radical shift is needed in defining housing.

Housing as a human right needs to be re-conceptualized and should be seen as a process rather than a product. A process in which individuals can participate in it in order to be

able to express their identity. It is obvious that the human-right based approach should be at the center of housing policy but according to the objectives of this thesis and the analysis that will be discussed later in case studies, among the criteria of adequate housing, the fields that are being intervened are affordability and cultural adequacy. Affordability is due to the fact that our target group is low-income people and culture adequacy is due to the necessity of considering housing as a cultural process.



Figure 14. Aerial view of slums in Lima.
Retrieved June, 2020 from Google earth

CHAPTER 4 - Development programs and informal actions

What was the answer of the government to the housing deficit?

What were the improvement programs in different scales of the country of Peru and the city of Lima specifically?

What was the response of people to their needs for housing?

DEVELOPMENT PROGRAMS

DEVELOPMENT OF SQUATTER SETTLEMENTS IN PERU AND IMPROVEMENT PROGRAMS

A lot of people migrated from peripheries to larger Peruvian cities due to an analytical growth in the **1940s** which caused the shift of Peru from being rural to an urbanized country during 30 years from 1940 to 1970. Nevertheless, in comparison with many other Latin American nations, import exchange due to post-war industrialization arrived later in Peru that led to poverty across the country.

The government surpassed a radical policy -the so-called *Barriadas* Law- in February **1961**, which recognized the authorized condition of present informal settlements; The Law for peripheral settlements as well as prominent Social Housing Estates; This radical progressive strategy was done in order to integrate these informal settlements to the city by connecting the actual physical enhancement as well as the authorization of current *barriadas* within a procedure known as “physical and legal improvement/regularization” [32]. This particular law guaranteed to cooperate to enhance infrastructure within current settlements while forbidding the construction of completely new settlements. But the enhancement continued until they complied with contemporary urbanization requirements and also grew to be qualified for individual land titles [33].

In **1971** a new form of settlement was established called “planned *barriadas*” in *Villa El Salvador* [32]. At the same time, National Social Mobilization System (SINAMOS- *Sistema Nacional de Movilización Social*) entitled other informal settlements as young towns and relocated them to the peripheries of Lima within new plots of the plan of greater Lima. The population of *pueblos jóvenes* or young towns within 10 years doubled and reached approximately 1,459,865 individuals and one-third of the whole population of Lima [34]. In **1979** in order to overcome the housing deficit, the government started a National Housing Fund (FONAVI) coming from the income of employees as an obligatory contribution which in **1980** was also served to produce the *Banco de Materiales* (Banmat). Banmat provided loans for constructing materials for self-help settlements, while FONAVI from 1980 to 1985 constructed settlements for middle-income people. However, it never resulted in an organized policy. Despite the effort of SINAMOS to recognize informal settlements, new legislation in the **1980s** was authorized which stopped entitlement and deserted the housing organizations. In **1996**, during the presidency of Fujimory, the Commission for the Official Registration of

DEVELOPMENT PROGRAMS

Informal Property (COFOPRI) was established by the government recognized also by the World Bank as a specific land-administration commission. From March 1996 to February 2009 across all over the country they allocated 1.797,836 land titles and about one-quarter was in Lima. In the 1960s and 1970s, the entire constructing procedure was held by the settlers while in the new approach the authorized constructing organization constructs basic modules for informal settlers. One of the main problems of this approach is the challenges to interact with building companies for the 'Construction in own site'. Since the lands are distributed in different locations, therefore, an integrate and adjustable plan is needed to involve construction companies, however, it is not easy to encourage them to do so since they prefer bigger sites[23].

DEVELOPMENT PROGRAMS

DEVELOPMENT OF SQUATTER SETTLEMENTS IN LIMA

The very first trend of development in Lima (1945 - 1960) was the establishment of squatter settlements towards the city center. This particular very first band of squatter settlements was developed often via the intrusion of the hills alongside the historic neighborhood or by the provision of private properties and leasing. [24] Fernando Belaúnde Terry, architect-planner and Lima Deputy, in 1945, trying to fill up the gap between the shortage of housing and demographic increase in Lima, introduced a housing plan called *Unidades Vecinales* which emphasized on neighborhood unit idea. The idea was to reconstruct the slums that were going to be eradicated and then move the people into new social housing units. At the beginning of the 1950s, a huge population and migrants resided in squatter settlements in Lima's peripheries and in deserts. In that year the National Housing Corporation (CNV- *Corporacion Nacional de Vivienda*) was established in order to prevent the unremarkable development of squatter settlement. The corporation was supposed to construct social housing all over the country. Whereas, after the conclusion of numerous units and social housing neighborhoods in Lima and Peru, the deficit became more severe.

In 1956 CRAV- *Comision de la Reforma Agraria y Vivienda* (1956-1958) was established as an advising team by the government in order to investigate the housing deficit to find out the problems and propose solutions. The leader of the team was architect Adolfo Cordova alongside other advisors anthropologist José Matos Mar and architect Eduardo Neira. The main problem stated by the team was deep structural issues of the country, and therefore, the only solution was in fact the solution people themselves found: The so-called *barriada*. In this regard, the team proposed the realization of the concept of Lots and services which were basic minimum units with basic services. A limited area with electricity and water.

Due to the lack of government's financial resources to construct mass social housing, self-help considered the proper way to overcome this problem. In 1957 John F.C. Turner was invited to Lima by the architect Eduardo Neira in order to discuss the problems with CRAV, other architects in CNV, and USAID anthropologist William Mangin relating *barriadas*[5]. General Prado's government (1956 - 1962) evolved the characteristics of squatter settlement development in February 1961 with the Law

DEVELOPMENT PROGRAMS

No.1351726. The law turned into a foundation of government policy in the sector of housing and squatter settlements. Once again the existence of these settlements was authorized and legalized and has been viewed as an unavoidable solution on the city's demand and intense development for housing. They also would have to become integrated into the community. Due to this law, the government supported settlers to upgrade their settlements and in **1970**, the military government provided access to basic services for settlers in urban poor districts since the military became the leader of the social development strategy.

The population of *pueblos jóvenes* doubled by **1981** comparing to 1971 approximately 1,459,865 and one-third of the whole population of Lima.

Figure 15 shows Lima's growth and Development from 1535 until 2002.

“**Today**, 70% of Peru's inhabitants are city dwellers, and 30% live in Lima. The urban area of the city increased from 44,598 hectares in 1981 to 66,452 in 1993, representing an increase of nearly 50% of its size in only twelve years. Lima grew from 645,000 inhabitants in 1940 to almost eight million in 2000 and it is estimated that half of the population lives in young towns” [24].

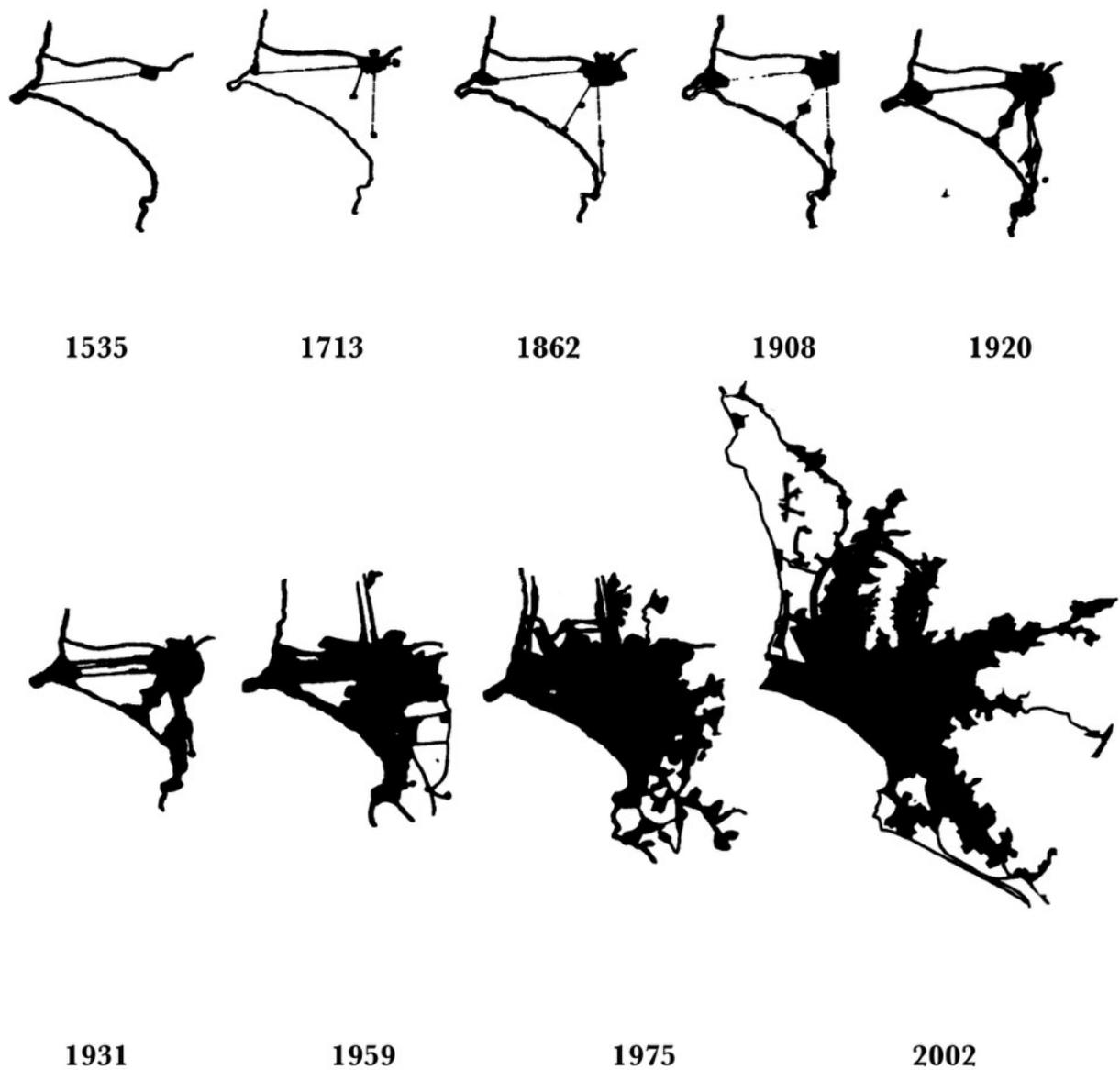


Figure 15 . Lima's growth and development,
 Source : Ortiz de zevallos (2002) *Nuevo Centro de Lima Norte : plan urbane estrategico para inpedencia Lima. municipalidad disrital de independecia*

DEVELOPMENT PROGRAMS

DIFFERENT TYPES OF SLUMS AND THEIR CHARACTERISTICS IN LIMA:

There are two major forms of housing in Lima, and each one has different subtypes:

1.1 Tugurios: There is an old part of the city called *tugurizadas* or slum zones with old, overcrowded, and deteriorated buildings that are called *tugurios* or slum tenements. The term is used also in the planning documents of the neighborhood and the term is known by the public, however, the residents of the neighborhood call it *solares* or tenements in English.

1.2 Pueblos Jóvenes and similar Forms: The so-called *barriadas* (shantytown), a title recognized in the 1950s, and known as *pueblos jóvenes* (young towns) in the 1970s are low-income settlements constructed by low-income immigrants who started to come to Lima in 1950s. However, from 1990 they are called differently by *asentamientos humanos* or human settlements. In these settlements, people first reside, and then build and provide services.

2. The *barriadas convencionales* (conventional shanty-towns): There is a variety of settlements from 1960 and other settlements from 1990 without any urbanized layout and completely unplanned. They have occupied the land whether in peripheries or

even close to city centers[15].

Housing neighborhoods are created when individuals move into an area and construct spontaneously the houses, equipments, services, and roads while *barriada* is a neighborhood built once it's been populated. Families usually invade illegally the vacant lands in the city whether just a couple of families over a night or by thousands of individuals subsequent to comprehensive planning.

Figure 16 shows how different slums are spread in Lima.

Other forms of *barriadas* have been created when households have one at a time occupied a vacant part of of land and progressively created a *barriada*.

The process of the development of *pueblos jóvenes* varies in different parts of Lima. In some areas, the improvement has been favorable and sometimes fairly remarkable due to the limited sources which the dwellers have had at the beginning. While in other areas the improvement has become poor and has also lowered the standards."Normally the squatter settlements are ranked lowest on the social scale, below the inner-city slum "[4].

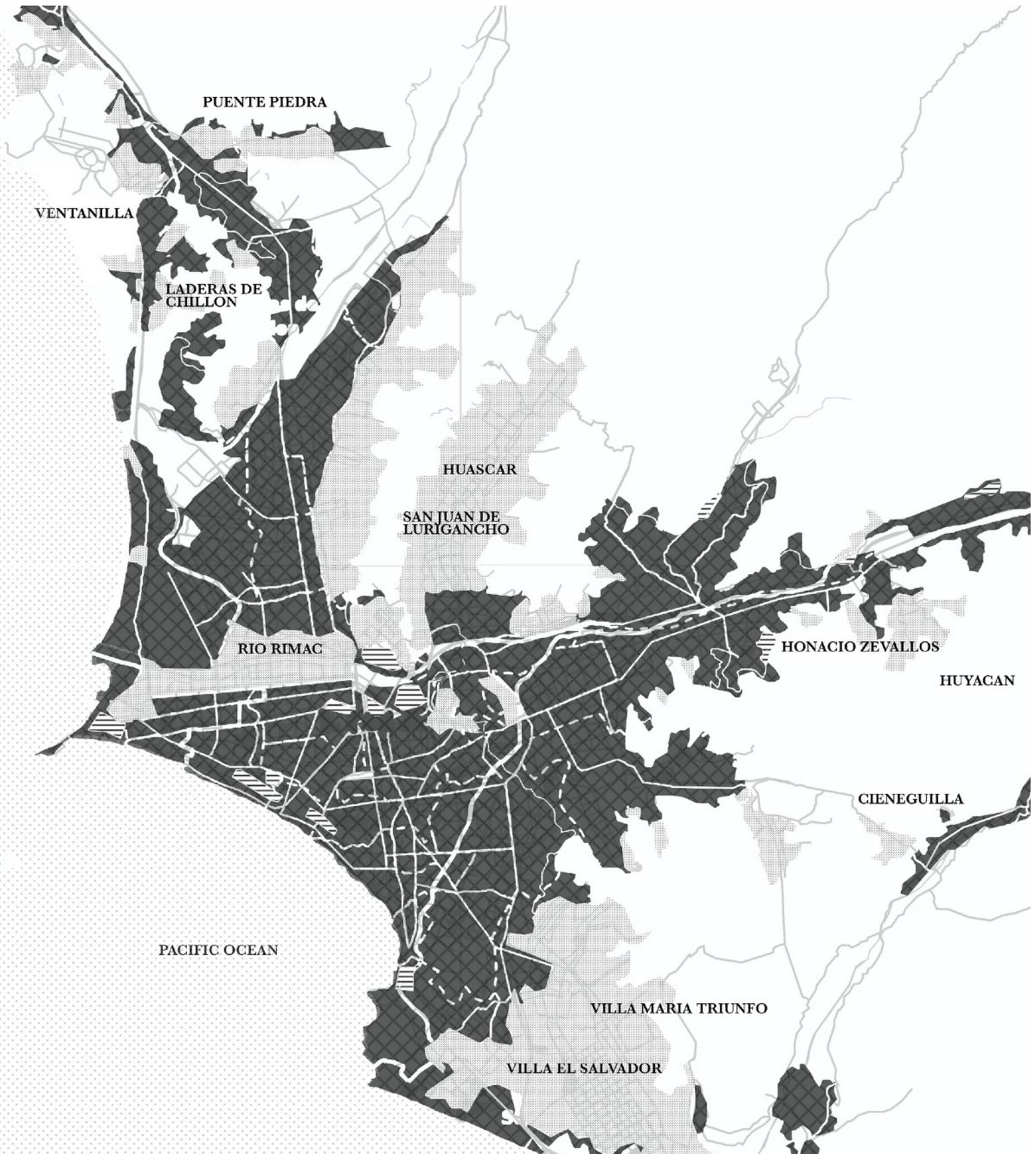
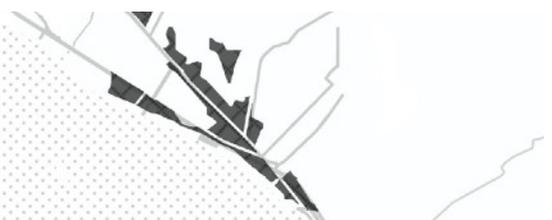


Figure 16. How slums are spread over the city of Lima



-  Shanty towns
-  Slum tenements
-  Conventional shanty-towns



DEVELOPMENT PROGRAMS

CONCLUSION

Regardless of various enhancement and development programs launched by architects and government, there has been always a gap between the demand for housing and the solution given by providers due to the increasing population growth. Therefore, households often had to discover a solution themselves. The only solution given by people has been constructing the squatter settlements that in some cases were authorized and in some other cases ignored and neglected. It is obvious that slums could alter the appearance of the community not to mention there's constantly been a difference in between rich and poor, but as we discussed before, slums tend to be the sole solution of the individuals that have no settlement to reside.

Therefore, maybe one of the best strategies is to introduce these settlers a leasing program and an affordable housing solution that can be applied by all families with any source of income within a participatory program. In this regard not only the appearance of slum changes and becomes an identity of them but also provides housing for all low-income people. In fact the participatory program and self-build housings are what is being already done by settlers without supervision of the government or any fund from

social housing organizations. A planned program in which settlers can be informed on how to construct their houses with introduced materials can be the beginning of turning the chaos to discipline.



Figure 17. Extreme poverty in Lima (Peru) slums (2013). Retrieved June, 2020 from <https://i.redd.it/2qfm54nmrvr01.jpg>



CHAPTER 5 - Case studies

In an urban scale following case studies are being analyzed:

- Ciudad De Dios
- Ciudad Satelite De Ventanilla
- Proyecto Experimental De Vvivienda
- Comunidad Urbana Autogestionaria Villa El Salvador

In building scale, As formal response, one of the projects from urban scale called PREVI designed by Aldo Van Eyk, and as informal response, two examples of self-build units from Villa El Salvador neighborhood built by people are being analyzed.

CASE STUDIES

CASE STUDY 1- SOCIAL HOUSING PROJECTS IN LIMA - URBAN SCALE

Lima, the capital of Peru is a city where most of the migrants tend to go. A noticeable migration from all over the country to Lima occurred in 1940 and 40% of all migrants lived in capital based on the 1981 census. Therefore, Lima is the main destination. As a consequence, this process causes a common trend of migration all over the country but Lima remains still the most important destination. There are three reasons for which these squatter settlements exist and are expanded all the time. First is due to the liberal mindset and attitude of the government toward these settlements. Second is the climate condition, the temperature is not extremely high or extremely low which makes it possible for dwellers to live in basic settlements without any thermal equipment. And finally, due to the specific condition of the land and inclines of the mountains, there is no intense struggle to occupying the lands on the desert. [4] The social housing projects constructed by the government were not accessible for the majority of the community population and in consequence, the settlements that according to the government were temporary became a permanent part in most of the urbanized cities with the most housing deficit and poor housing conditions.

Later on, since squatter settlements and slums with the highly poor environmental condition were expanding constantly, the government attempted to push these settlements to peripheries or in much less apparent areas of the community with the hope that it will force them to go back to their cities. However, once more the government was wrong. It had been only at that point that different urbanists and scientists decided to analyze and observe these settlements. In Latin America Turner and Mangin and in Asia, Charles Abrams came to the conclusion that despite the negative common opinion of community and government regarding these settlements, on the contrary, the settlers had a considerable potential to create a vital community and regardless of all the problems they have faced, they could manage to construct their low-cost settlements and respond to their needs. Turner made a research on the number of houses produced by the government in Lima and the settlements constructed by people during 7 years from 1949 to 1960. He demonstrated that settlers using their ingenuity and energy had created 50,000 dwellings while the government constructed only 5476 units. This is while none of these units were affordable for a low-income family.[4]

CASE STUDIES

In order to go deeper into strategies that government proposed and constructed for people four different architectural and city-making strategies among the housing projects that have been analyzed by Sharif Kahatt are introduced in the figure 18. Sharif Kahatt have worked on urban design and progressive housing strategies in Lima from 1954 to 1984 and have shown also how these projects have changed over time. In this regards a chart has been created in order to summarize the projects before and after transformation and the strategies that were planned to be implemented. These projects after transformation formed the picture of contemporary Lima. The observations and details shall be described in specifics later.

Project	Year	Strategy	
Ciudad De Dios	1954	Social infrastructure as urban catalyst	Market, open spaces, recreation
Ciudad Satelite De Ventanilla	1958	Pedestrian pathway as urban grid	Industries and recreation
Proyecto Experimental De Vvivienda - PREVI	1968 - 1975	Community clusters as urban driver	Plazas, churches
Comunidad Urbana Autogestionaria Villa El Salvador - CUAVES	1980	Inner corners as urban matrix	Organized and sports

Figure 18. Social housing projects in Lima. Information: Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984. *CLARA, No4*.

Planned spaces+residential	Urbanization system	Lot size(M)
Church, municipal hall, theater, post office, community center, and commercial facilities.	Housing units organized in two zones with public services and commercial facilities in the central spine	200
Commercial areas as well as a natural beach with sports and recreational facilities.	Long linear blocks that created pedestrian pathways	160
Church, atria, side walks and malls	Clusters of units, creating public spaces placed along the pedestrian spine, and traffic separation in the neighborhood	80<lot<150
Urban planning that allow for future markets, schools and facilities	Programmed and landscaped voids by elongated blocks surrounding a central open space	140

1-Ciudad De Dios - Social infrastructure as urban catalyst

Housing units organized in two zones with public services and commercial facilities in the central spine



Figure 19. Aerial view of Ciudad De Dios, 1962. © Archivo Del Servicio Raerofotográfico Nacional



Figure 20. Ciudad De Dios squatter settlement, Southern Lima (Hacienda San Juan) January 1955 © Archivo Del Servicio Raerofotográfico Nacional

STRATEGY

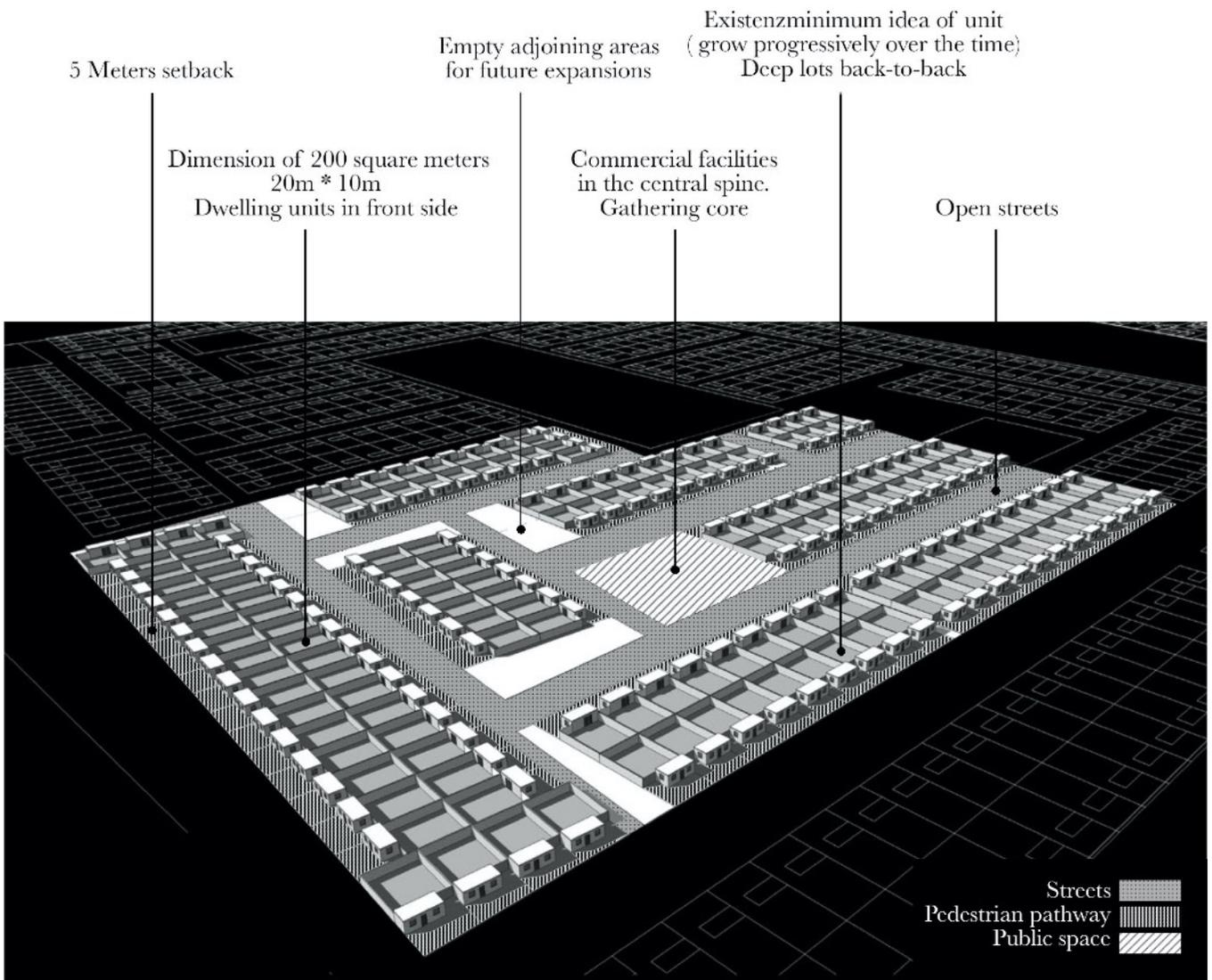


Figure 21. Digital reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984.

AFTER



Figure 22. Ciudad De Dios in the district of San Juan De Miraflores, Lima, 2014. © Photo: Evelyn Merino Reyna.

TRANSFORMATION



Figure 23. Typical street section in Ciudad De Dios, 2014.
© Photo: Sharif Kahatt

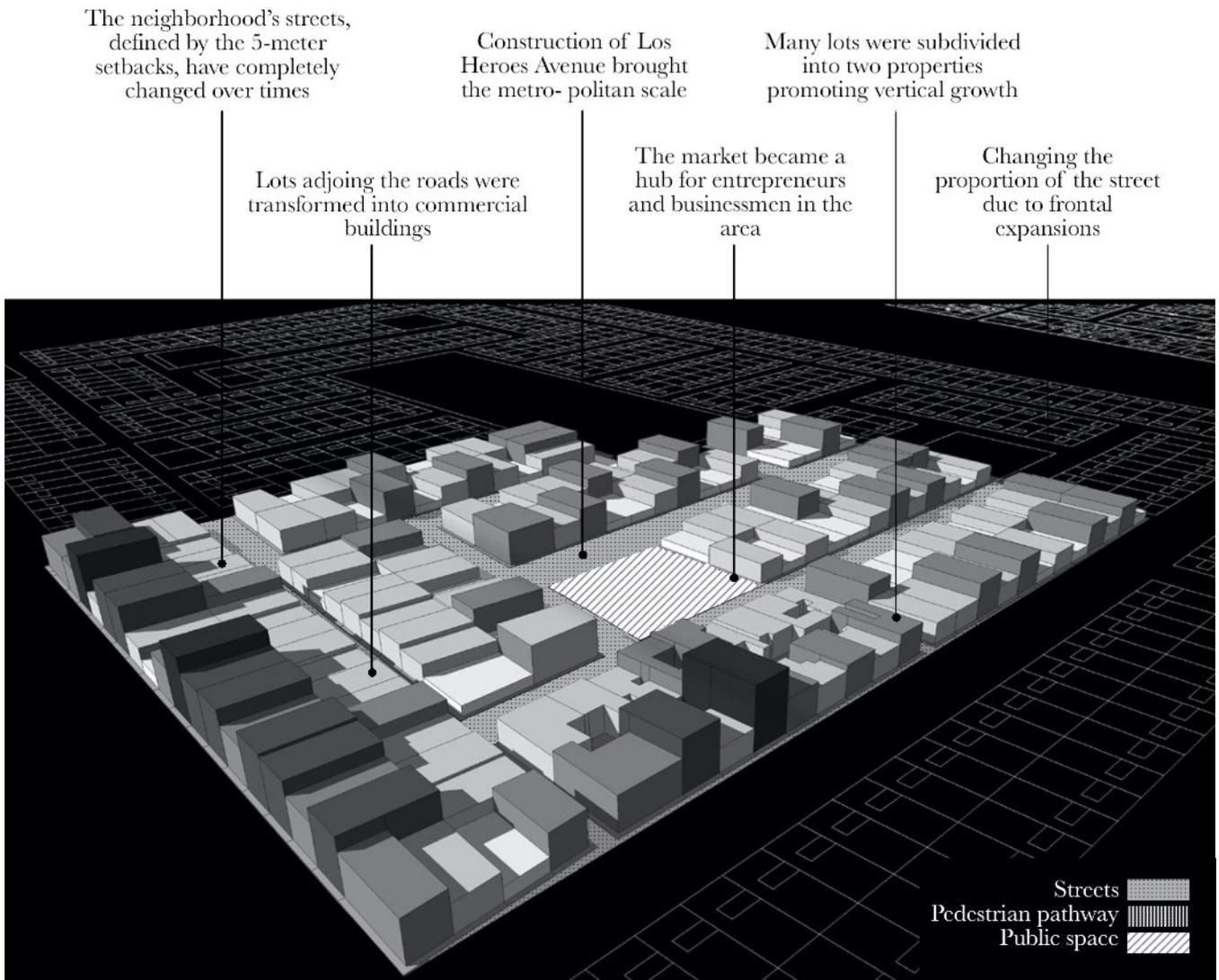


Figure 24. Digital reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984.

2-Ciudad Satelite De Ventanilla - Pedestrian pathway as urban grid

Long linear blocks that created pedestrian pathways



Figure 25. Aerial view of Ventanilla, 1963. © Archivo Del Servicio.

STRATEGY



Figure 26. Ventanilla Tv on Facebook. Retrieved June, 2020 from <https://www.facebook.com/ventanillatv/videos/321187578676763/>

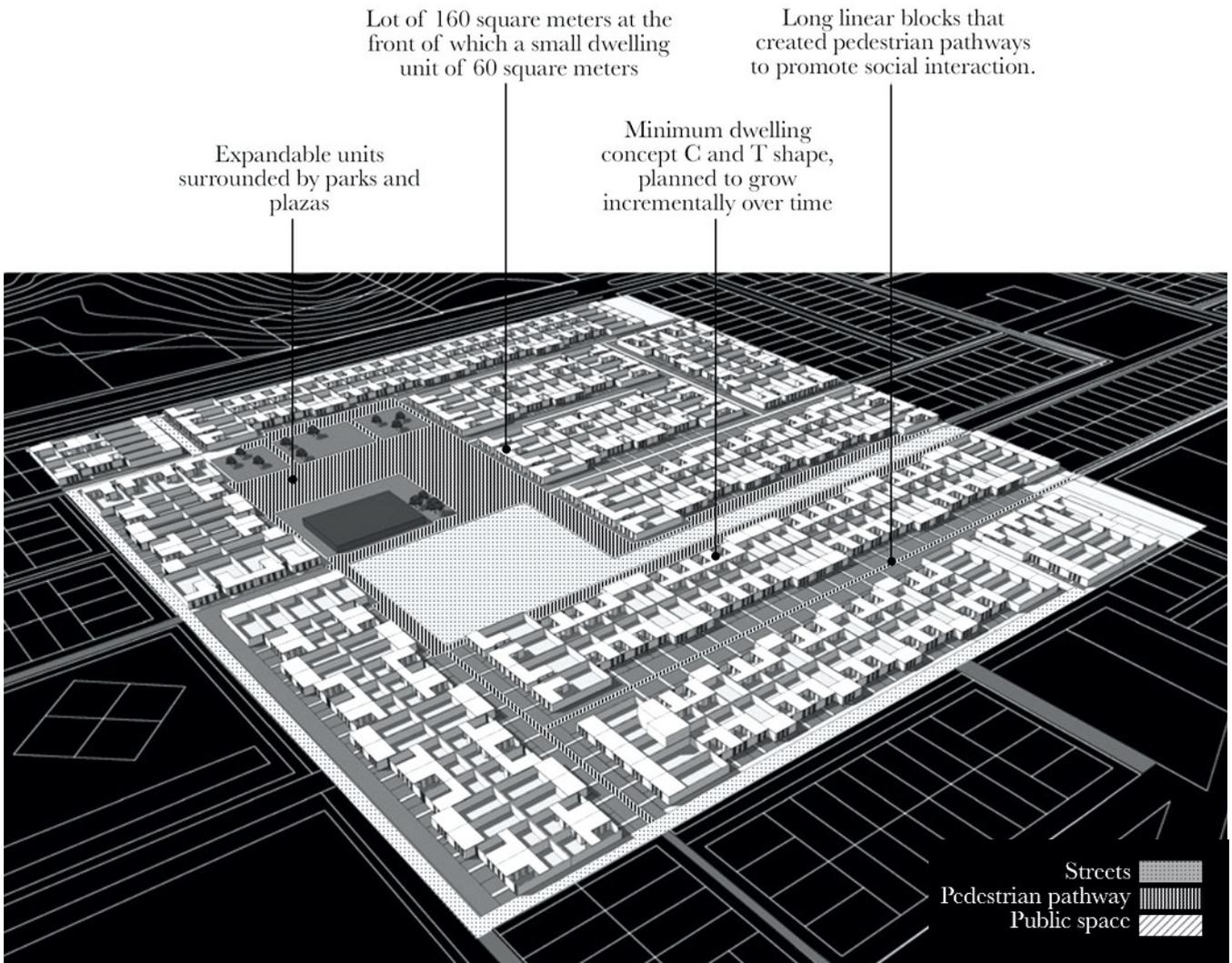


Figure 27. Digital reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984.

AFTER



Figure 28. Ciudad Satelite De Ventanilla in the district of Ventanilla, Lima - 2014. © Photo: Evelyn Merino Reyna.

TRANSFORMATION



Figure 29. Typical pedestrian pathway section in Ventanilla, 2014. © Photo: Sharif Kahatt

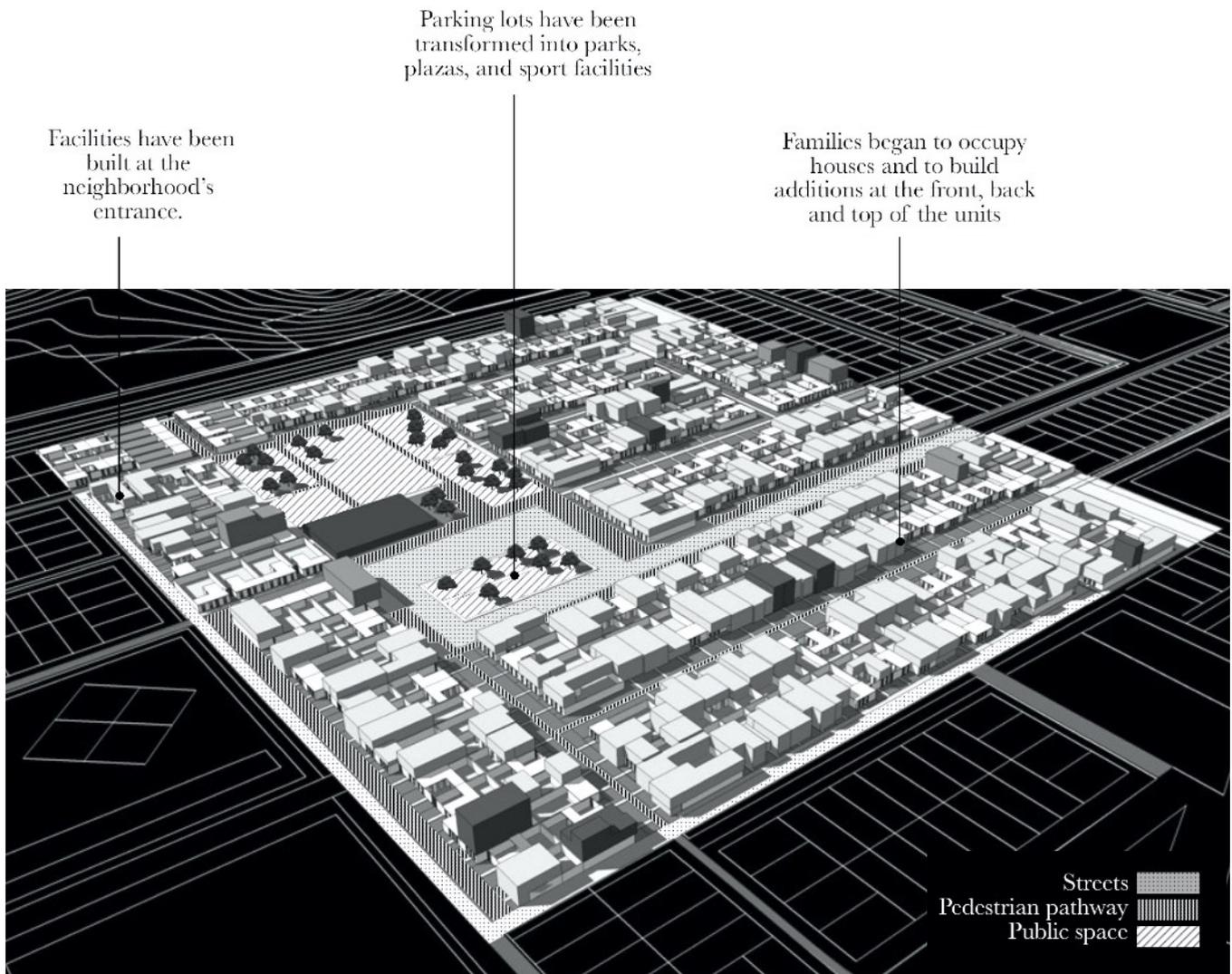


Figure 30. Digital reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984.

3-Proyecto Experimental De Vvivienda - PREVI - Community clusters as urban driver
Clusters of units, creating public spaces placed along the pedestrian spine, and traffic separation in the neighborhood



Figure 31. Aerial view of PREVI, 1975. © Personal archives of architect Peter Land.

STRATEGY



Figure 32. Prototypes designed by Germán Samper in PREVI. © Photo: Peter Land Retrieved June, 2020 from <https://www.germansamper.com/previ-lima-peru>

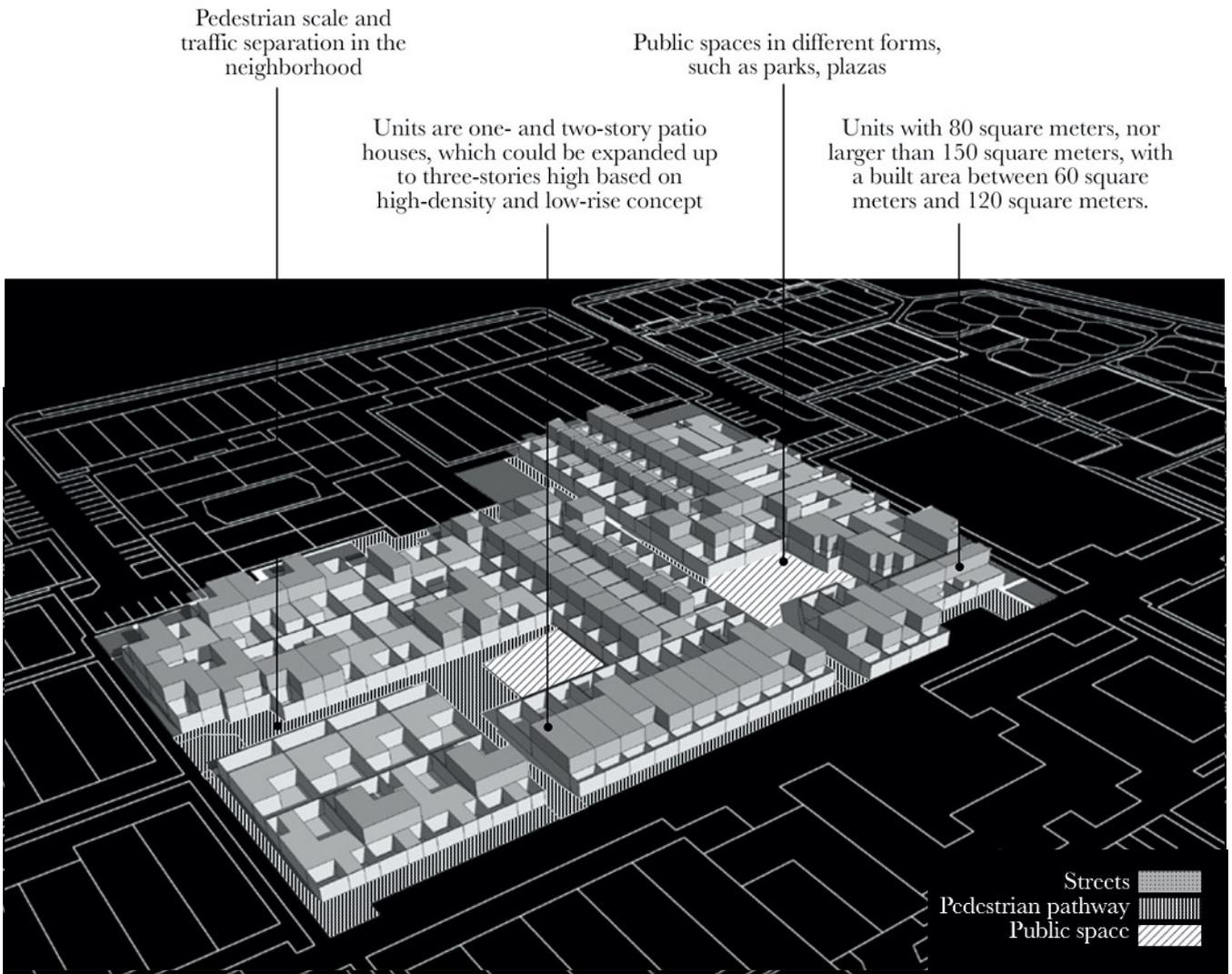


Figure 33. Digital reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984.

AFTER



Figure 34. Proyecto Experimental De Vivienda in the district of Los Olivos, Lima, 2014. © Photo: Evelyn Merino Reyna.

TRANSFORMATION



Figure 35. Typical communal area. Small plaza with concrete furniture at PREVI. Retrieved June, 2020 from <https://www.transfer-arch.com/reference/previ-lima-1969/>

Main pedestrian spine and the principal open spaces still act as a superstructure that ensures the connection between public spaces

Several plazas were fenced to prevent outsiders to access them, and many gardens have been illegally privatized

Many commercial activities appeared on the ground floor offering services and eventually encouraging vertical growth

New additions at the front, back and top of the units



Figure 36. Digital reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984. *CLARA, No 4*.



Figure 37. Aerial view of Villa El Salvador, 1983. © Archivo Del Servicio Raerofotográfico Nacional



Figure 38. Self-build housing in initial condition of Villa El Salvador. Retrieved June, 2020 from <https://favelissues.com/2010/07/12/lima-san-juan-de-lubrigancho-villa-and-salvador/>

STRATEGY

Blocks surrounding a central open space

Repetition of a singular superblock, which consists of 24 identical lots of 140 square meters forming a square of 288 meters-long sides

Programmed and landscaped voids allow for cultural development and social interaction

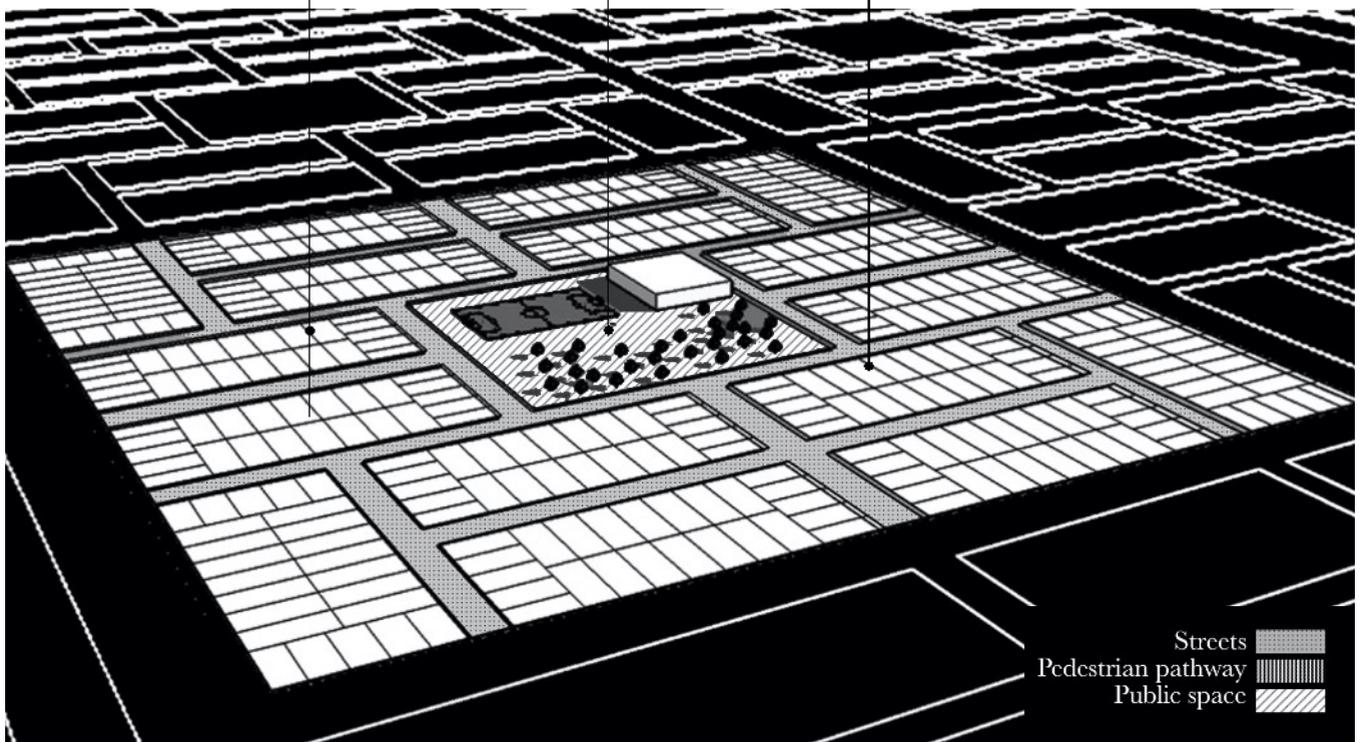


Figure 39. Reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984. *CLARA, No4*.



Figure 40. Left: Comunidad Urbana Autogestionaria Villa El Salvador in the district of Villa El Salvador, 2014.
© Photo: Evelyn Merino Reyna.

TRANSFORMATION



Figure 41. Typical commercial street section and corner in Villa El Salvador, 2014. © Photo: Sharif Kahatt

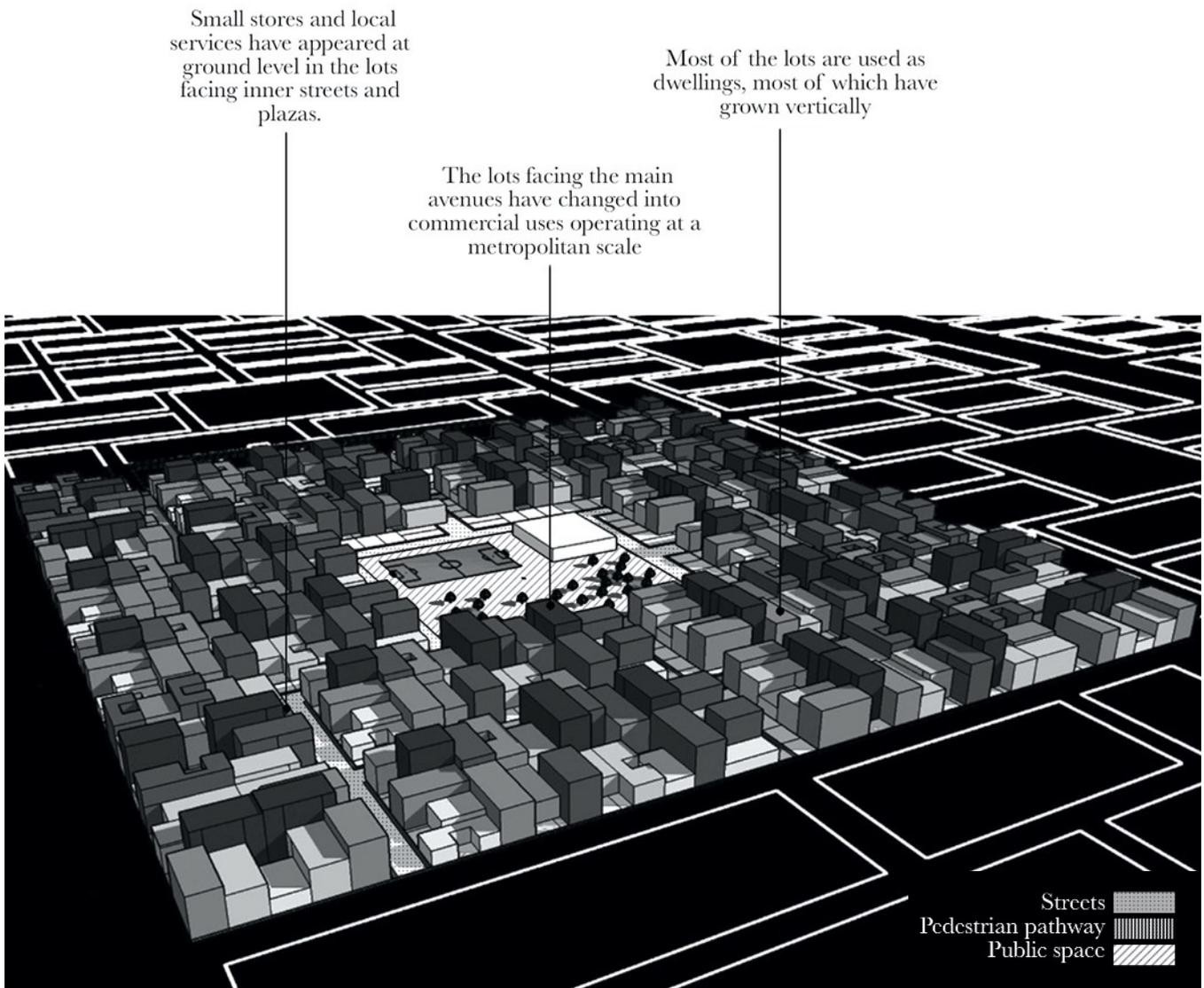


Figure 42. Reconstruction in axonometric view of housing cluster. Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984. *CLARA, No 4*.

CASE STUDIES

OBSERVATIONS

The strategies introduced have been capable to connect conventional and informal part of the city motivating social interaction and have created neighborhoods which enhance urban development with constraint resources.[15] What is common in all four projects is the attention that has been placed on creating different forms of public spaces by different urban planning strategies. In *Ciudad De Dios* as Central spin, in *Ciudad Satelite De Ventanilla* as pedestrian pathways, in *Proyecto Experimental De Vivienda* as pedestrian spin and in *Comunidad Urbana Autogestionaria Villa El Salvador* as voids, which all boosted community interaction and exchange and have a local community sense. These neighborhoods work as a cultural engine that has created a system of urbanized life that enables cultural development. Since the culture of self-help exists in the context and people due to family growth will need to expand the house therefore, neighborhoods were created as self-organized communities. Households would figure out how they would need to expand their houses according to their necessities. The expansion can be done horizontally or vertically with a self-built approach. This approach will give the community a sense of belonging representing their cultures and identity. Individuals can

express their cultures and preferences within their choices [35]. Another common component in all the projects is courtyards which happens to be a reminder of conventional little courtyards units in Peru. Courtyards have an environmental impact on the house due to the fact that they provide ventilation and light for the house. However, when families need to expand their houses due to family growth the priorities changes and having an extra habitable room will be prior to environmental quality [19]. Therefore, a housing strategy rather than being responsible for population growth, should be responsible for environmental quality as well in a manner that can not be changed or transformed by the occupants. The issue isn't simply how you can have low-cost housing but landscaping, energy, human scale and environment are all linked together. The size of the plots vary from 140 up to 200 square meters which according to John Turner are reasonably large. "Even cases outside Latin America can have large lot- sizes. Tokman pointed out that the densities in Ankara's *gecekondus* are lower than the densities in the middle or high-income settlements of the city (1984). John Silas (1984) wrote that in the kampungs of Jakarta and Surabaya , more than 50% of the building plots have an area of over

CASE STUDIES

30% exceed 100 m² (1080 ft²). Similarly, Lynn Pikholtz described a successful case of shack settlement upgrading in South Africa (1997) with lot-sizes of around 250 m² (2700 ft²) area. All these papers suggest that lot-sizes within low-income housing settlements are reasonably large — typically, larger than 50 m², although, sizes of over a 100 m² are not uncommon”[36].

As can be seen in transformation process many of the lots transformeer to commercial activities in ground floor which depicts the necessity of economic growth in the neighborhood.

CASE STUDIES

CONCLUSION

“Socioeconomic development and urbanization are two closely related processes. Urbanization, with its economic, social and environmental implications derived from a transformation of production, distribution and consumption systems, has transitioned from a model based on primary activities to one based on secondary activities that, in their advanced stages, rely on financial capital and services and are framed in a global economic context. Another strategy for positively increasing the productivity of cities is the promotion of “clusters” in the urban economy, since they exploit the benefits of agglomeration economies in an urban context in a more specialized manner [37]”.

“It is important to invest in services and facilities within communities, rather than connecting them to better-served areas. In this context, it is worth emphasizing the social urban planning interventions focused on promoting social change through urban transformations and investments in vulnerable areas (UN- Habitat, IDB, ACI, 2011.). Culture is an axis of development, led by the growth of the creative economy in general, and of the cultural and creative industries in particular. The creative economy is acknowledged for its economic value and role in the production of new technologies and ideas

and for its nonmonetary social capital and strengthening of culture and belonging (UNDP-UNESCO, 2014) [42]”. Different strategies might be implemented but they can be appropriated only if they are according to the needs of the individuals. In this regard, same strategy can not be implemented in different locations [39].

Thus, what required is low-tech and low-cost innovative developments and even techniques for tactical urbanism on the community scale to enhance existing situations as well as facilitate a lot more socially sustainable strategies[44]. Turner changed the evolved notion on the squatter settlements as a "solution" As opposed to a "problem" that promoted an alternative way of thinking which may characterize as a "self-help" approach. The new concepts about self help demanded a change from providing to supporting point of view[27]. Therefore, instead of providing houses that are usually not affordable for low-income households or big lots that dwellers might never have the chance to expand, it is better to support the approach of self-help which already have been used by people as a reaction to this deficit.

It needs to be mention that none of the projects introduced in the urban scale was completed as

CASE STUDIES

planned due to economic and political reasons. In order to help the full realization of the social housing projects in the condition of crisis, it is needed to lower the expenses as much as possible. Self-build is definitely the best way since the citizens themselves provide the labor. Using local materials or zero energy materials like rammed earth would be a benefit in case of saving for the government and also for the residents in the lack of financial support. The result would be a combination of formal architecture with supervision and design of the experts and informal construction with the self-help approach. The lower the cost the more willingness of the government to intervene and provide facilities.

Another issue that needs to be taken in to consideration is that due to the incompleteness of the projects, the area had a lack of commercial activities. Usually the social housing projects or self-build slums are built in peripheries of the city in distant areas from the city center and to job opportunities. In this regard, residents have to start commercial activities within their own houses and this is the reason for the transformation of residential to commercial. It can be concluded from the analysis that the availability of commercial activities is as

important as access to housing since the residents need to have a source of income and as it has been said before housing is not adequate if it is cut off from employment opportunities.

However, the analysis in urban scale can not depict the unit transformation in detail and can only show the general reasons for transformations. In this regard, further analysis in building scale would make the understanding of these transformations easier.

CASE STUDIES

CASE STUDY 2- Aldo Van Eyk UNIT DESIGN; PREVI; UNIT SCALE;

From the case studies explained in the previous part in the urban scale, the PREVI project has been chosen to study on in order to go deeper in analysis and find out the transformations in detail.

PREVI—*Proyecto Experimental de Vivienda*— was a competition launched for 13 worldwide famous architects, along with so many Peruvian architects, ended up being commissioned to create a community of 1,500 dwellings. They were supposed to produce prototypes of the urbanized houses with the possibility of growth and transformation. This was probably the very first move that recognized the valuation of the possible growth adopted within informal settlements [41].

PREVI(1968-75), was introduced by Peter Land and John Turner as a mentor in 1966. In that period the vacant lots were already occupied by dwellers who were searching for lands to settle. PREVI investigated the feasibility of creating new neighborhood units in Lima. A city that faced a huge housing deficit and increasing population growth in that period.

In PREVI competition there were six principals that the architects had to take into consideration.

1- In urban scale the goal was to construct low-rise, high-density units.

2- In neighborhood scale in order to create a sense of community the aim was to design clusters around a square.

3- In buildg scale there had to be considered the possibility of expansion with a courtyard due to family growth.

4- Prefabricated inexpensive materials should be used for mass production.

5- Street furniture, lighting and landscape must be deigned.

6- Pedestrain sidewals or human-scale environment with traffic separation should be forseen[42].

CASE STUDIES

One of the projects in PREVI is related to Aldo van Eyck, Dutch architect and member of Team 10. In his proposal an attempt has been done in order to prevent unnecessary expansion in the house by choosing a hexagonal shape as a perimeter of the house. Hexagonal shape discourages the dwellers to expand their houses whether from the front or backside of the house. In consequence, excessive expansion will not act as environmental barriers for ventilation and light [43]. Figure 43 shows the stages of the design according to what has been planned. The analysis has been done showing how the forms and function are changing during the period of 40 years. However, what was built at the end was different from the the designed plan. Figure 44 explains that the hexagonal shape of the plot did not help preventing further expansions and the speed of the expansion was faster than what was thought before.

WHAT WAS DESIGNED

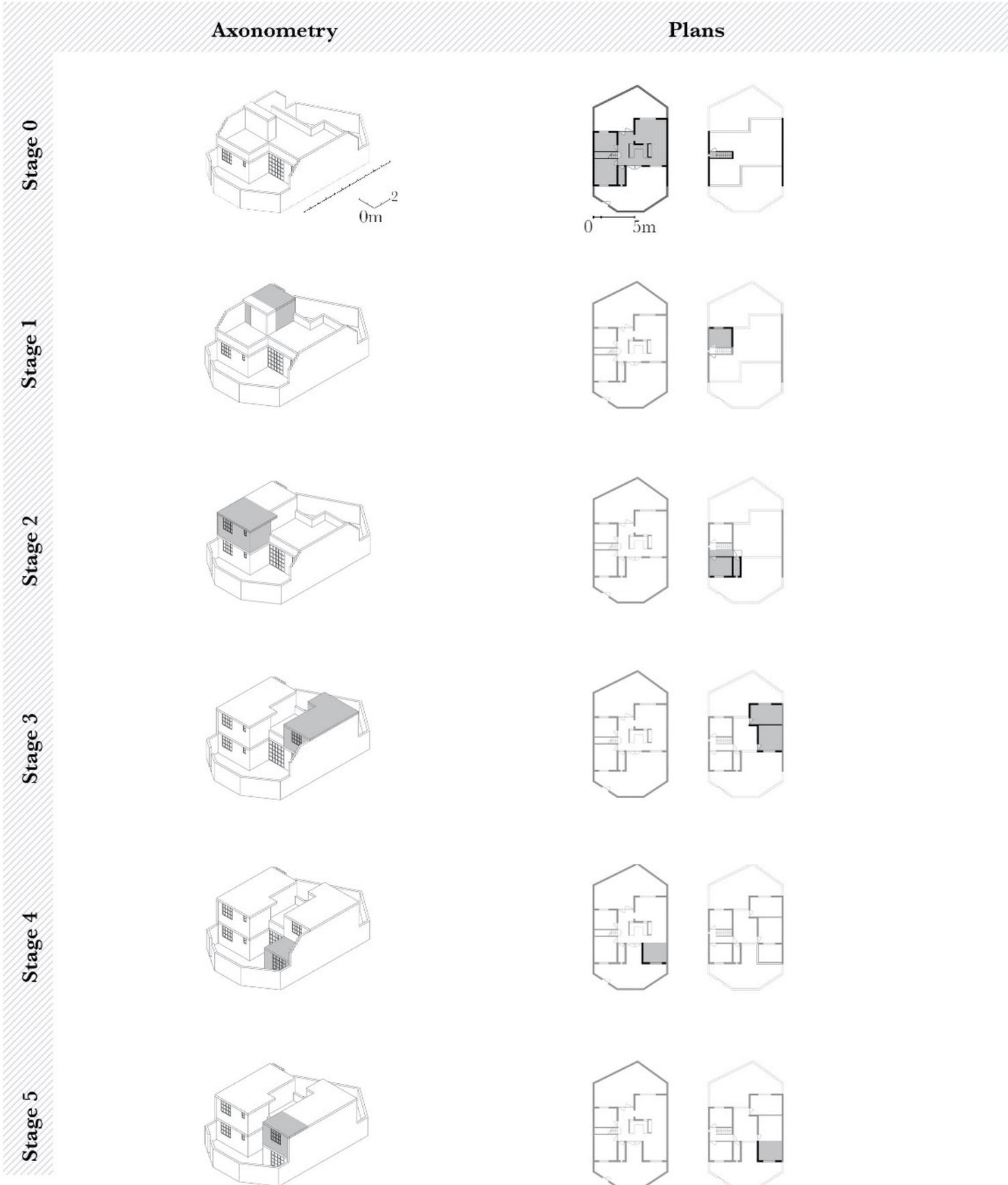
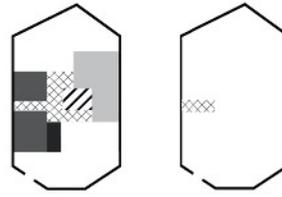
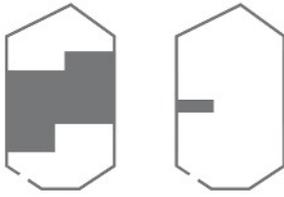


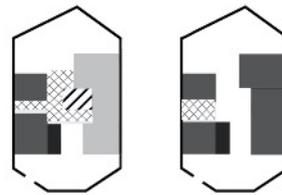
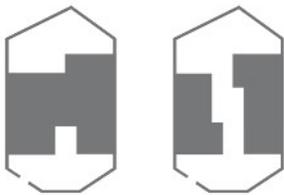
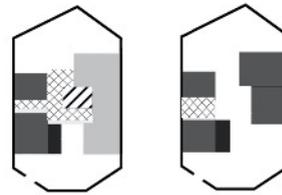
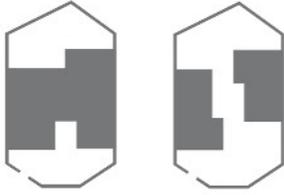
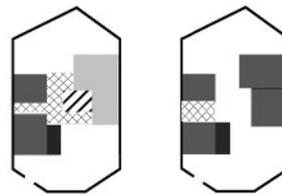
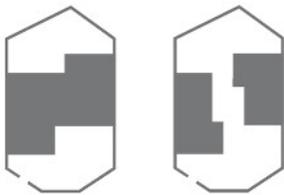
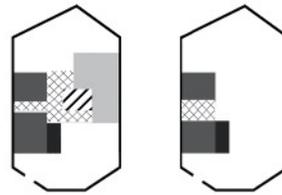
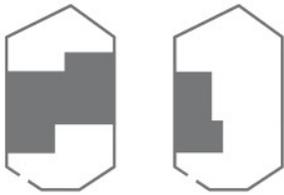
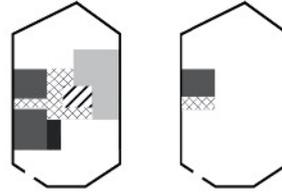
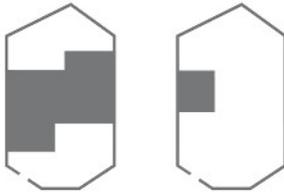
Figure 43. Different stages of development in Aldo Van Eyk project in PREVI. Source of axonometry and plans: Bas Hoevenaars 4243544, April 2014

Forms

Functions



- Bedroom
- Livingroom
- Toilette
- Kitchen
- Corridor



WHAT WAS BUILT

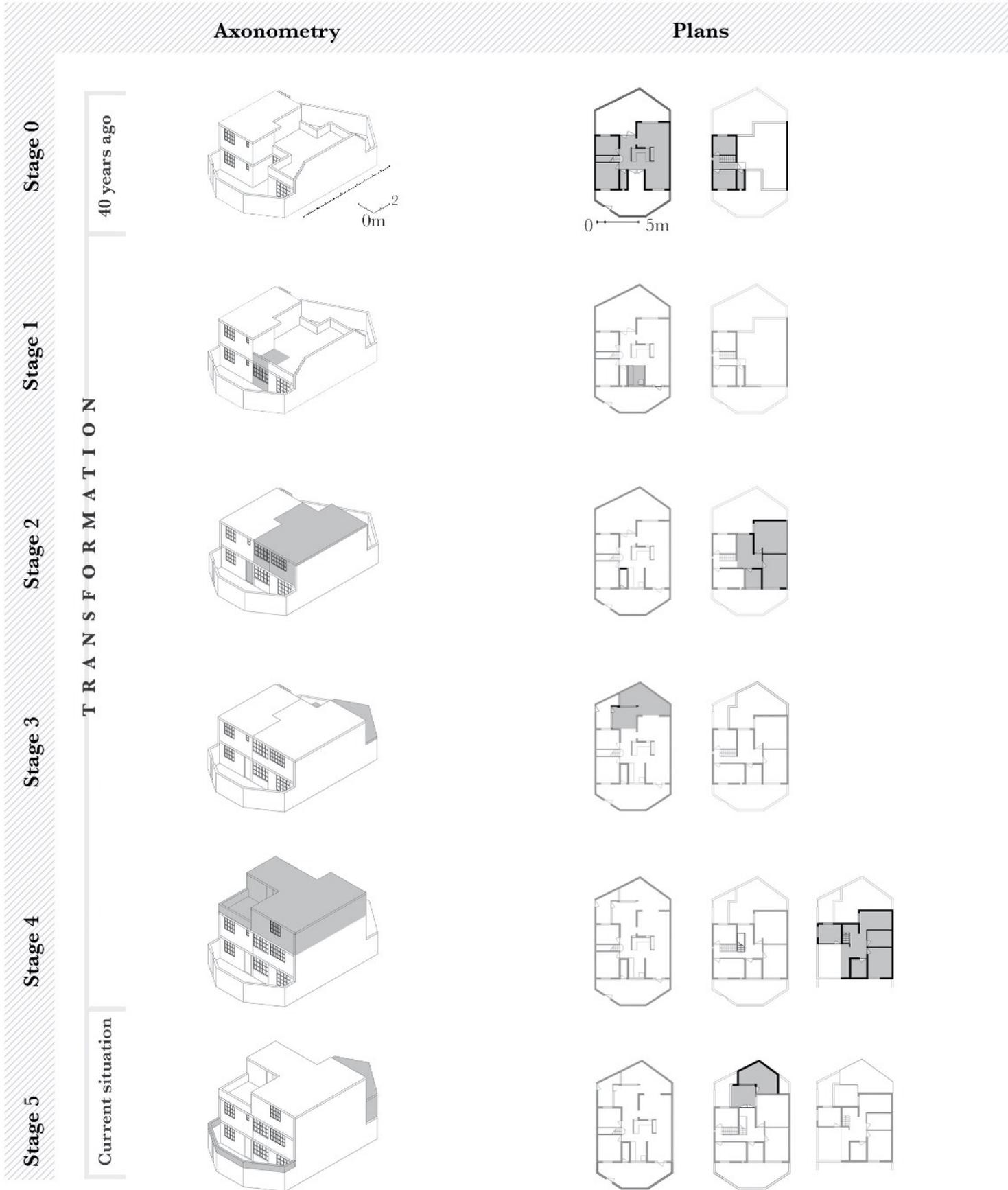
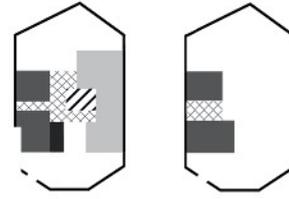
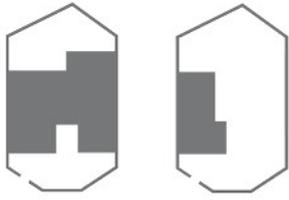


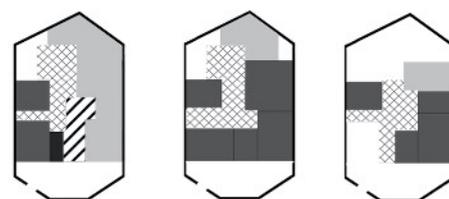
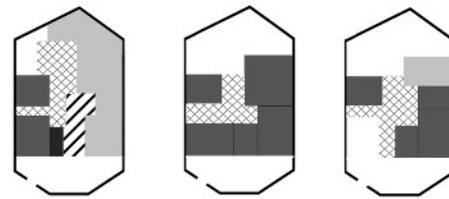
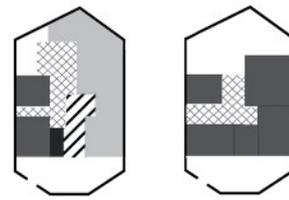
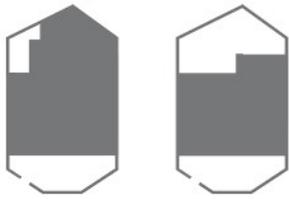
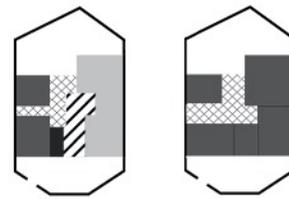
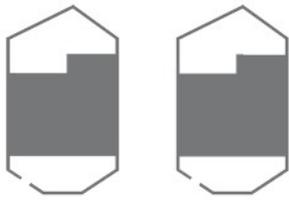
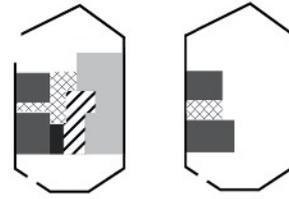
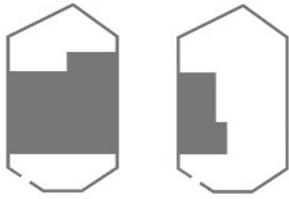
Figure 44. Different stages of development in Aldo Van Eyk project in PREVI. Source of axonometry and plans: Bas Hovenaars 4243544, April 2014

Forms

Functions



- Bedroom
- Livingroom
- Toilette
- Kitchen
- Corridor



CASE STUDIES

OBSERVATIONS

The unit is built within a hexagonal perimeter leaving the front and back part of the plot empty as courtyards in order to provide light and ventilation. The form can be described as two volumes on the right and left part of the plot attached to each other by the kitchen in the central part of the house. The built area is 75 square meters consisting of rooms, a kitchen, and a living room, each with a separate space. Due to the hexagonal shape, the complete expansion of the house on the ground floor will firstly prevent natural ventilation and light transmittance and secondly will create irregular space. In this regard, the expansion will be limited on the first floor and due to the presence of the staircase, it will, therefore, be continued on the second floor. It had been imagined that in each phase of expansion, one or two maximum rooms will be added. In the last phase of development, both floors will consist of two connected volumes. However, what had been designed was built differently in the end, and the changes that had been imagined to happen occurred completely in a different way.

The hexagonal shape could not help with the prevention of expansion and in fact, the need for additional space forced people to ignore the need for ventilation or light.

Therefore, environmental quality has been neglected.

The speed of expansion is far faster and the need for having new rooms has gone beyond the design. Therefore, the major part of the plot has been filled. Other entrances have been added later due to the need to rent a part of the house as a source of income, in this regard the need for maximum flexibility can be seen in the development progress. Although in the design stage it was supposed to have a maximum of two floors, in reality, the dwellers constructed also the third floor and they have also divided the spaces into smaller spaces in order to have the maximum usage of the space.

CASE STUDIES

CONCLUSION

Even though one of the principals of the competition was designing an expandable unit, however, the architect tried to limit this expansion by creating a hexagonal form. What has been not considered is the culture of the settlers. Family growth is an inevitable issue that should be taken into consideration. The point is that the family growth does not stop in one generation, on the contrary, even the next generation is going to live in the house and therefore, the expansion may not stop with the construction of additional floors and might continue to construct further floors.

The need for additional space is a priority for the families and due to the continuous family growth and changing needs, also the function of spaces switches over time. This is why the units must have a maximum degree of flexibility in order to be responsive to their needs.

In this proposal, the architect believed that the women have the main role at the house and, therefore, the best position for the kitchen would be in the heart of the house in the central part. As has been seen, regardless of his belief, in practice, they even changed the position of the kitchen.

Another essential aspect is the need for these families to have a source of income.

The reason is that these settlements are mostly built in peripheries which tends to make it hard for any settlers to have a job within the city. Even in cases that they would have access to jobs, it is not sufficient for the family needs and an additional source of income would be needed. They can shift a part of the house to retail or rent it. In this regard, the potential of doing so must be taken into consideration. According to analysis on an urban scale and a deeper look at PREVI, it can be concluded that probably there are two main reasons for transformation, firstly ignoring the culture of inhabitants and secondly ignoring the need to have a source of income. This is the reason why among the criteria of adequate housing, the fields that are being intervened are affordability and cultural adequacy.

However, in these social housing projects there were designers and architects involved in designing the units who might have not been completely aware of the needs of inhabitants. In this regard, in order to understand better the culture and needs of the inhabitants it would be better to study how the people themselves would construct their houses and what are their priorities.



Figure 45. A comparison of Aldo Van Eyk prototype in 1974 and today. RESEARCH TEAM: Supersudaca (Manuel de Rivero, Félix Madrazo & Juan Pablo Corvalán). Retrieved June, 2020 from <https://51-1.com/Y-PREVI>



CASE STUDIES

CASE STUDY 3- SELF BUILT UNIT IN LIMA; UNIT SCLAE;

In the previous part, the analysis has been done on an urban scale and social housing as a system proposed and executed by the government. However, as it has been seen not all the projects were successful due to the ignoring of the culture of inhabitants. In the absence of government response to the housing deficit, it is up to individuals to figure out a solution. In order to go deeper in detail and understand what are the needs of the habitats and how do they construct their settlements and how do they change the functions or forms during years, another analysis has been done on self-built housings. Villa el Salvador has been chosen as a selected neighborhood and since a direct survey was not possible, two housing plan samples among 75 have been chosen randomly from research done by Claudia Andrea Sakay Rodriguez about Effects of Tenure Security in Housing collected from Nuevo Pachacutec, Manchay and Villa el Salvador (25 samples from each squatter settlement) and the transformation during different period of time has been observed. Analysis has been done through the characteristics of the house that changes throughout different stages that are explained in the following.

Stage A – Occupying the land

Stage B – Permanent walls and temporary roof

Stage C – Permanent walls, masonry, concrete

roof Stage D – Second set of permanent walls.

Stage E – Third or more set of permanent walls.

“In Nuevo Pachacutec results had found that there is an unwillingness to invest and construct permanent and durable housing. Most of the structures are still under the category stage A (80%) and B (20%) which indicated the tenure insecurity and uncertainty of rights to land had tremendous effects on housing investment decisions [16]”.

People of Lima living in slums try to build their homes in every vacant spot they find. If there will be no available flat area they have to move to the sidehills, a vulnerable area with no access to water or electricity with no proper roads in the most insecure places. They have no distinct property ownership however they construct their settlements with anticipation to possess the ownership at some point. Because of the serious poverty and absence of financial support they are not able to construct their settlements all at once. They begin with a bag of cement as well as continue building as they are able to get an additional bag.

When people are lacking the basic requirements

CASE STUDIES

to live they are forced to sacrifice the social needs to accomplish the fundamental struggle for a living. Self-help is constantly the only method for low-income households to get their own house. Low-income households are able to construct as well as enhance their settlements step by step as soon as adequate finance is available and when the households face the necessity of expanding. Such a construction process is frequently spread over an extended period of time [44].

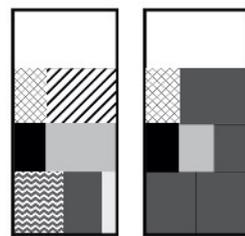
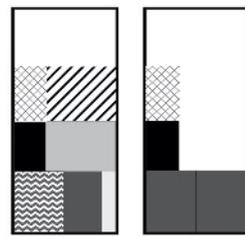
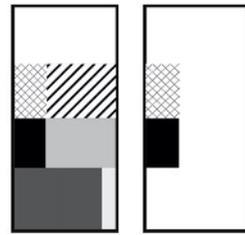
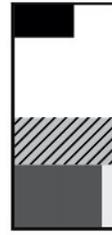
In the following figures of 46 and 47, the two samples are analyzed. In order to understand the priorities of each family, the minimum plot area and minimum space needed for each function and the intimacy and sense of privacy have been analyzed.



Figure 46. Different stages of development in a self-build house from Villa El Salvador. Rodriguez, C. (2015). *The Transformation of Squatter Settlements into Urban Cities through the Effects of Tenure Security in Housing and Infrastructure Investments : The Evidence of Three Squatter Settlements in Lima, Peru*, pp. 201.

Forms

Functions



- Bedroom
- Livingroom
- Toilette
- Kitchen
- Corridor
- Rcatil



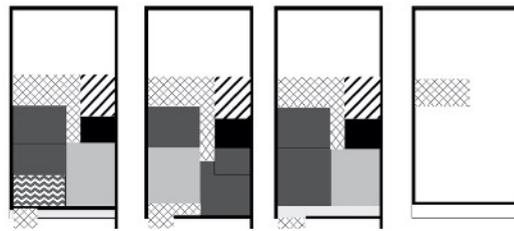
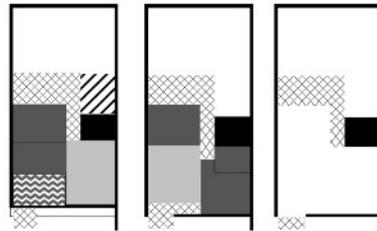
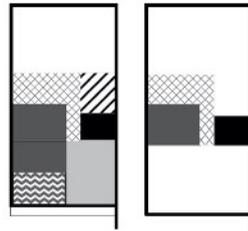
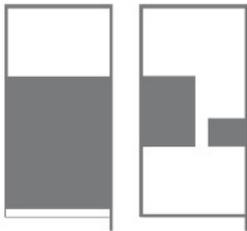
Figure 47. Different stages of development in a self-build house from Villa El Salvador. Rodriguez, C. (2015). *The Transformation of Squatter Settlements into Urban Cities through the Effects of Tenure Security in Housing and Infrastructure Investments : The Evidence of Three Squatter Settlements in Lima, Peru*, pp. 196.

Forms

Functions



- Bedroom
- Livingroom
- Toilette
- Kitchen
- Corridor
- Reatil



CASE STUDIES

OBSERVATIONS

INTIMACY: An overall comprehension of the units is that houses have a vertical orientation with the built area in the front side while leaving the back part empty occupied only by toilet which can be translated as proof to privacy and intimacy. Both cases have the same level of intimacy.

FUNCTIONS: The first stage of the house is constructing a space that is mostly used both as a kitchen and a living room/bedroom, not separated on the front side of the lot and the toilet in the backside of the lot. During a period of almost 7 years, a bedroom will be separated into a new additional space that will be built, and then the kitchen will be shared with the living room. After that in the case of family growth, the house will be expanded and additional bedrooms will be added and in the final stage of the development, each function of living room, bedroom, kitchen, and toilet will own a separated space, and another floor will be added as well. Depending on the need of the family the houses can be developed in different ways. Whether to please the family growth's need or the economy needs of the family. In the case of economic growth, small workshops or retails will be replaced with the functions that are facing the

the front side of the lot in order to be rented or used by the owners themselves.

FORMS: Normally the lots are occupied by the built area in front or in between with a backyard and during the time the lot area will be expanded both in-ground level or vertically, having always a back yard or *patios* and generally, in rare cases the full lot will be filled up fully by the built area. Having mostly a set back in front as an entrance which can be probably due to lack of defined urban development. Therefore individuals are forced to define the entrance of their houses and make a visible division from the road. Normally the functions of each space whether it is the bedroom or kitchen or living room changes over time according to the family's needs. therefore, a scalable system unit that is adaptable and flexible to personalization can be a response. In both cases, a part of a house has changed a function from residential to commercial. Therefore, education and job creation are two important social dimensions that need to be integrated into the social structure of the self-help housing residents.[45] Social and economic sustainability are not separate issues in maintaining the sustainable conditions of transformed self-help housing areas. The post-self-help housing area must be accompanied by economic viability.

CASE STUDIES

PERIOD: An average period for adding additional space to the building is 17 years which shows conjunction to the needs of new generation. Whether the Child of the family grows up and needs his own space or get married and need a new room. Therefore, as an answer to family growth, it is compulsory the availability of a lot in which the unit can be expandable for additional rooms.

MATERIALITY: In both samples the changes of the units has a duration of 40 years and it takes a long time to change the stage of house in case of materiality from temporary to permanent which shows the lack of financial support. In this case a sustainable, modular, replicable housing prototypes which is affordable and self-constructible in a short period of time would be a great solution.

CASE STUDIES

CONCLUSION

Self-help housing is what people have always done during history and any support done by the government to provide assistance to help people construct their settlements is originated from the individuals themselves. The concept of self- help has been introduced by JFC Turner even if the concept has been practiced and analyzed for a hundred years before him by scientists.

Considering "Verb" as a process and "noun" as a product, Turner argued that housing should be translated as a verb. He emphasized that this process occurs over a period of time according to the needs, incomes, and longevity of the inhabitants. He additionally states that the housing should not be seen as a product or in other words as "what it is", however, is "what it does". The fact is that the physical characteristics of the housing changes over time and will be improved [46].

Citizen involvement initiatives present significant obstacles within conditions of creating community interaction involving people and governments, so an institutional authorized framework is necessary to explain a strategy and participation systems to co-ordinate powers so as to stay away from the type of instrumentalization that delivers authenticity to unilateral choices.

A participatory society grounded within modern

society also is required that could take complete benefit of governance constructions [41] One of the primary challenge on the poverty parts in Lima, is housing; The majority of the locations include settlements constructed from cheap, non-durable materials. In line with the United Nations ambitions for poverty elimination, the very first action which should be done is constructing houses with durable materials and convenient infrastructure [33]. In this regards, the objective should be building cheap small units by using domestic workers and local materials for low-income people and also to create more jobs for domestic workers.



Figure 48. Sample 02 of self-build house from Villa El Salvador. Rodriguez, C. (2015). *The Transformation of Squatter Settlements into Urban Cities through the Effects of Tenure Security in Housing and Infrastructure Investments : The Evidence of Three Squatter Settlements in Lima, Peru*, pp. 156.

CHAPTER 6 - Site analysis

Where is the chosen site and why is it selected?
How is the status of houses in the selected
neighborhood?

SITE ANALYSIS

SELECTION OF THE SITE

Lima is one of the driest urban areas in the world, inside the Pachacamac Sanctuary, which is situated along the central coastline of Peru on the foothills on the Andes, temperature is higher due to exposition of heat on the sand, and it ranges of as much as 40s Celsius which makes it an interesting spot to work on. It is located in the southern part of the city. Not merely the certain local weather of this part but additionally the connection in between the Sanctuary and the instant area of its surroundings have been changed considerably within recent years. A countryside boundary has turned into a faltering type of defense, hardly keeping up against the onslaught of urbanization.

The population has a tendency to elevate the level of their houses and push their houses within the sanctuary while triggering major visual impact on the landscaping. Pachacamac used to be a religious community, developed, modified, and expanded by 4 Pre-Hispanic cultures during 15 centuries. Nowadays it is surrounded by farms, companies, industrial factories, transport companies, and also small lots settled as informal settlements occupied by residents [15]. The chosen site is in the north part of the northern sector of Pachacamac Sanctuary in Lima, Peru.

The reason is that the eastern and western parts have been limited by some fences while in the north part the people still intend to make progress on the edges. Figure 49 shows the graphical understanding of the situation of the site and relation of Pachacamac boundary with its surrounding.

There is also a vacant spot in the northern boundary which undoubtedly will be constructed by people. The best solution is to give an option to these people to build a house that can be dismantled in the future in the case of future excavation for the sanctuary. Figure 50 shows where Pachacamac Sanctuary is located and in the following figures of 51, 52, 53, and 54 different boundaries of Pachacamac Sanctuary can be seen, while figure 55 shows the exact location of the site.

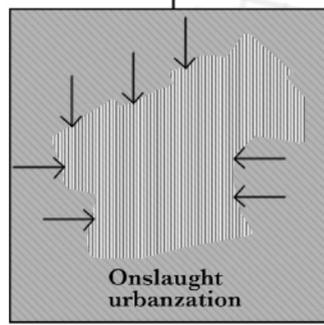
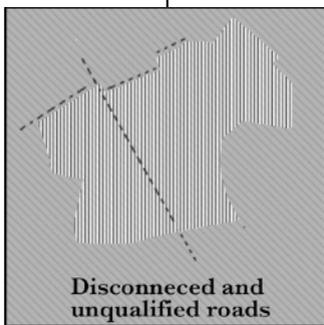
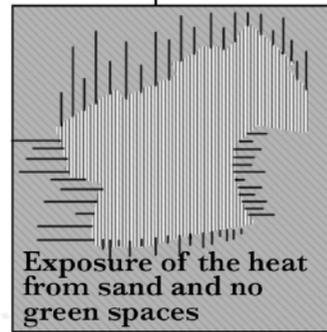
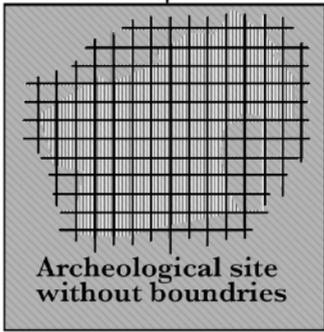


Figure 49. Graphical understanding of the situation of the site and relation of Pachacamac boundary with its surrounding.



Figure 50. Aerial view of the Pachacamac Sanctuary and its relation to the surrounding. Retrieved June, 2020 from Google Earth



2000m

400m

0



Figure 51. Northern boundary of Pachacamac Sanctuary. Competition brief, Habitat for inhabitants Lima, 2018





Figure 52. Western boundary of Pachacamac Sanctuary. Competition brief, Habitat for inhabitants Lima, 2018





Figure 53. Eastern boundary of Pachacamac Sanctuary. Competition brief, Habitat for inhabitants Lima, 2018





Figure 54. Northern boundary of Pachacamac Sanctuary, selected site. Competition brief, Habitat for inhabitants, Lima, 2018





Figure 55. Aerial view of the selected site in northern sector of Pachacamac Sanctuary. Retrieved June, 2020 from Google Earth



500 m

0

SITE ANALYSIS

NEIGHBORHOOD ANALYSIS

“The recent finding shows that only 6 percent of homes in Lima’s *barriadas* (shantytowns) constitutes “finished” dwellings, while over 90 percent remain in incipient and medium states of consolidation seem especially troubling” (Fernandez- Maldonado 2007 Tokeshi et al. 2005.) [16]. In order to have deep knowledge about the neighborhood, an analogical approach has been done through observation and identifying the status of each house using Google Earth, in the specific part of the northern sector of Pachacamac Sanctuary shown in figure 56.

The primary utilization of the land is non-commercial represented by single flooring houses constructed by temporary, not durable materials profiled fiber cement roofs and wooden walls, along with soil or cement flooring. Lots of roadways continue to be unpaved with lack of infrastructure or basic services and facilities remain unconnected to the urbanized system of Lima community. Houses are in different stages ranging from being a shelter to being a permanent house that can be explained in specific in the following:

A- Due to the fact that forced eviction might happen anytime, individuals get sure of using affordable materials that can be dismantled easily

B- The beginning phase is constructing the perimeter of the house with brick walls around the temporary shelter in order to define the limits with other neighbors. Later on, other rooms will be added to the current shelter or the shelter will be improved internally. The affordable cheap roof is due to the high cost of concrete.

C- An initial action in order to have vertical expansion is to build a permanent durable roof constructed of concrete. The shift from temporary to permanent will be costly for low-income families therefore it might happen in a long period of time or in different stages. The houses expand horizontally in this stage.

D- In this phase since the roof of the first floor is already shifted to concrete, therefore, the second floor can be constructed and additional rooms are being built and occupied by the families. The temporary walls become permanent.

E- In this phase second or third floor will be constructed depending on the income of the family and how fast they can develop and expand the house vertically.

SITE ANALYSIS

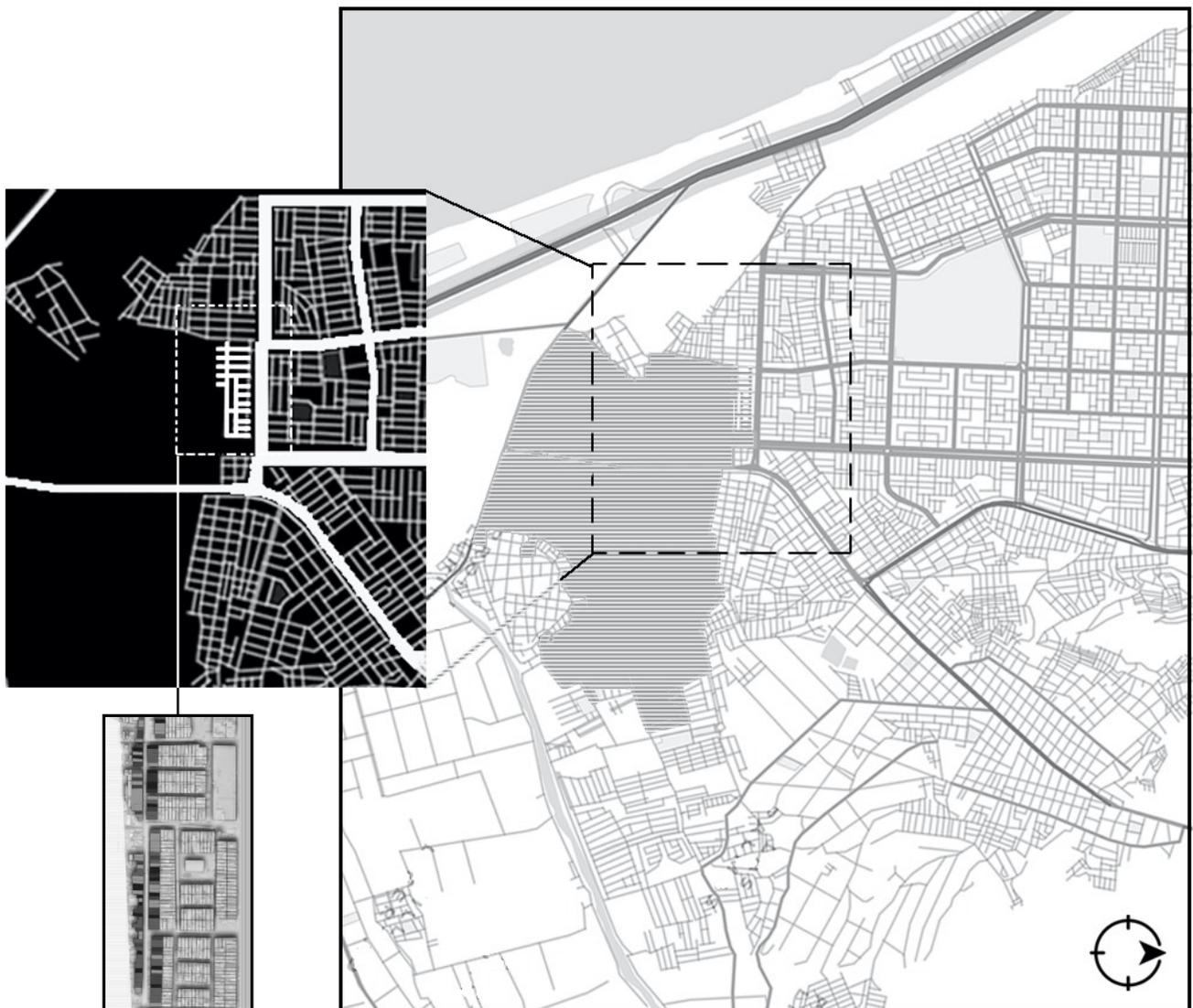


Figure 56. Selected area for neighborhood analyzing in northern sector of Pachacamac Sanctuary

SITE ANALYSIS

According to the observations, the highest percentage of houses are in stage A while the lowest percentage dedicates to stage D shown in chart 01 . It translates to the fact that major part of the people has the need to an immediate shelter and the lowest percentage shows the people rarely tend to stop constructing after the realization of the first floor and population growth force them to expand the house vertically. Figure 57 shows the randomly selected houses in the neighborhood while figure 58 shows the cases in greater detail.

Stages	Percentage
A- Temporary wall and temporary roof	34.53%
B- Permanent wall and temporary roof	27.33%
C- Permanent wall and permanent roof basic stage (normally one story)	17.26%
D- Permanent wall and permanent roof advance stage (normally two stories or more)	2.15%
E- Permanent wall and permanent roof advance stage temporary second or thiond floor's roof	17.26%

Chart 01 .Percentage of each stage in the selected neighborhood

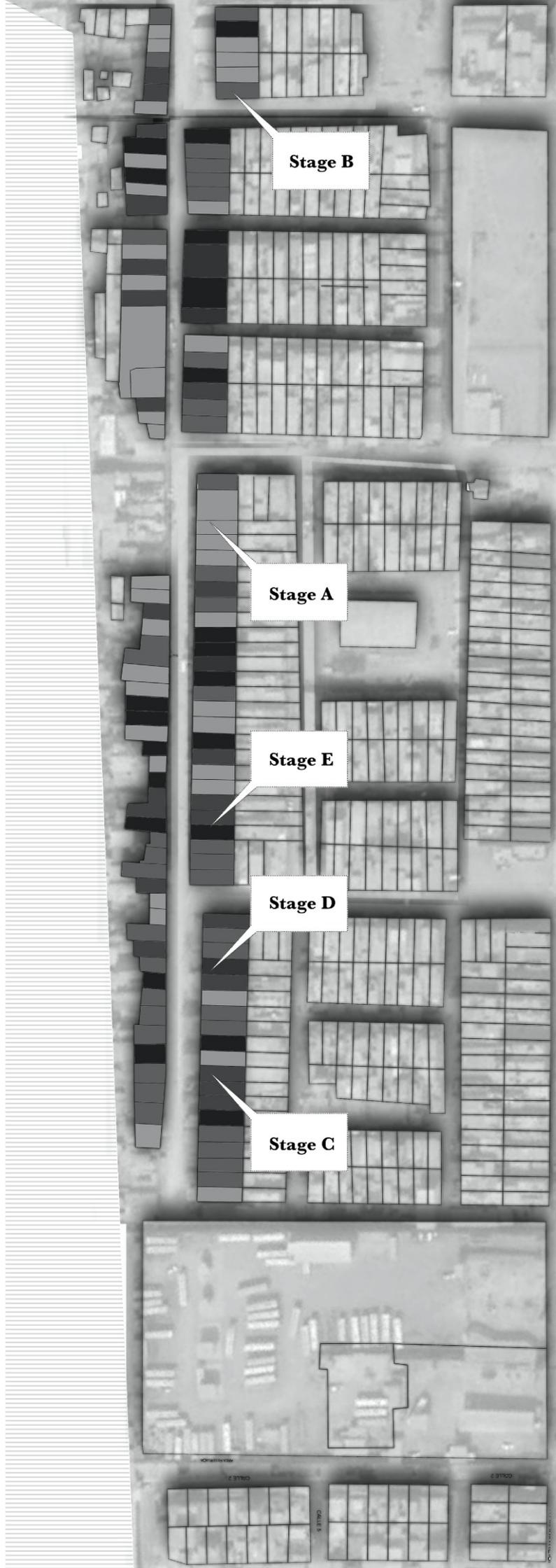
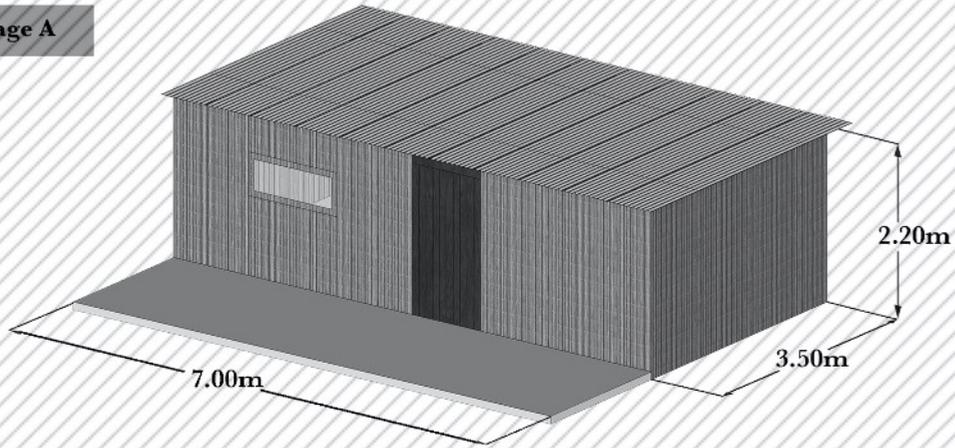
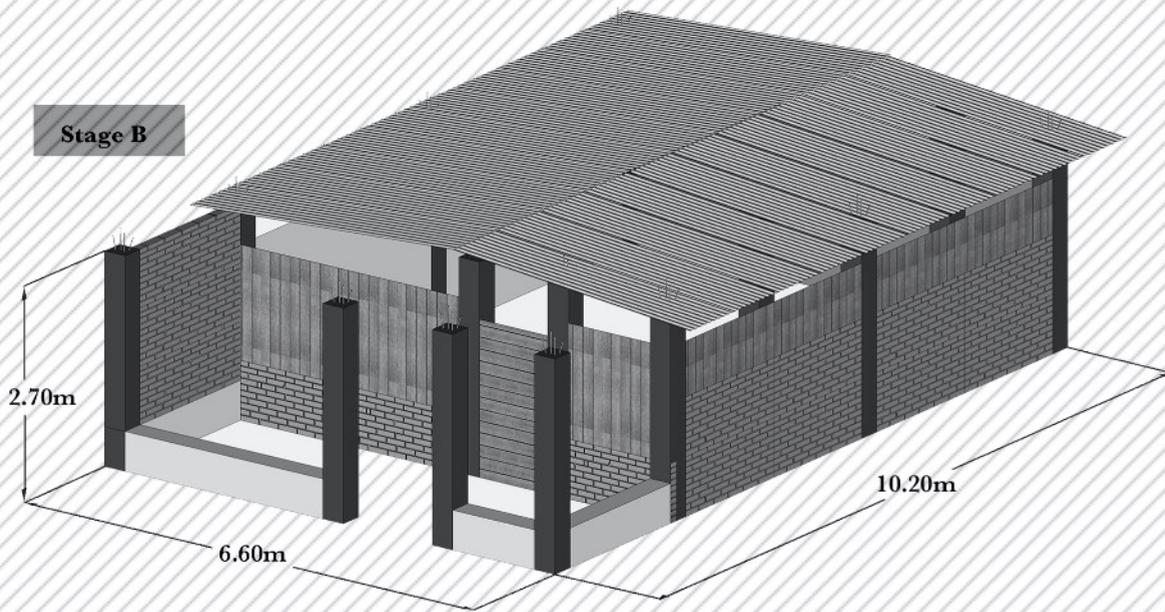


Figure 57. Randomly selected houses

Stage A



Stage B



Stage C

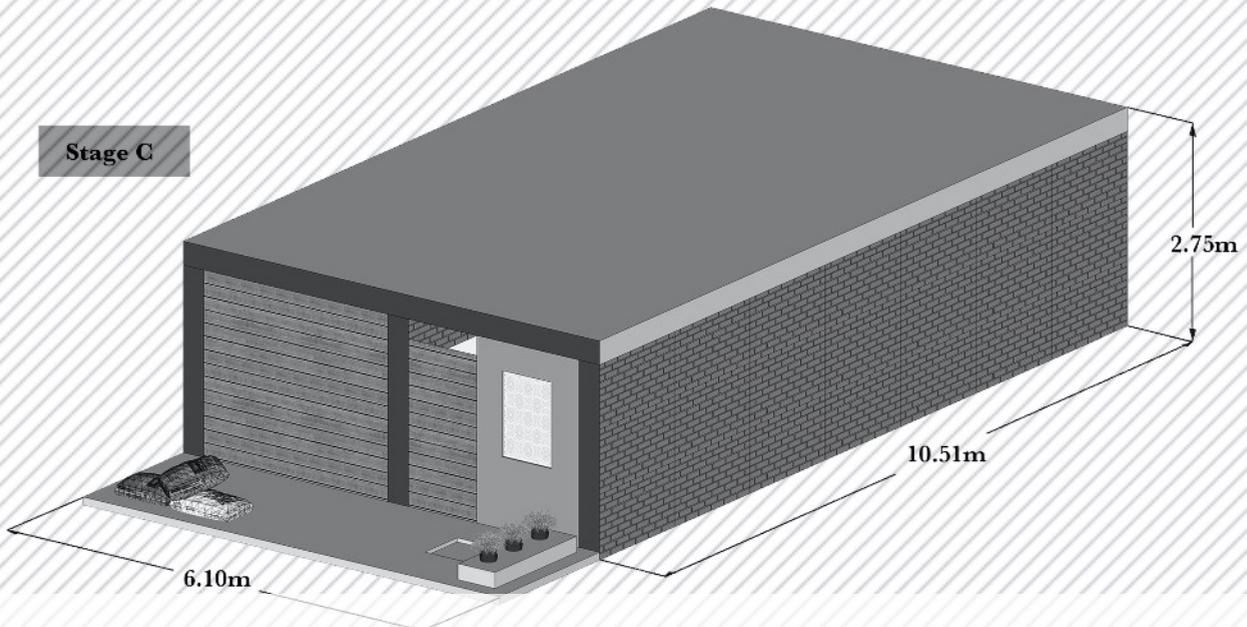
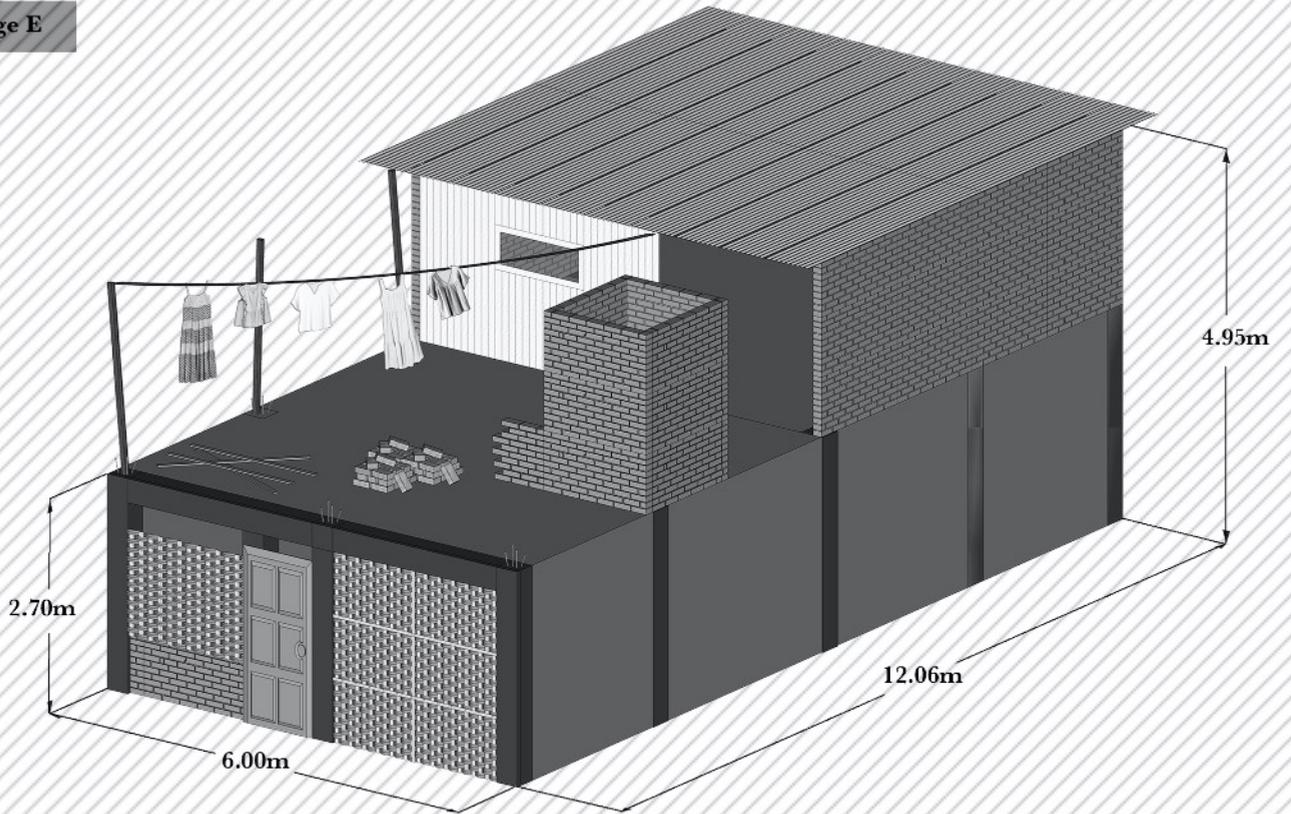
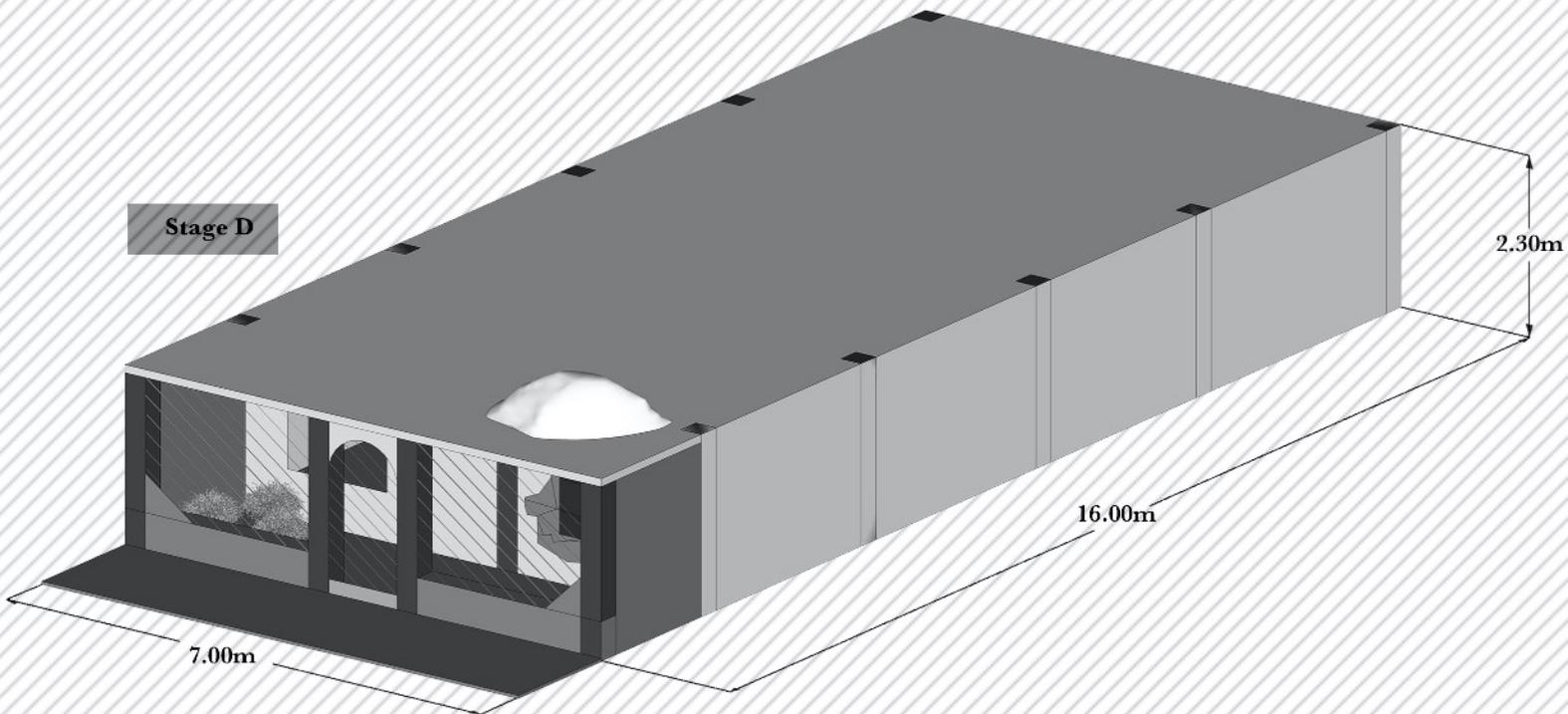


Figure 58. Different stages of selected houses in northern sector of Pachacamac Sanctuary within the selected site

Stage E



Stage D



SITE ANALYSIS

OBSERVATIONS

Sample house on stage A:

- Dimensions of $L=7 * W=3.5 * H=2.20m$
- One Floor without any structure. All made with woods and corrugated metal roof.
- The dimensions are minimum and materials are not in good condition which means the structure is more a shelter rather than a unit or a house.

Sample house on stage B:

- Dimensions of approximately $L=10.20 * W=6.60 * H=2.70m$
- One Floor with a concrete structure and brick walls covered with plaster (dimensions are approximate with an assumption of each door to be $L=1 * H=2.20m$).
- A shift back of approximate 2m from the main entrance to the unit is done in order to have further expansions.
- The walls were made of woods which by passing time took its place to brick.

Sample house on stage C:

- Dimensions of $L=10.51 * W=6.10 * H=2.75m$
- One Floor with concrete structure and brick and wood walls.
- Only one of the façade has plaster.

- A concrete slab with a length of 2m is built at the entrance in order to define the border and privacy.
- Bags of cement are showing an ongoing process.

Sample house on stage D:

- Dimensions of approximately $L=16 * W=7 * H=2.30m$
- One Floor with a concrete structure and brick walls covered with plaster (dimensions are approximate with an assumption of each door to be $L=1 * H=2.20m$).
- A shift back of approximate 2m from the main entrance to the unit is done in order to have a front yard.
- Metal bars are used to fill up inbetween the structure at the entrance.

Sample house on stage E:

- Dimensions of $L=12.06 * W=6 * H=5.5m$
- Two Floors with a concrete structure and brick walls. First floor with plaster and second without plaster which shows a different period of construction.
- The façade of the entrance has been built with wood and woven mat which probably shows the initial status of the house

SITE ANALYSIS

- The second floor is unfinished, the bricks, pieces of woods and an-unfinished structure shows the future expansion and the size of the house shows the growing status of family.

The houses have a maximum height of three levels which have been built through different periods of time because of the different materials being used in each level. Normally the houses with only one floor are built in wood and in the case of two or three floors, normally the first level is built in wood. This firstly shows the necessity of having a shelter in the shortest time and secondly using the most affordable material available on site. Apart from the single floor houses, which have no structure and are built with woods as the quickest response to have a place to live, the most common building strategy is to build a concrete structure and fill it by different materials. As mentioned before the selection of materials varies according to time. The quickest way to fill the structure is with the materials they can find locally in a site such as wood. Some others are built with bricks in an incomplete way and the single bricks around the house show a period of time they need to wait to save money and continue the construction.

The houses with more progress and complete status are those who have plaster on the finishing walls.

A possibility to grow and add more levels can be visualized easily in their unfinished roofs and is common in most of the houses. Those who have concrete structures leave the bars out of the roof in order to complete it later.

Usually, they leave an open space before an entrance by shifting the entrance back from the structure level or by adding a concrete slab at the opening to define their border and privacy.

They have a lack of green space so they dedicate a space in their entrance for this matter even if they do not have it at the moment with the hope to have in the future.

SITE ANALYSIS

CONCLUSION

As it has been mentioned before, one of the minimum criteria for housing to be adequate is culture adequacy. Many of the social housing projects have been a failure because the culture of the habitants was not being taken into account and the project was condemned to be changed by the users. A human rights-based approach will be successful only if people can participate in the process and even in decision making. It is their right to have a home according to their necessities, a place that responds to their physical, social, cultural, environmental, and mental needs.

According to Turner the implications of housing in individuals' life may just be directed in terms which explain human relationships as well as procedures. Actual values are the ones that lie inside the human relationships. That is why housing should be seen as a verb and not as a noun or stock of dwelling but by what that stock is produced as well as taken care of. This point of view explains the necessity of involving people in decision-making as primary factors[47].

Constructing houses and providing social housing is not just an answer to housing deficit in case of numbers and census. It is to create places in which people can answer to their social and cultural needs, where they can flourish.

It is to lead communities to develop and urbanized [35]. Usually individuals who live in slums are deprived from adequate housing. They do not have the knowledge nor the financial support to build their homes. Therefore, they build their homes with available materials on site or cheap materials they can afford to buy, shown in figure 59. The problem is that these houses are not safe and well-constructed, placed in vulnerable areas prone to natural disasters. And due to the lack of monetary and financial support they cannot build it all at once. What is necessary is to provide them a system of housing that is affordable and is easy for them to build even if they do not have the constructional knowledge. A system which meet the minimum criteria to be sustainable and adequate.



Figure 59. Different houses in the selected neighborhood on northern border of Pachacamac Sanctuary. Retrieved June, 2020 from Google Earth

CHAPTER 7 - Design guidelines

Based on what policy new units are being constructed and who is going to pay?

What are the modules made of?

Due to the lack of water how people can provide drinkable water and how the toilettes are going to work without water ?

DESIGN GUIDELINES

PARTICIPATORY POLICY

In chapter 5, different housing strategies implemented by the government have been introduced and discussed. However, evidences showed that people have changed their houses according to their needs. Different housing strategies implemented and built by people have also been introduced and it has been seen that the houses had poor quality. With a participatory and inclusive policy, we can enhance the existing circumstances by providing individuals a method for self-constructing low-income housing. In this regard, individuals will be informed of their potentials, rights, and limitations in this process. Consequently, people can communicate and dialogue with the government with their own language. This dialogue not only pushes through the perception that community awareness is a vital stage within ensuring the general welfare of all of the individuals but also generates immediate profits for the government.[27] The new concepts about self-help demanded a change from providing to supporting a point of view. Therefore, instead of providing houses that are usually not affordable for low-income households or constructing houses that can never fill the gap between the increasing population and the demand for housing, it is better to support the approach of self-help which already have been

used by people as a reaction to this deficit. If we consider the role of individuals in the self-help process not as a single person but as a group of people who are capable of being helpful in a certain method of governance, self- help could be seen as an engine for organizing the community.[27] Possibly the ideal approach as a result of this particular inevitable progression is introducing Self-help housing as a joint venture with the government considering a human rights-based approach to create higher quality settlements. The settlements that can be integrated into the city and can have the potential to become the vibrant heart of the city. Therefore, a multi-sectoral partnership among government, housing organizations, and communities are needed.

DESIGN GUIDELINES

CONSTRUCTION OF A MODULE WITH A MULTI-SECTORAL PARTNERSHIP

This partnership starts by supplying a temporary usage for municipal lands which otherwise would usually be vacant, in order to construct modules. In the future, when the lands will be needed for permanent use, these modules can be dismantled as well as transferred to another site. The government transfers inexpensive lands in various locations of the city to the people with a 99-year housing plan. The cost of the land will be removed and subsidies will be provided for housing loans along with guidelines in order to construct low-cost modules for the settlers. Similarly, brochures will be distributed. In this way, there will be job creation as well as increase of skilled employees. The non-profit organizations provide also materials for constructing units. The unit is going to be made of wooden pallets. It is modular, energy-efficient, and affordable, making it perfect for low-income housing. The community will involve in the process and participate in the workshops. In another word, people will learn how to construct their houses based on the given guidelines, while they have to pay only for housing construction and materials. Figure 60 shows the process. As has been discussed before, according to the case studies analysis, the average dimensions for a plot is

~100 square meters while the minimum space that can be used for bedroom, kitchen, or living room is 9 square meter. Therefore each module for the shelter will have the same dimension. In order to have a basic unit, three modules can create a unit including one module as a bedroom, one module as kitchen and living room sharing the same space and another module for the bathroom and entrance. In this regards, 3 modules can create a basic unit that can be expanded by adding extra modules according to the needs of the occupants which can be seen in figure 61. The modules can be extended up to 7 on the first floor in a plot of 13*8 meter and if necessary, up to 5 modules on the second floor. The following figure 62 shows the position of the modules on the plot and the stages of expansion.

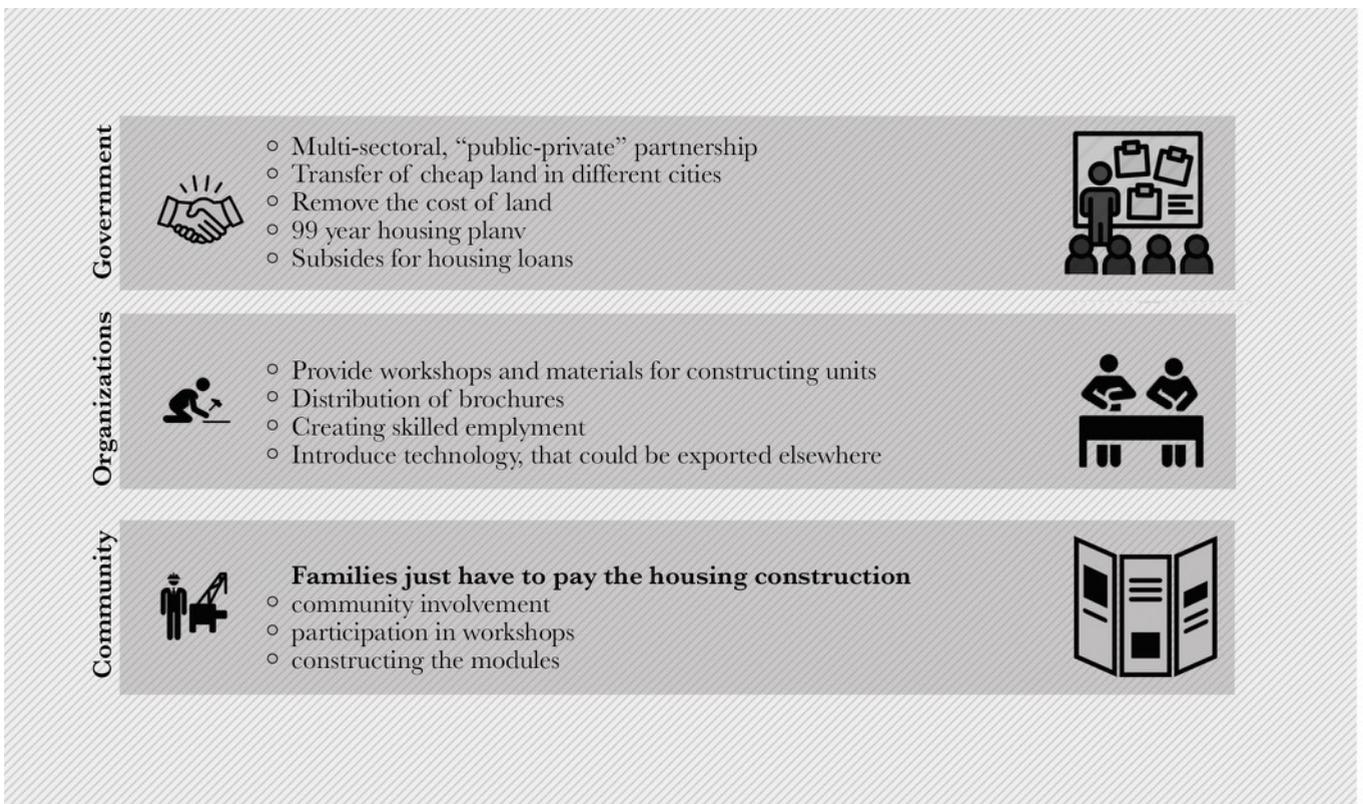
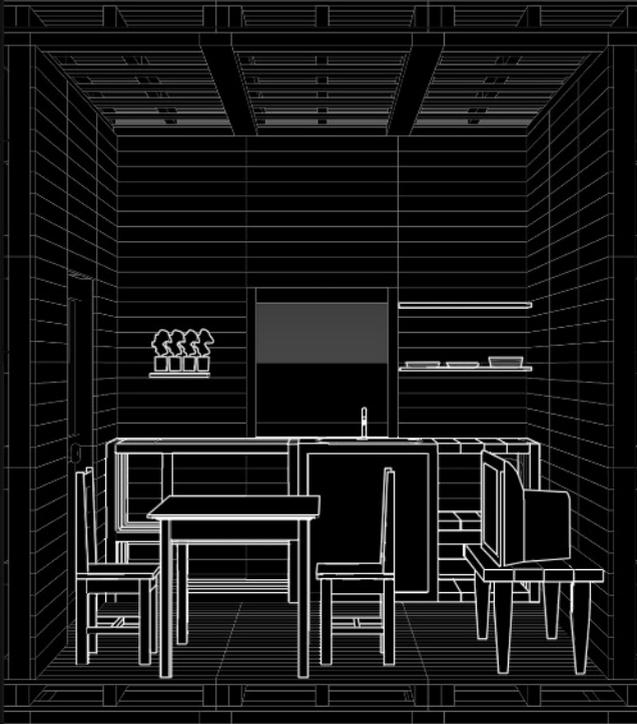
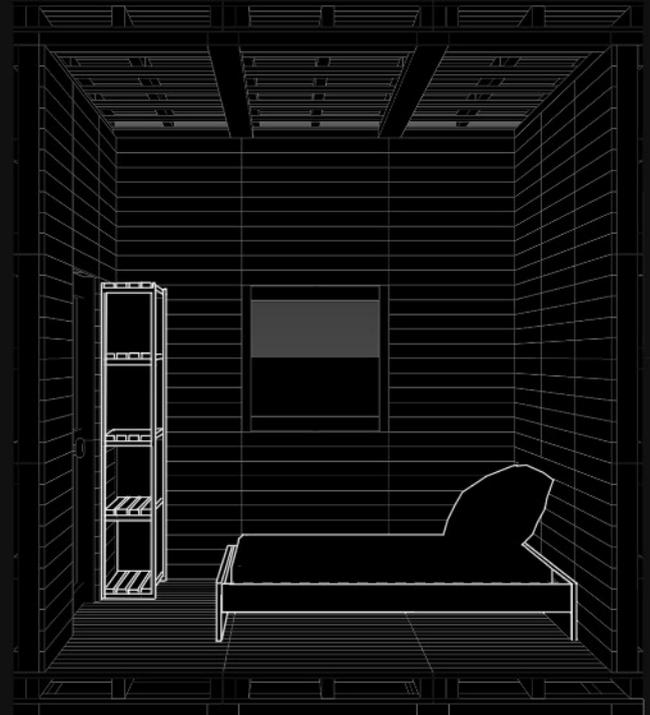


Figure 60. Multi-sectoral partnership



One module base kitchen + livingroom

Dimensions of each pallette: 1.00 x 1.00 x 0.15 m
 Area: 9.00 m²
 Volume: 27.00 m³



One module base bedroom

Dimensions of each pallette: 1.00 x 1.00 x 0.15 m
 Area: 9.00 m²
 Volume: 27.00 m³

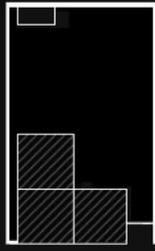


One module base toilette and entrance

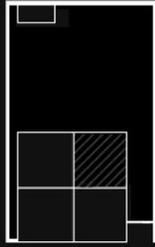
Dimensions of each pallette: 1.00 x 1.00 x 0.15 m
 Area: 9.00 m²
 Volume: 27.00 m³

Figure 61. Function of each module

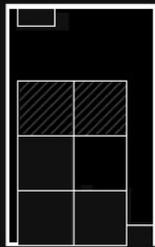
Stage 0



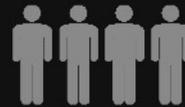
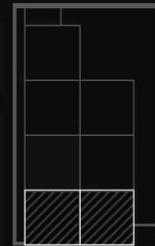
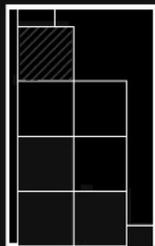
Stage 1



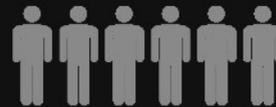
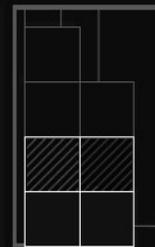
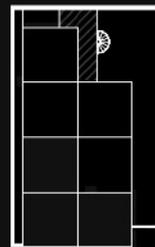
Stage 2



Stage 3



Stage 4



Stage 5

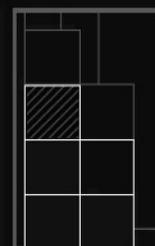
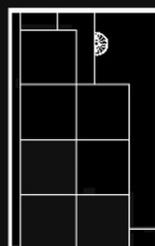


Figure 62. Position of the modules on the plot and the stages of expansion

DESIGN GUIDELINES

PALLET STRUCTURE

According to the neighborhood analysis, the highest percentage of houses are dedicated to wooden shelters. Since the proposed design focuses on intervening on this stage and providing shelters for settlers, this is why the chosen material is wood. The unit is going to be made of wooden pallets. It is modular, low-cost and energy-efficient. Pallets are vulnerable to microorganisms, so they need to be treated with a polyurethane varnish in order to have a further layer of strength. Wooden pallets are perfect choice for low-income housing due to their low cost. In order to reduce even more cost, the pallets that will be used can be recycled pallets that are being recouped from stores and warehouses. In the case of massive production, every pallet can be offered at a fee of 5\$ each. Each module needs 54 pallets (4walls of 9 pallets each + roof and floor). In this regard, the cost of constructing a module is 270\$. As it has been mentioned before, each basic unit is constructed from three modules, therefore, the minimum cost for constructing 3 modules is 810\$. The houses attached to Pachacamac Sanctuary should be two floors high. What needs to be considered is that pallets are heavy. This is what limits people to expand more than two floors. In the case, the unit needs to be expanded vertically, the strong base will be needed to be constructed in order to

support the weight of the building.

Process of assembling a pallet structure:

- 1-** Some pallets are going to be disassembled in order to fill the gap of other pallets. (if pallets are going to be bought, they can be customized before the order) shown in figure 63.
- 2-** Pallets need to be joined to create a wall, roof or floor. In order to join them it is needed to nail each two pallets from the internal lateral part using wooden pieces that have been disassembled before. (in the case plywood panels are available, a longer piece can be used to connect the three of them all once) Shown in figure 64
- 3-** Then the structure is rotated and will be used as the floor. To place the walls on the floor, it is needed to be considered that two parallel walls need to be shorter in width in order to fit later with the other walls and not exceed the dimension of the floor. It is needed to shorten the lateral sides of the wall by cutting the wood pieces and then extract the blocks and nail them again. After nailing them, it is needed to cut the extra part which is out of the structure to later fix the perpendicular wall shown in figure 65.
- 4-** Metal brackets and screws are used to fix them and connect them with each other. The module will be ready to replicate. by connecting to each other and create a unit shown in figure 66.

Some pallets are going to be disassembled in order to fill the gap of other pallets

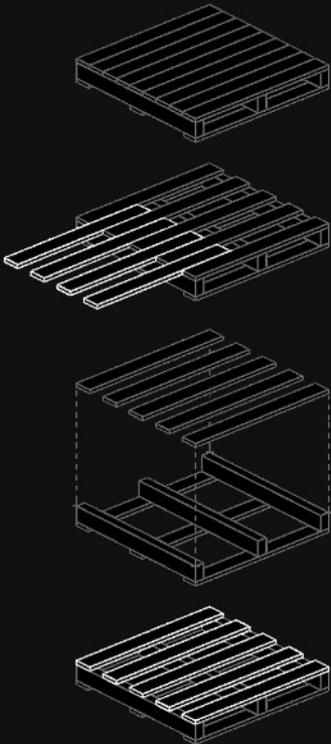


Figure 63. Reassembling the pallets

In order to join them it is needed to nail each two pallets from the internal lateral part using wooden pieces that have been disassembled before. (in the case plywood panels are available, a longer piece can be used to connect the three of them all once

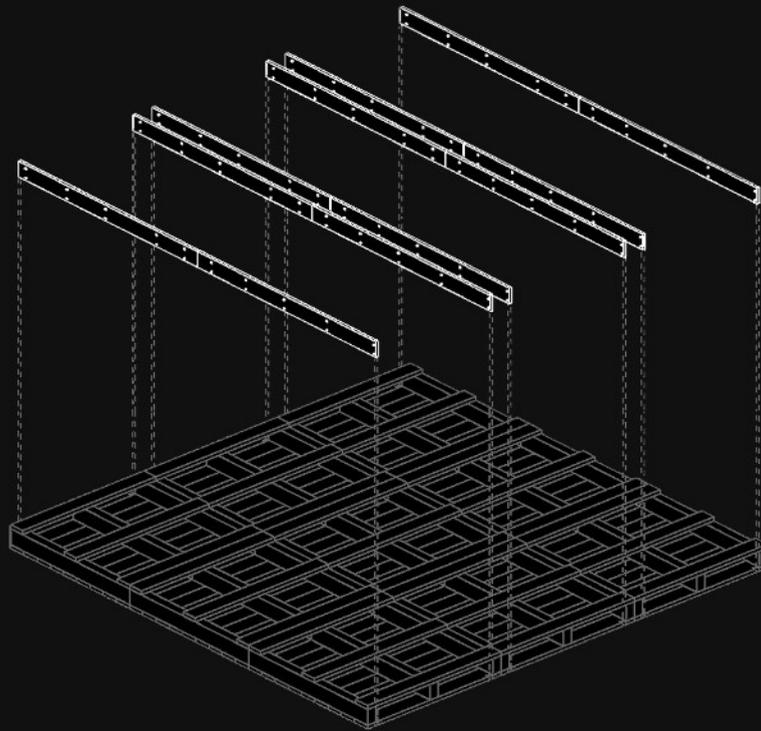


Figure 64. Joining pallets

Two parallel walls need to be shorter in width in order to fit later with the other walls and not exceed the dimension of the floor

Cutting the wood pieces and then extract the blocks and nail them again.

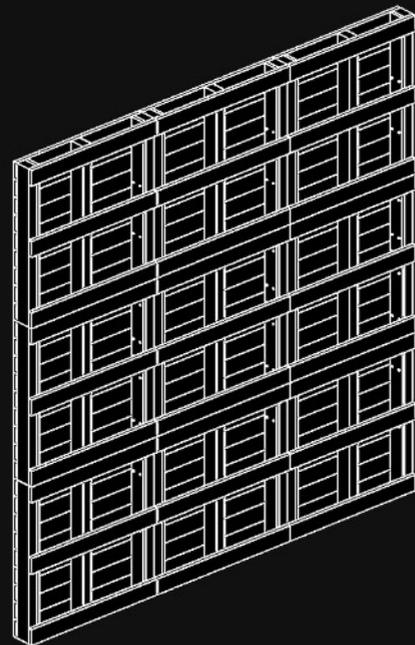
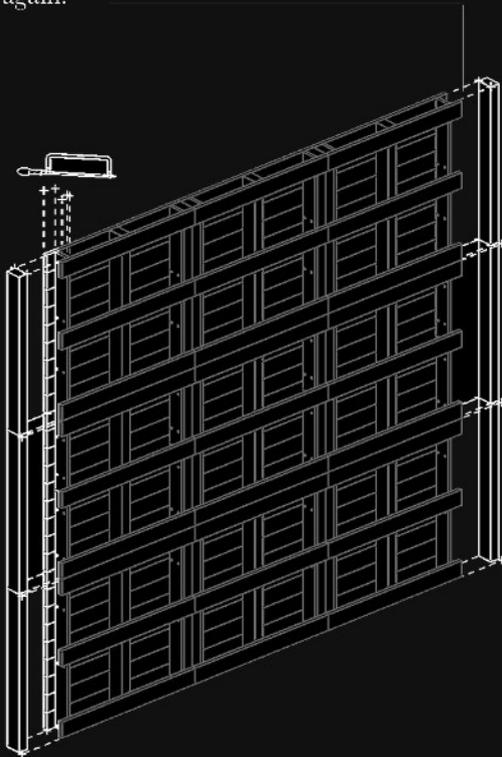


Figure 65. Cutting pallets

Metal brackets and screws are used to fix them and connect them with each other

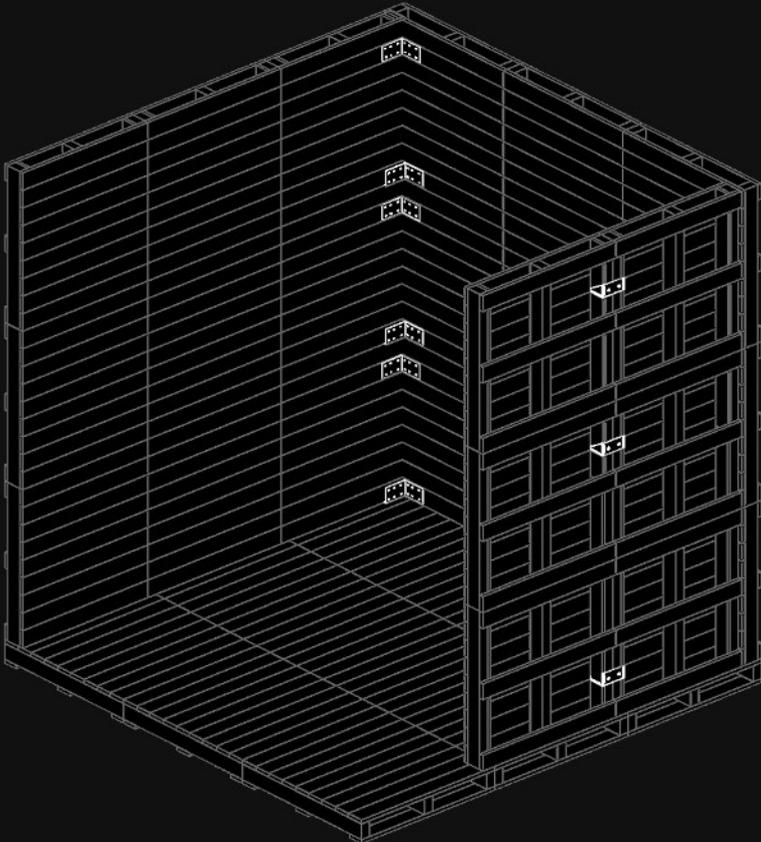


Figure 66. Connecting the pallets

DESIGN GUIDELINES

LCS INSULATION AND RUBBLE TRENCH FOUNDATION

When all the pallets are unified with each other, thanks to the form of the pallets, there will be empty spaces that can be filled with LCS- light clay straw- as insulation. It can be a good choice since straw is a renewable agricultural by-product which is affordable and locally available.

The insulation can easily be constructed by mixing the mud with straw, putting that inside a wooden frame, let it dry and then remove the frame and place the blocks within the pallets. Each pallet has two empty rows of each 40 cm width and 1-meter length that need to be filled. In order to make the infilling easier, it is better to build small blocks of LCS. In order to easily place the blocks one on top of another, after connecting the pallet, blocks of 10*40*30cm will be needed. 10 blocks will fill one row of a 3m wall, and 60 blocks will fill the whole wall.

Finally, lime plaster will be applied to the LCS, shown in figure 67. Since straw and also wooden pallets are in the vicinity of humidity, the floor will remain without any insulation to have the movement of the air from the bottom of the structure and avoid rising damp.

However, a foundation is also needed to create a stable base to distribute the weight of the structure. In the pallet, two-floor structure, is it not needed any massive foundation of cement.

Widening the base of the wall by rubble trench foundation is one of the simplest construction approaches that is sustainable and eco-friendly. In order to have a rubble trench foundation it is needed to dig a trench underneath the walls and fill it with stones shown in figure 68. Earthen bags can also be placed on top of it afterward. This method is very useful specifically in seismic regions.

Vertical members of the pallets need to be doubled in order to create the pillars to distribute the weight of the building evenly to the ground. In the case of having two floors beams will also be needed on the roof. Figure 69 shows in detail the structure.

Light straw clay is being used as insulation and lime as finishing plaster.

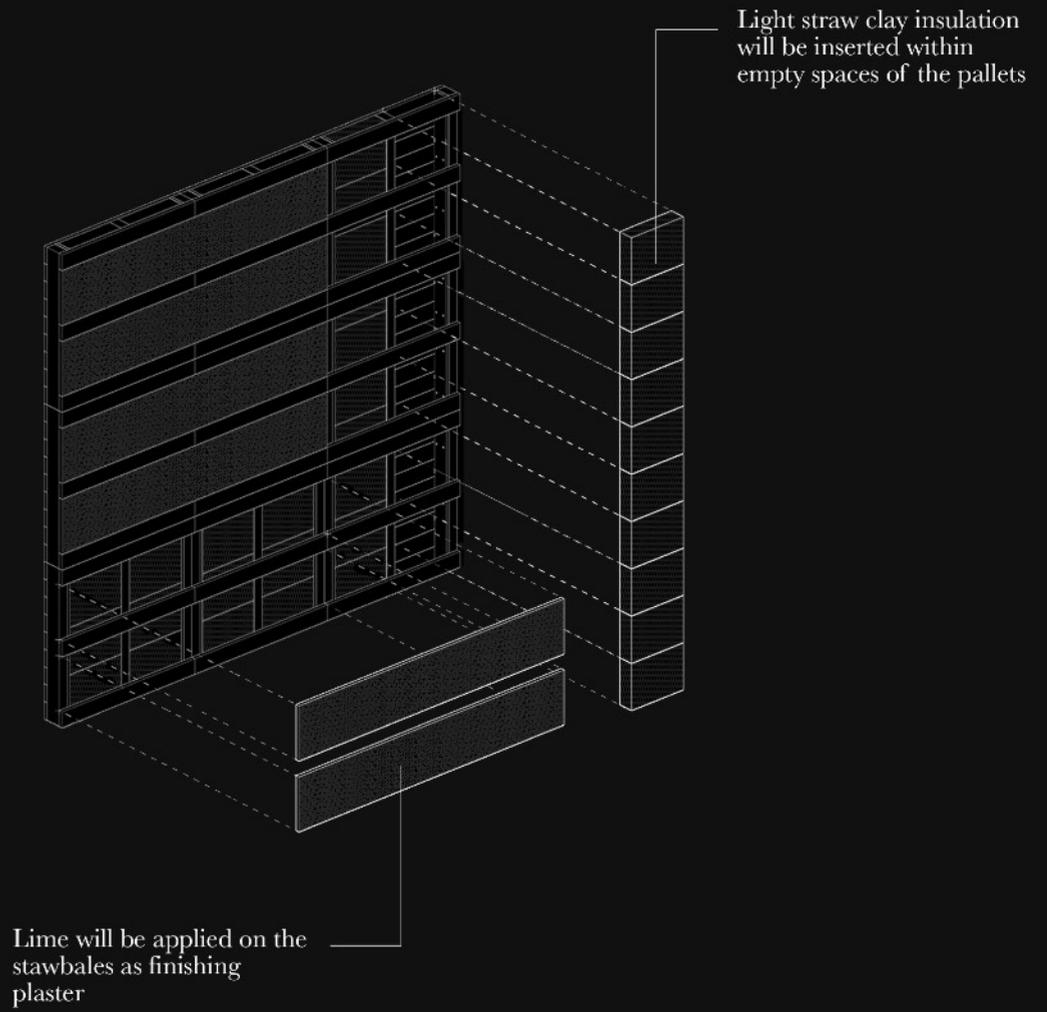


Figure 67. Insulating pallets

Widening the base of the wall by rubble trench foundation and using the pallets to create columns

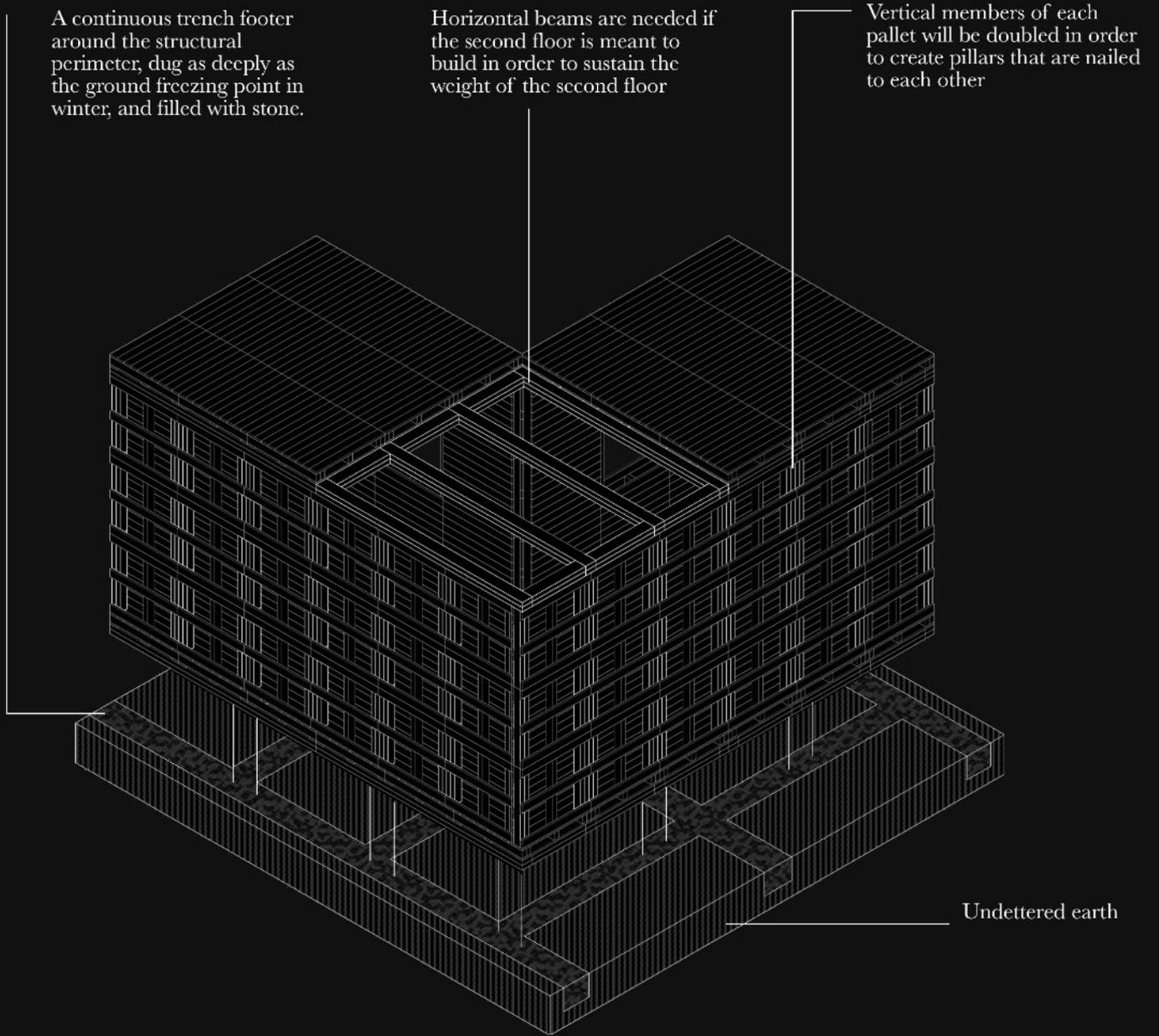


Figure 68. Rubble trench foundation

Vertical members of the pallets are being doubled and then connected to each other in order to create the columns. The roof will need also wooden beams to distribute the weight into the columns and in consequence to the foundation.

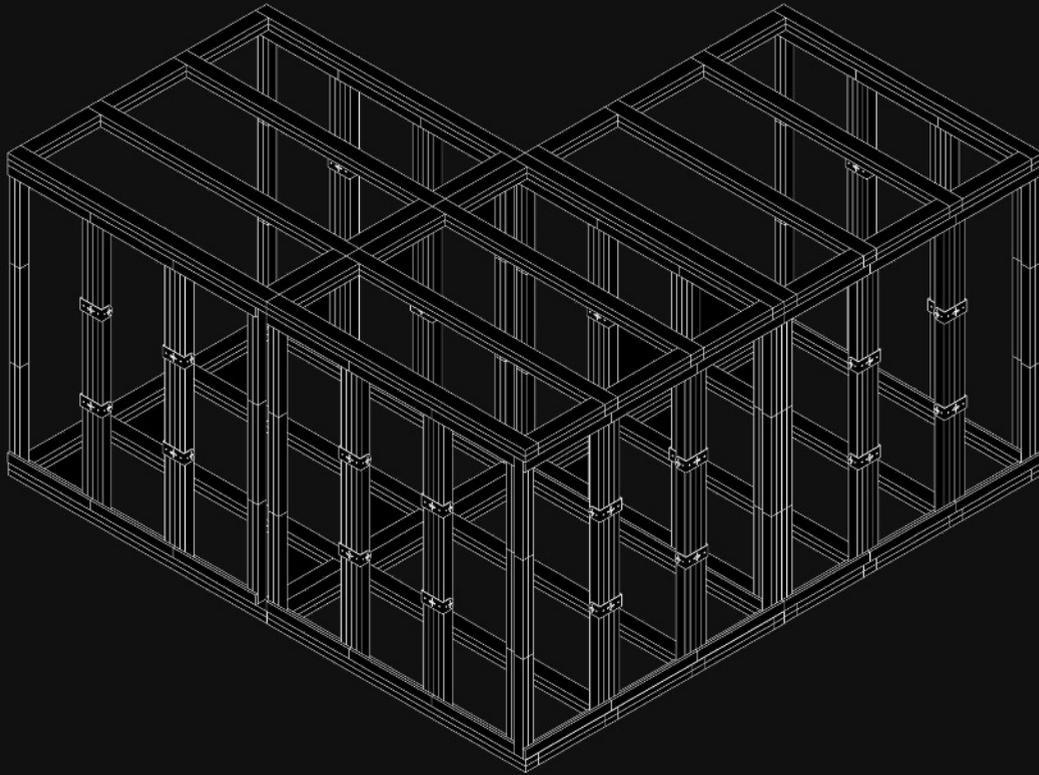


Figure 69. Structure

DESIGN GUIDELINES

WINDOWS AND DOORS

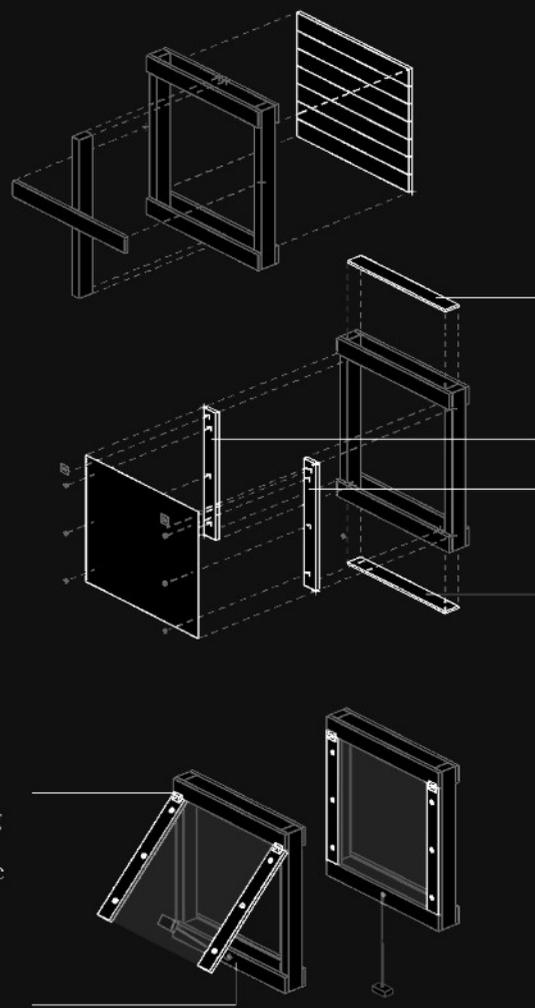
Since the construction of the unit as an immediate shelter, is based on low-cost solutions, therefore, it is assumed that individuals have difficulty buying windows frame and the cost of the glass would be also high. In this sense, the pallets are acting as the window frame by disassembling internal wood panels and keeping the surrounding panels of each pallet. A more affordable solution to use, instead of glass can be polycarbonate panels. They are stronger and lighter than glass and they have superior thermal insulation. Polycarbonates are also a better choice due to affordability and energy saving. Polycarbonate panels can be ordered in personalized sizes. According to the dimension of the wooden pallet which is 1m*1m, a panel of 80*80cm will be used that costs 35\$ with thermal conductivity of 0.19W/mK, and R-value of 1.54 K.m²/W for a 6mm panel. In order to fix the polycarbonate panel to the window frame, it is needed to drill holes on panels of the pallet and also on the polycarbonate panels. Tap cones need to be inserted inside the holes of the frame and in following a washer will be inserted. Then the panel will be placed on the washers and will be secured with washerd wing nuts.

In order to create a top hang opening, hinges are

being inserted on top of the frame, and a metal hangs underneath the structure with a wooden end to hold it. Figure 70 shows the details of the windows.

In order to place the doors inside the pallets, two pallets will be removed while the frames will be remained in order to be integrated to the columns as can be seen in figure 71.

A pallet will be disassembled and the frame will remain as a window frame



Disassembled parts will be used in order to fill the gaps and to build the frame of the polycarbonate panel. Holes will be drilled both on panel and on the frame in order to be secured later with washered wings nuts.

Cover will act as a top-hang opening. Hinges are being inserted on top of the frame and a metal hook underneath the frame will be placed in order to keep the cover closed and secure.

Figure 70. Windows assembling

In order to place the door inside a pallet, two pallets will be removed

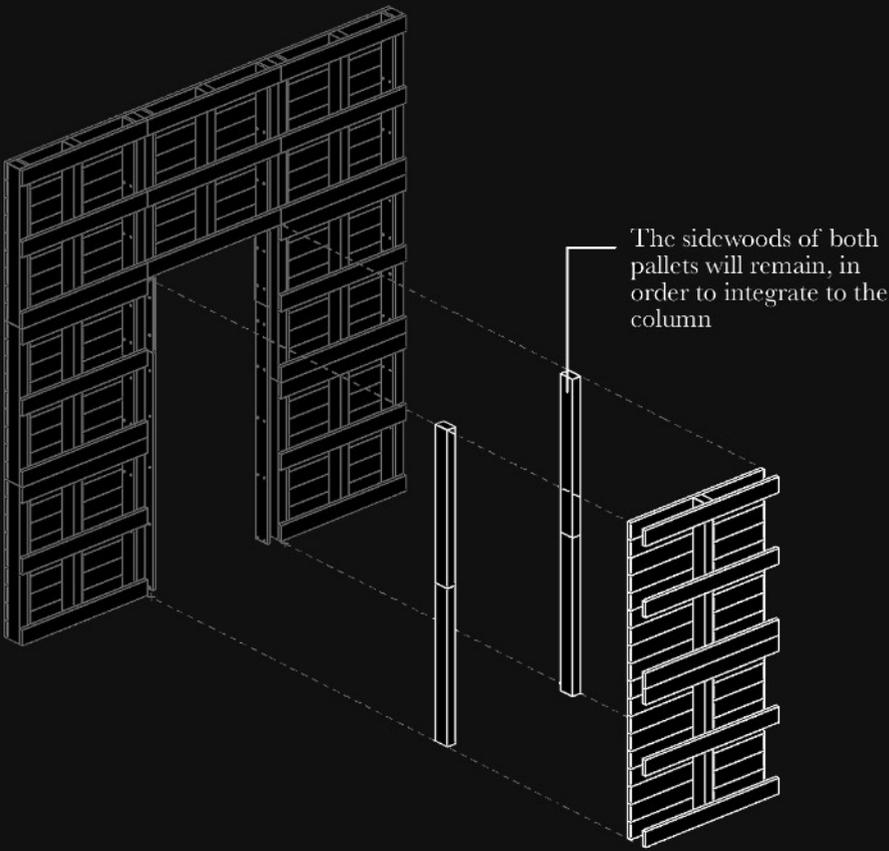


Figure 71. Door frame

DESIGN GUIDELINES

UNIT EXPANSION AND *BAHAREQUE* FACADE

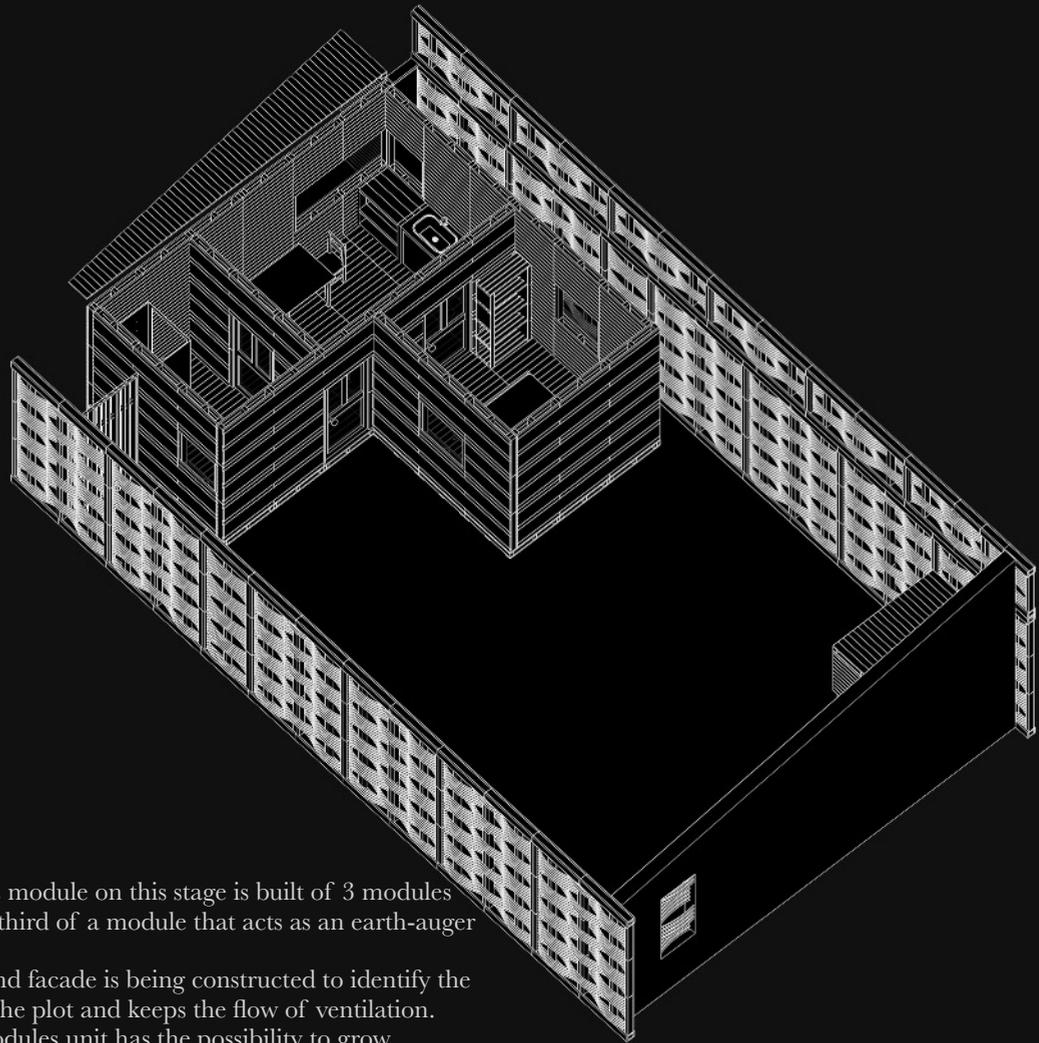
In the analysis of different social housing that has been done in chapter 5, it had been seen that houses change over the period of time. 5 stages of expansion had been considered for the changes. The same strategy is considered for the design of proposed modular units. The very first stage would be constructing the perimeter walls in order to identify the limits of the plot which acts also as a double facade as an environmental solution that creates shadow and helps the natural ventilation. To construct this second facade, a construction system called *baharaque* is being used which is low-cost and is already being used by the Latin American people. It is an interwoven cave with mud finish. Lima is one of the seismically-active regions in Peru and also in the world, and *baharaque* had shown great behavior against earthquakes. Another advantage is that it helps to prevent the emission of carbon dioxide in the atmosphere. The second facade constructed by disassembled palettes as structure and interwoven caves or sticks will be left unfinished in order to keep the flow of natural ventilation while on the backside of the houses which connects to the Pachacamac Sanctuary, it will be finished with mud. The concept is to keep the continuity of the desert into the houses and make them united.

The basic unit is constructed by three modules on the front-right side of the plot in order to consider the intimacy of the inhabitants. The back part will be dedicated to the back yard and provides the possibility of expansion due to family growth.

There will be a set back of 1.5meter from the right side, where the entrance is placed, in order to provide shading on the west facade by the mean of the overhanging roof and doubled facade. In the next stages, modules will be added consequently. The process of expansion is explained and shown in the following figures of 72 to 78.

Axonometry

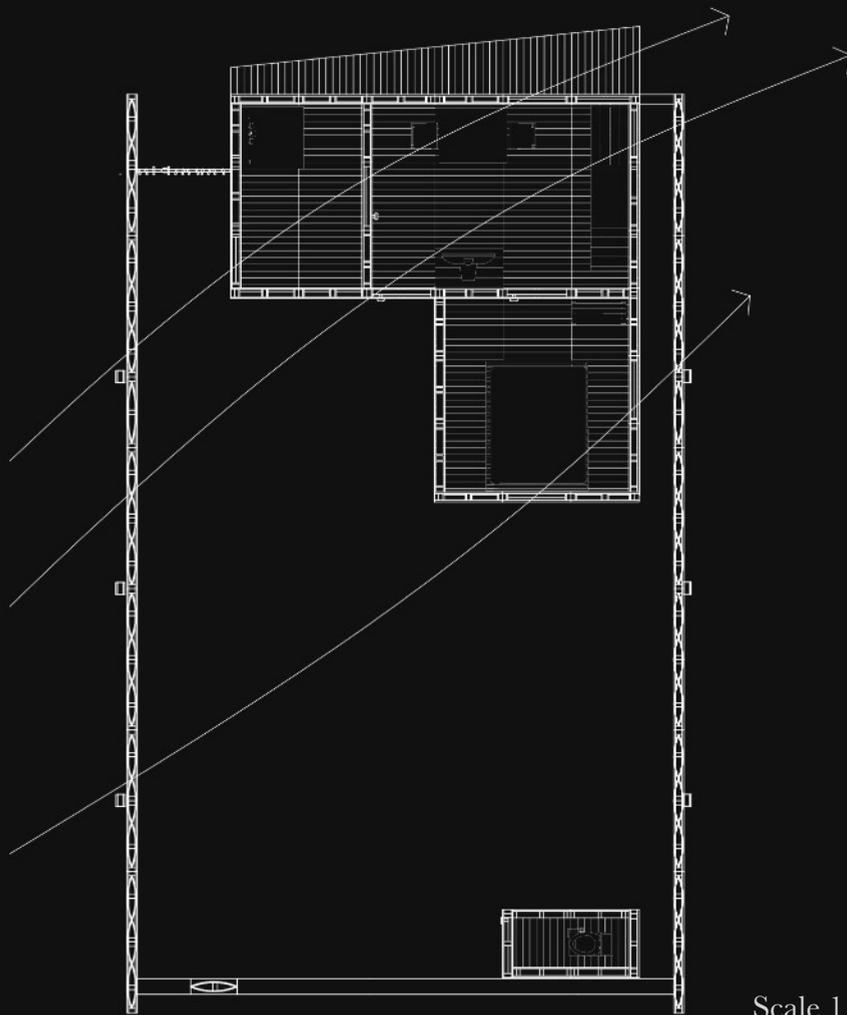
Stage 0



- The basic module on this stage is built of 3 modules with one-third of a module that acts as an earth-auger toilette.
- The second facade is being constructed to identify the limits of the plot and keeps the flow of ventilation.
- The 3-modules unit has the possibility to grow according to the needs of the family.
- The modules are built on the left side of the plot in order to have a set back from the western facade.
- Windows are placed oriented to the summer breeze which is blowing from south and south-west.

Figure 72. Very first stage of construction- Stage0

Plans

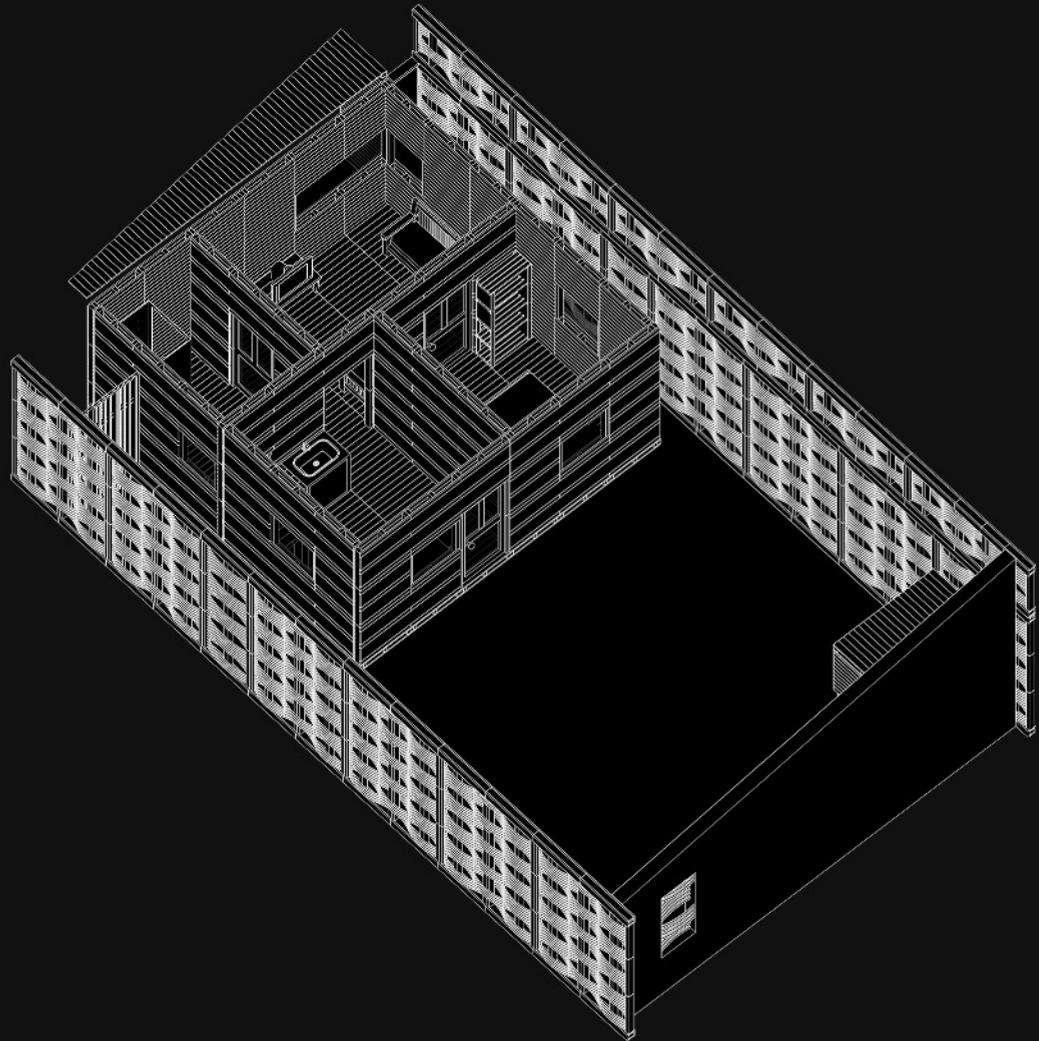


Scale 1/100



Axonometry

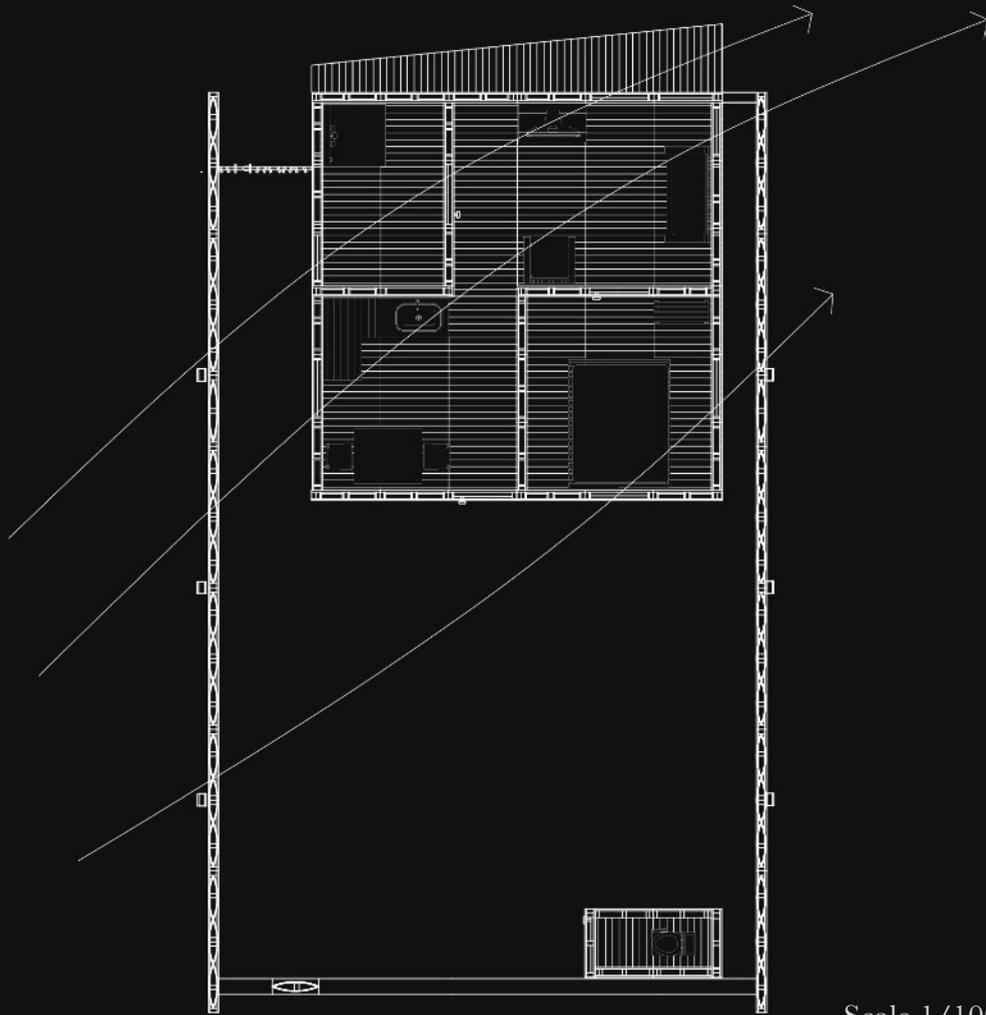
Stage 1



- Another module has been added in order to separate the livingroom from the kitchen

Figure 73. Stage1 of expansion

Plans

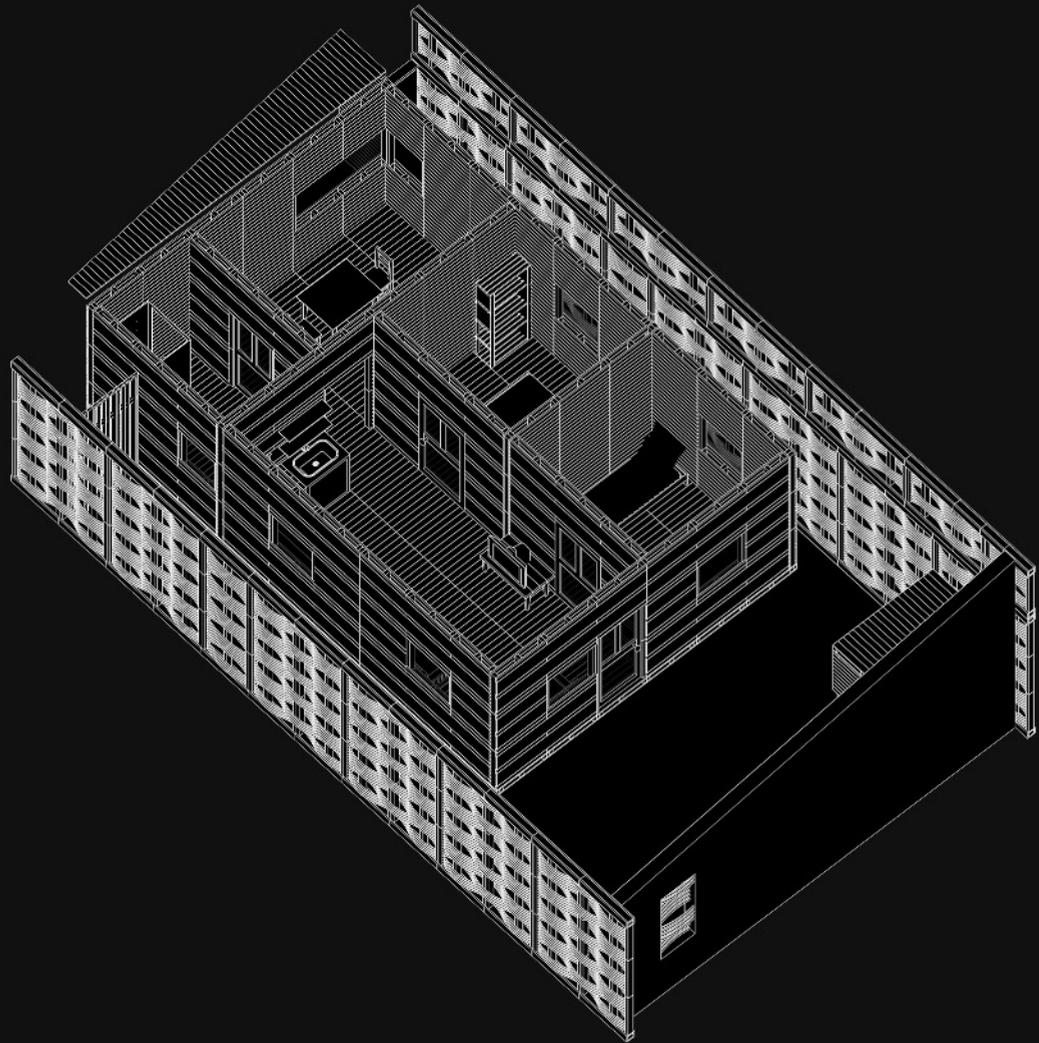


Scale 1/100



Axonometry

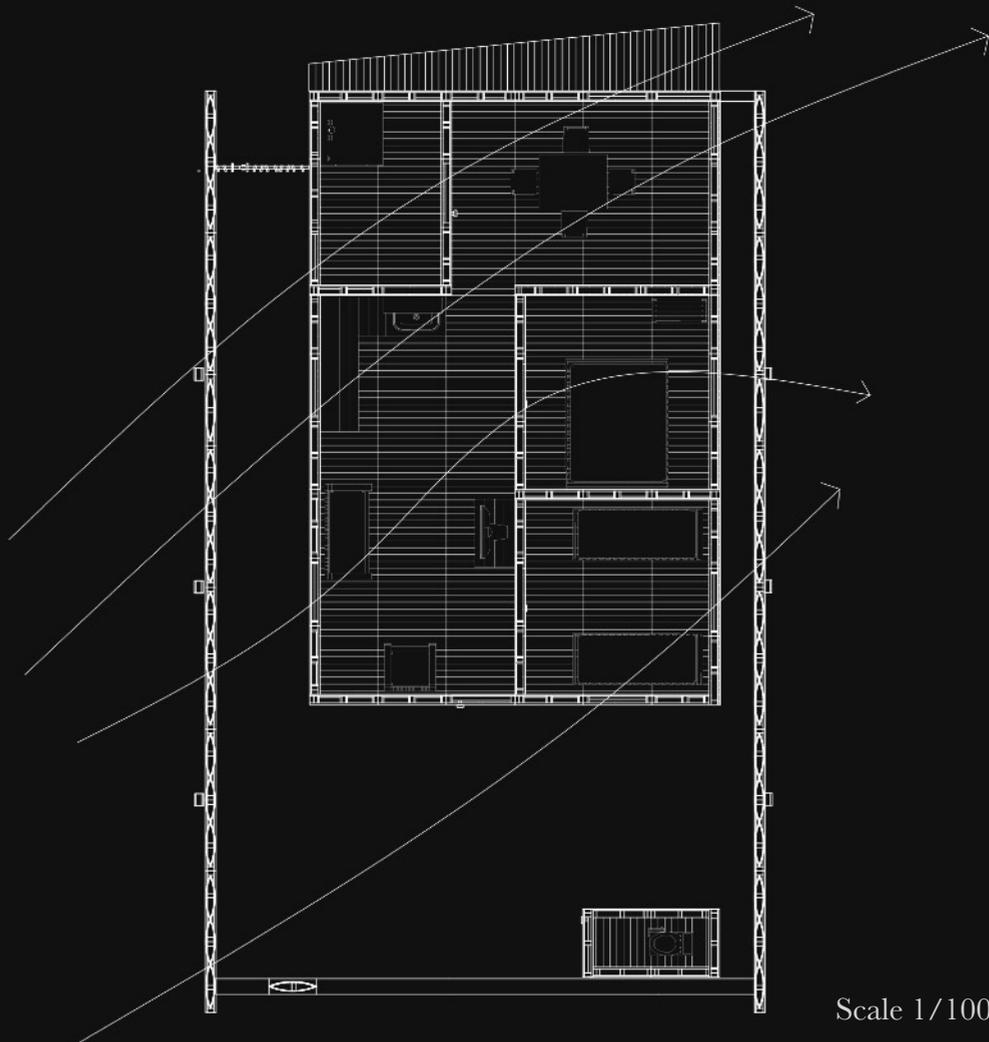
Stage 2



- Two module has been added as a response to family growth.
- New bedroom has been added while, livingroom turns to diningroom and kitchen becomes united with new module as livingroom sharing a bigger space.

Figure 74. Stage2 of expansion

Plans

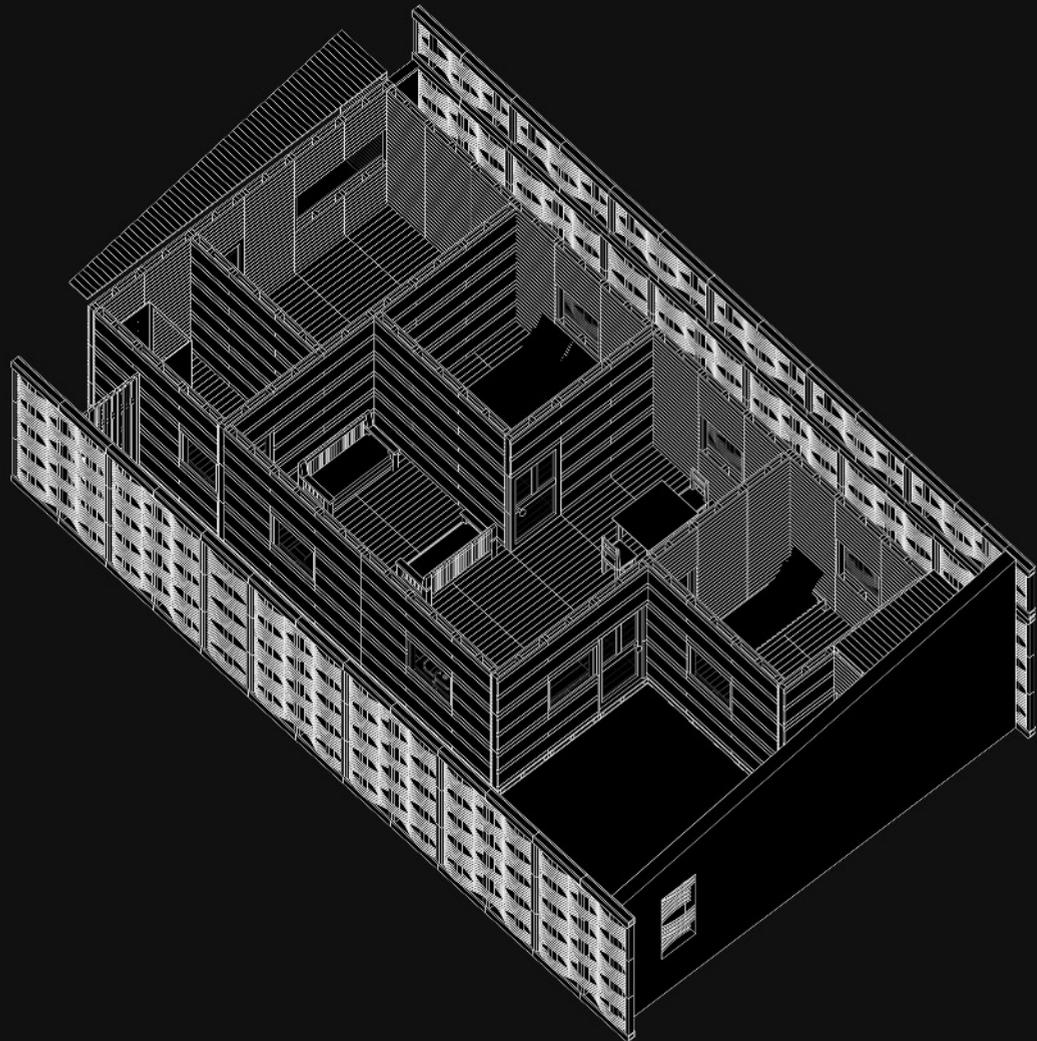


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Axonometry

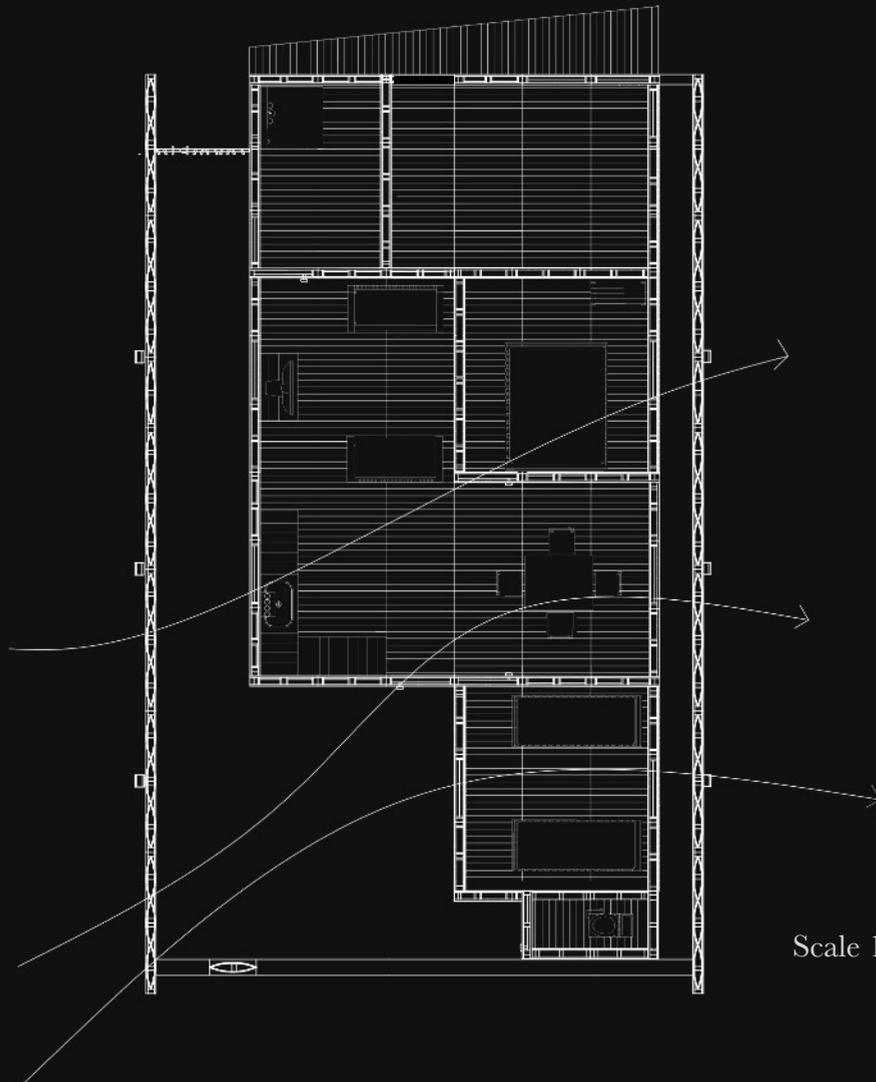
Stage 3 - First floor



- Three modules have been added. One on the first floor as a new bedroom, and due to the need for extra space to place the stairs, two other modules are built on the second floor.
- The second floor acts as a suit and can be used in the case of family growth.
- Diningroom in the front side of the first floor can be transformed as retail in order to have a source of income.

Figure 75. Stage3 of expansion

Plans



Scale 1/100



Axonometry

Stage 3 - Second floor

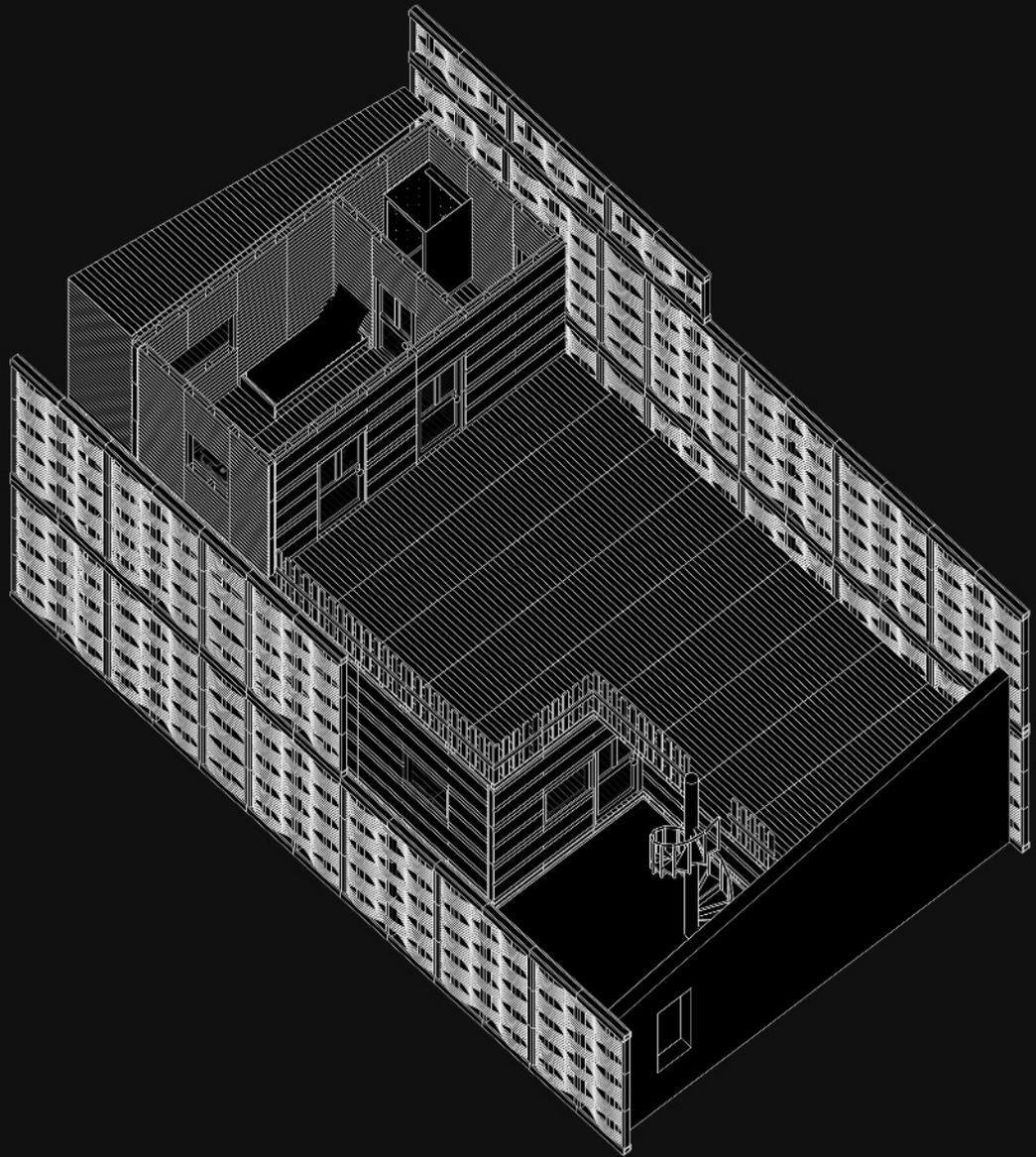
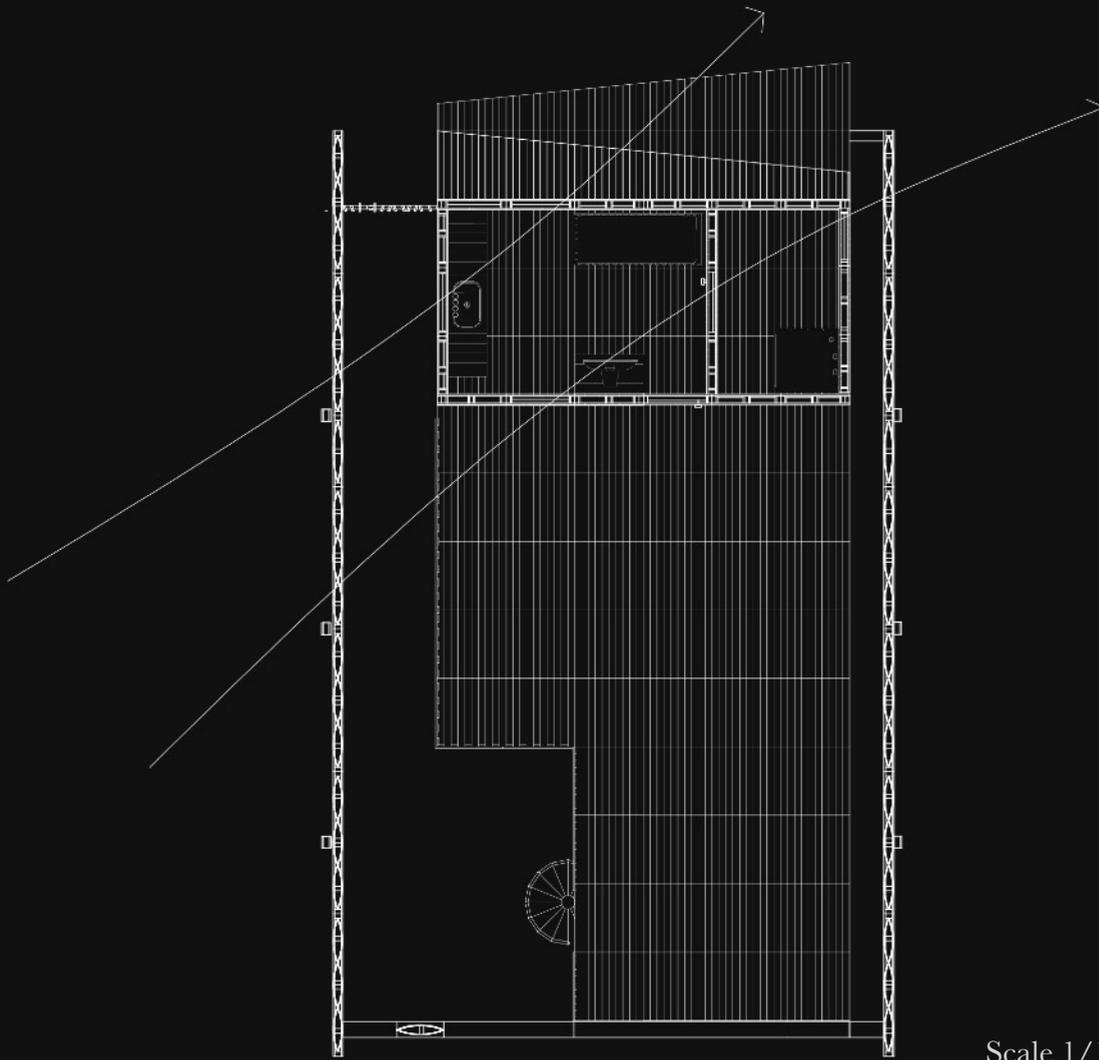


Figure 76. Stage4 of expansion

Plans

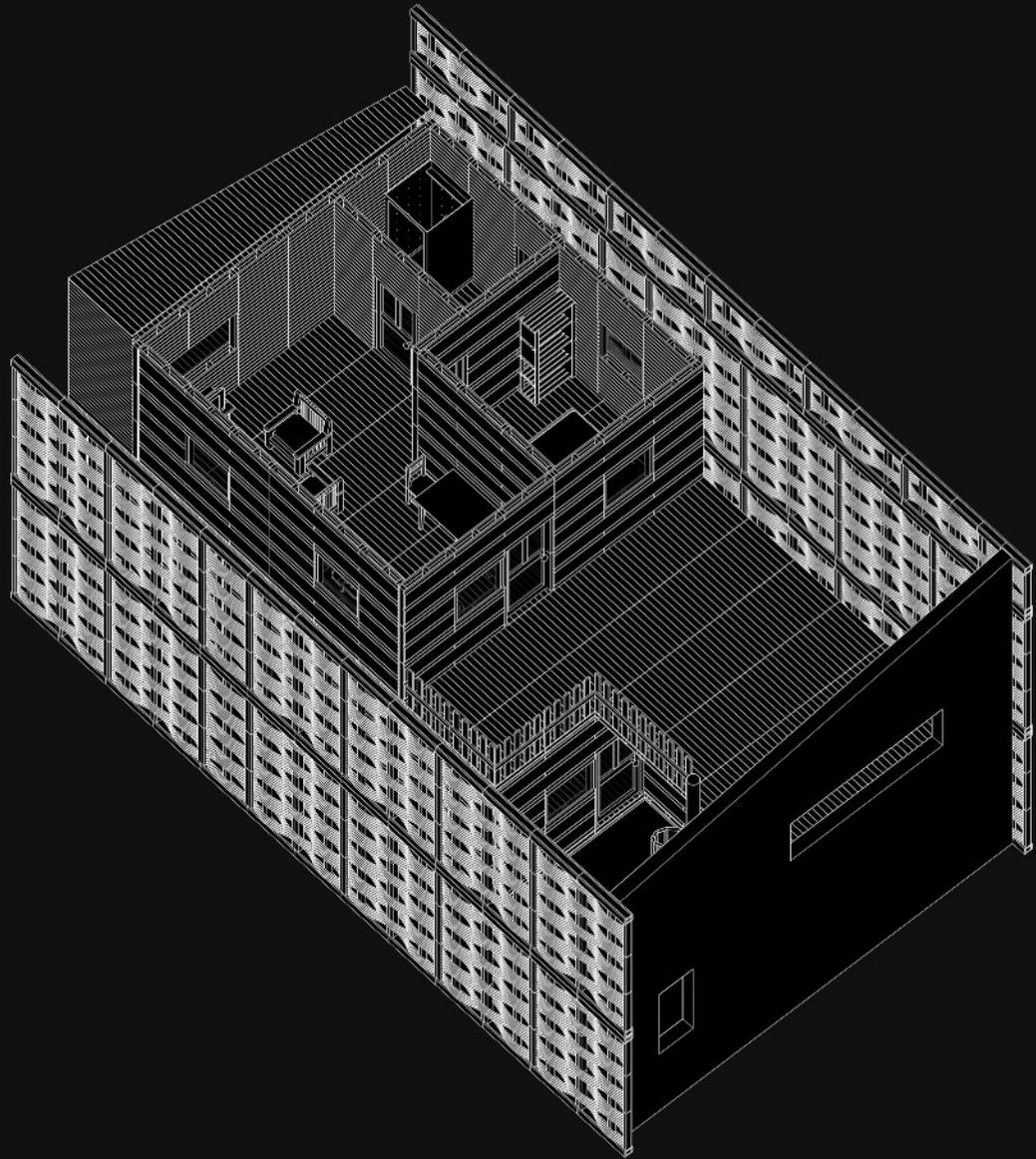


Scale 1/100



Axonometry

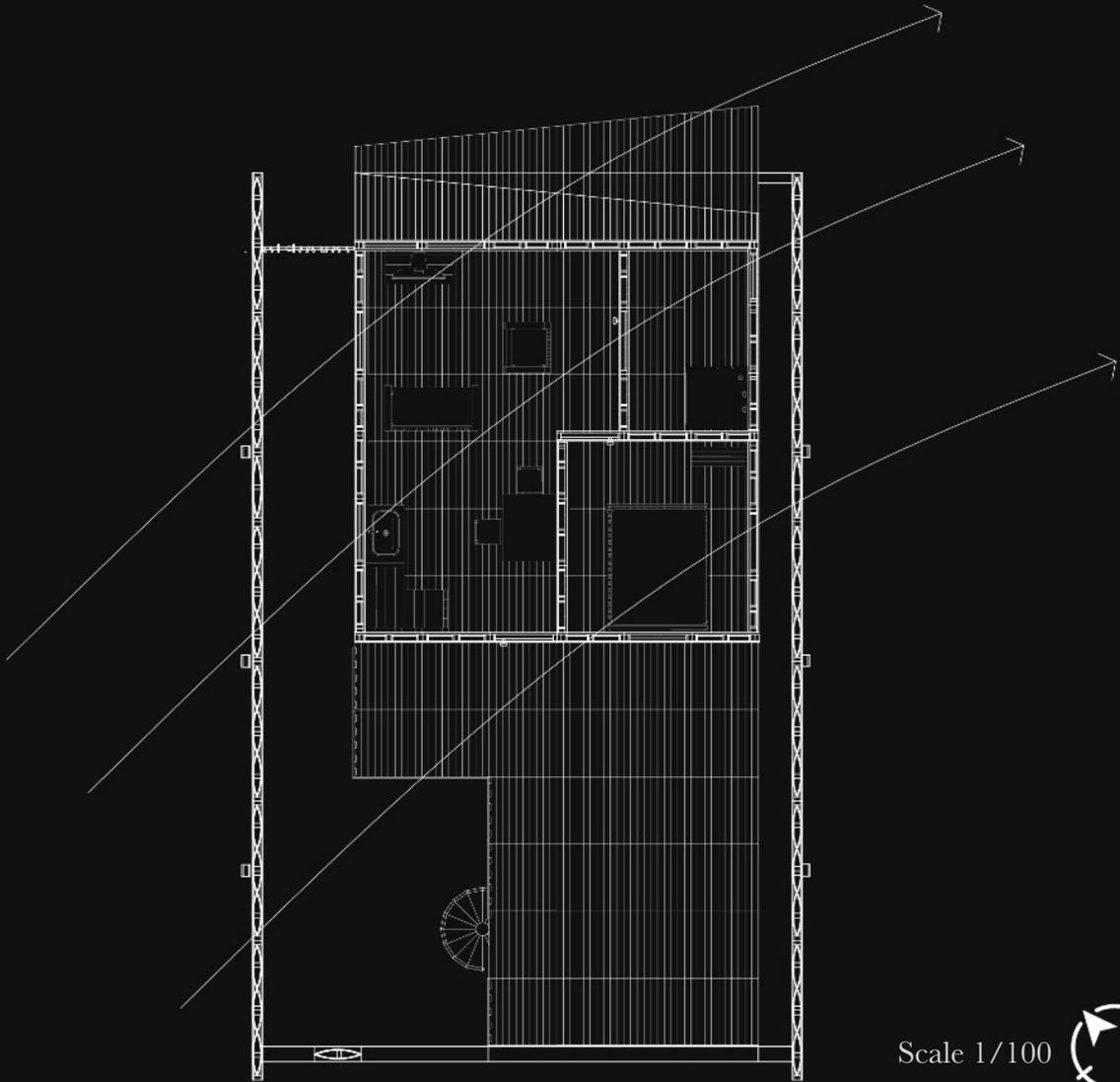
Stage 4



- Two module have been added with an independent room but a shared space for kitchen and livingroom

Figure 77. Stage5 of expansion

Plans

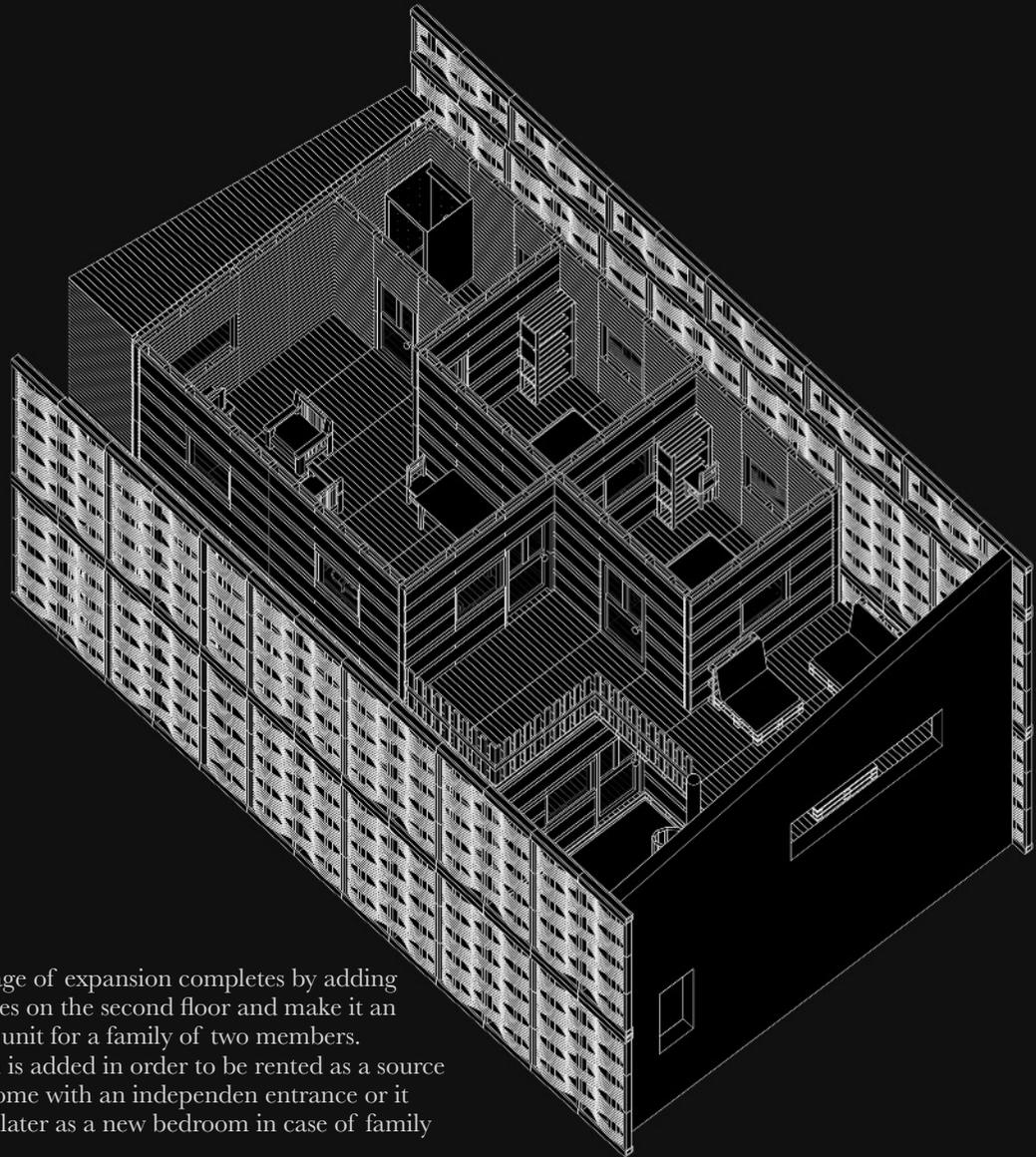


Scale 1/100



Axonometry

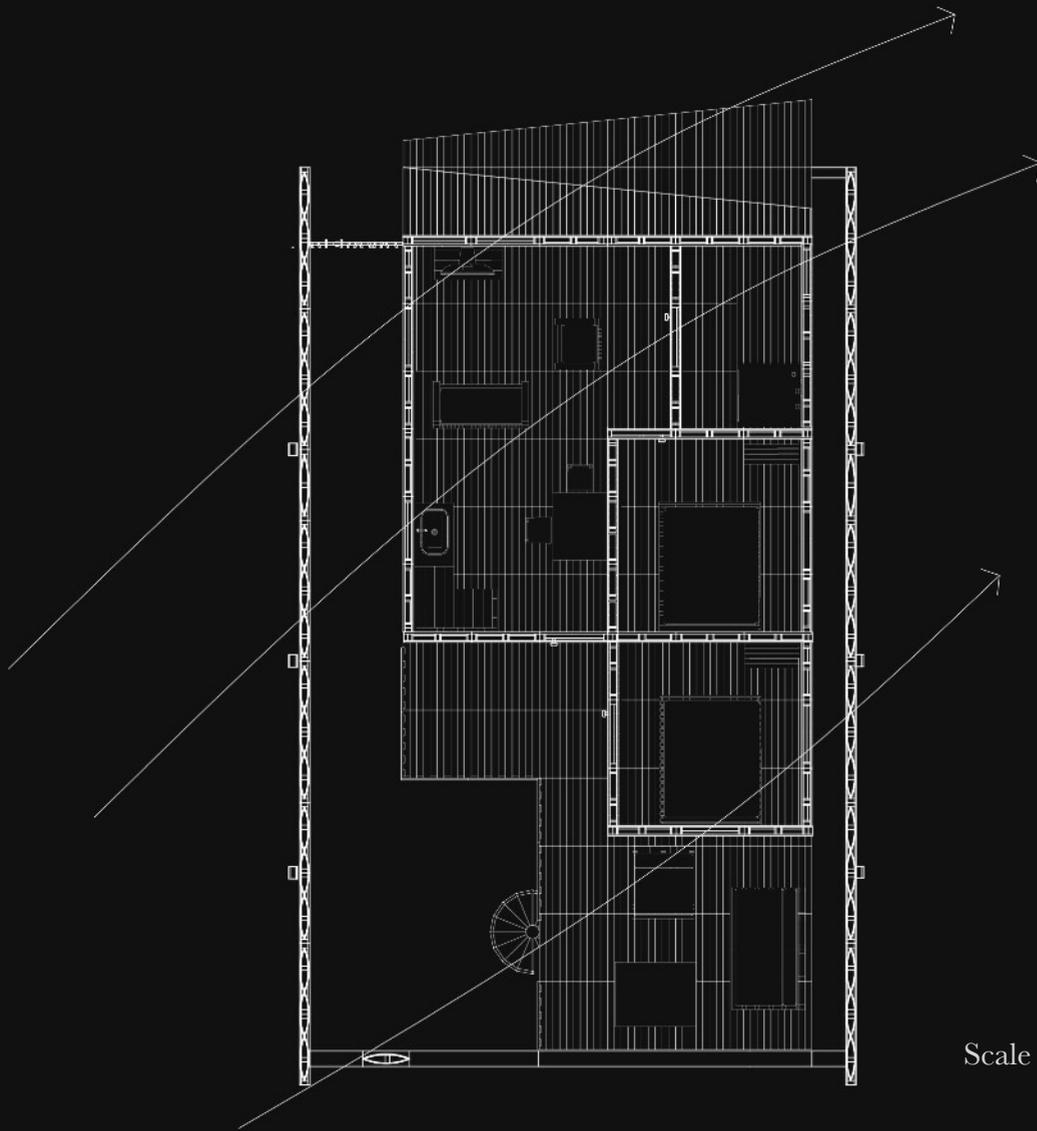
Stage 5



- The final stage of expansion completes by adding three modules on the second floor and make it an independent unit for a family of two members.
- A new room is added in order to be rented as a source of extra income with an independent entrance or it can be used later as a new bedroom in case of family growth.
- Fog catchers are installed on the roof in order to harvest water that is drinkable and can be used also as household use.
- The dry toilet can be removed and a new toilette can be added inside the unit since the water is available.

Figure 78. Stage5 of expansion

Plans



Scale 1/100



DESIGN GUIDELINES

EARTH AUGER TOILET

Lima faces scarce of water. Settlers have only access to water which is brought by the tank for them and is expensive as well as having a huge carbon dioxide footprint. People have to use this water for multiple purposes, household-use and also as drinkable water even if it is not safe, and causes diseases. In order to provide solutions to drinkable water, a method called fog catcher is introduced, which will be explained in the next part, while for toilet usage, a new method is introduced which works without the need for water which is called earth auger toilet.

“A decentralized and ecological urine-diverting dry toilet where diverted urine is infiltrated into the ground and feces are being composted.

When the pedal has operated the feces, cleansing paper and automatically added sawdust are mechanically processed through a pipe with an auger inside, which mixes, aerates and moves them through a composting chamber to storage.

In storage, it is detained for an additional 1-5 months (depending upon a number of users) for compost stability and pathogen kill prior to being used as a soil amendment. Direct handling of excreta by the user is thus not required as the whole process is pedal-operated until harvest.

The urine is harvested separately in hose-connected containers, or mixed with wash water

and used in a greywater system. The toilets differ in price and number of accessories: in mass production, the different units are expected to cost between US\$150 and US\$ 300.”[48]

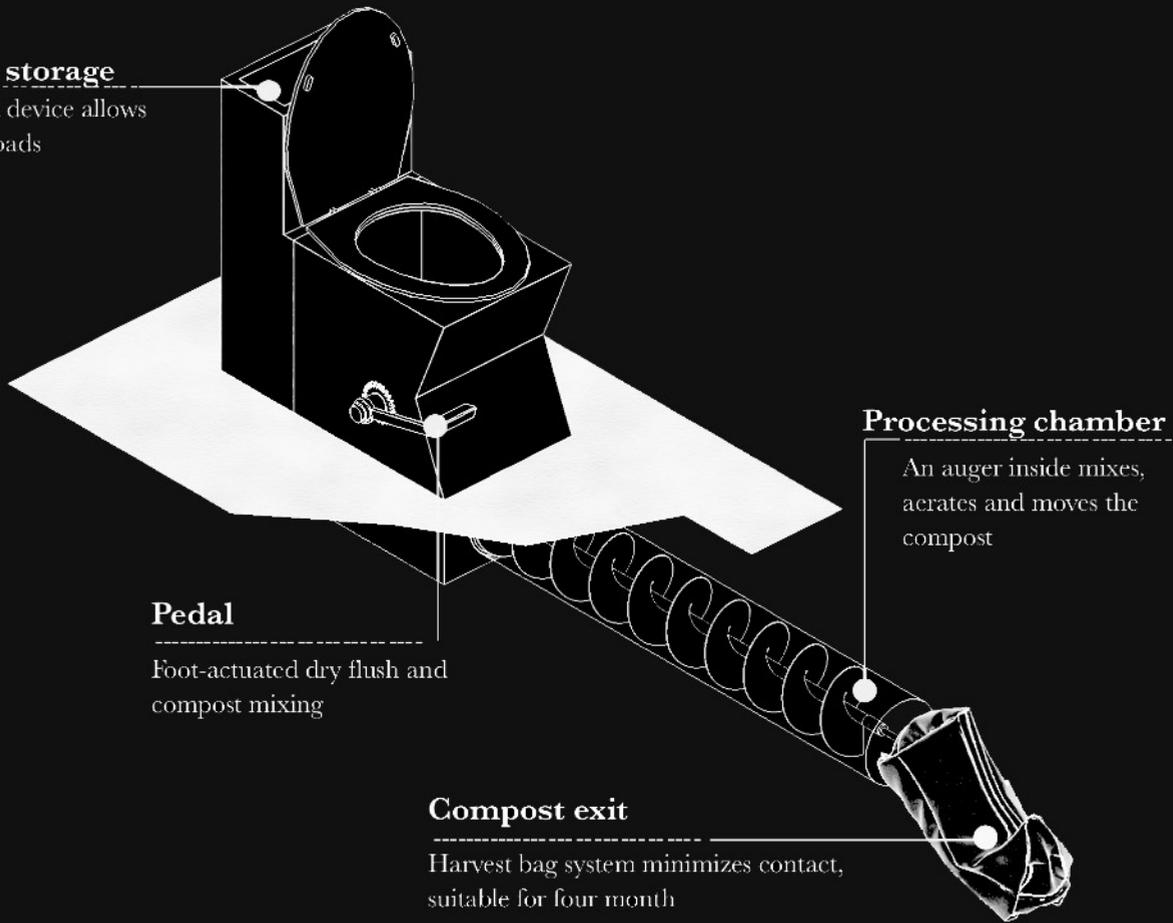
The main features of the earth auger toilet are being energy and water-free, low-cost and small foot-print, and having mechanical, pedal-operated processes. The system consists sawdust storage that after each flush, a small number of compost exits; A pedal which is responsible for foot-actuated dry flush and compost mixing; Processing chamber for mixing, aerating and moving the compost with an augur inside; Compost exit which is a harvest bag system that minimizes contact, suitable for four-month depending on a number of users. Figure 79 shows the details of earth-augerr toilet.

The earth auger toilette
200\$ to 300\$ per household

Eco-toilette with reuse of
by-products 560\$ to 650\$
per household

Sawdust storage

independent device allows
controlled loads



Pedal

Foot-actuated dry flush and
compost mixing

Processing chamber

An auger inside mixes,
aerates and moves the
compost

Compost exit

Harvest bag system minimizes contact,
suitable for four month

Figure 79. Earth auger toilet

DESIGN GUIDELINES

FOG-CATCHER

The annual humidity in Lima is 82% which shows a high amount of humidity in the air that can be turned to water with an appropriate method. Fog catcher is a passive technique that depends on the presence of fog and humidity in the air as well as wind. The annual wind speed in Lima is 12km/h. Fog catcher is a sustainable low-cost system that works through the process of condensation. A mesh surface will capture the fog and turns it to the water. The water will drop down by gravity and will be harvested within a tube which is placed at the bottom of the mesh. The water can be used immediately as drinkable water. The amount of harvested water will differ by using different types of mesh. The best mesh is a “UV- resistant PP or PE raschel mesh with a shade percentage between 30% and 60%.

Raschel mesh consists of flat vessels (1mm in width) that are woven in V shapes. This mesh is applied in two layers and forms a 3D structure that is able to collect to most water out of the fog.” [49] The fog catchers work the best in high elevated areas as well as when the maximum percentage of the wind can pass through. Therefore, much more amount of humidity will be condensed if the fog catcher is placed in the roof. A tank will be needed in order to store water for further use. FogQuest is a non-profit

organization that works on fogcatchers and has done projects in different countries including Peru specifically in Lima. The harvested water can be used also in agriculture to grow seeds and vegetables and in the future can act as a source of income for families. The compost in earth augur toilet can provide fertilizer for growing the vegetables as well. The following figure 77 shows the details of the fog catcher. The fog catcher has been considered as a separate structure in order to be changed or repaired later, therefore a separate foundation has been considered. Tire foundation shown in figure 80 is the most economic and sustainable solution and is also the best alternative for seismic areas due to its durability if it doubles. Scrap tires are wastes that are harmful to the environment and are non-biodegradable. However, they can be reused in different contexts instead of being disposed in landfills. In order to use them as a foundation, they need to be filled with compressed gravel on the earth beneath of compacted gravel. Under the tires, a base metal plate will be placed to distribute the forces to the soil. Four threaded rods will be welded to the plate and then will be attached to the socket above the tires to align them. U-form brackets will be then welded to the sockets in order to maintain the columns [50].

The wind pushes the fog through the mesh and the water condenses on the surface in little drops. fog catchers work best with uv-resistant polypropylene mesh with shade percentage of 30-60%

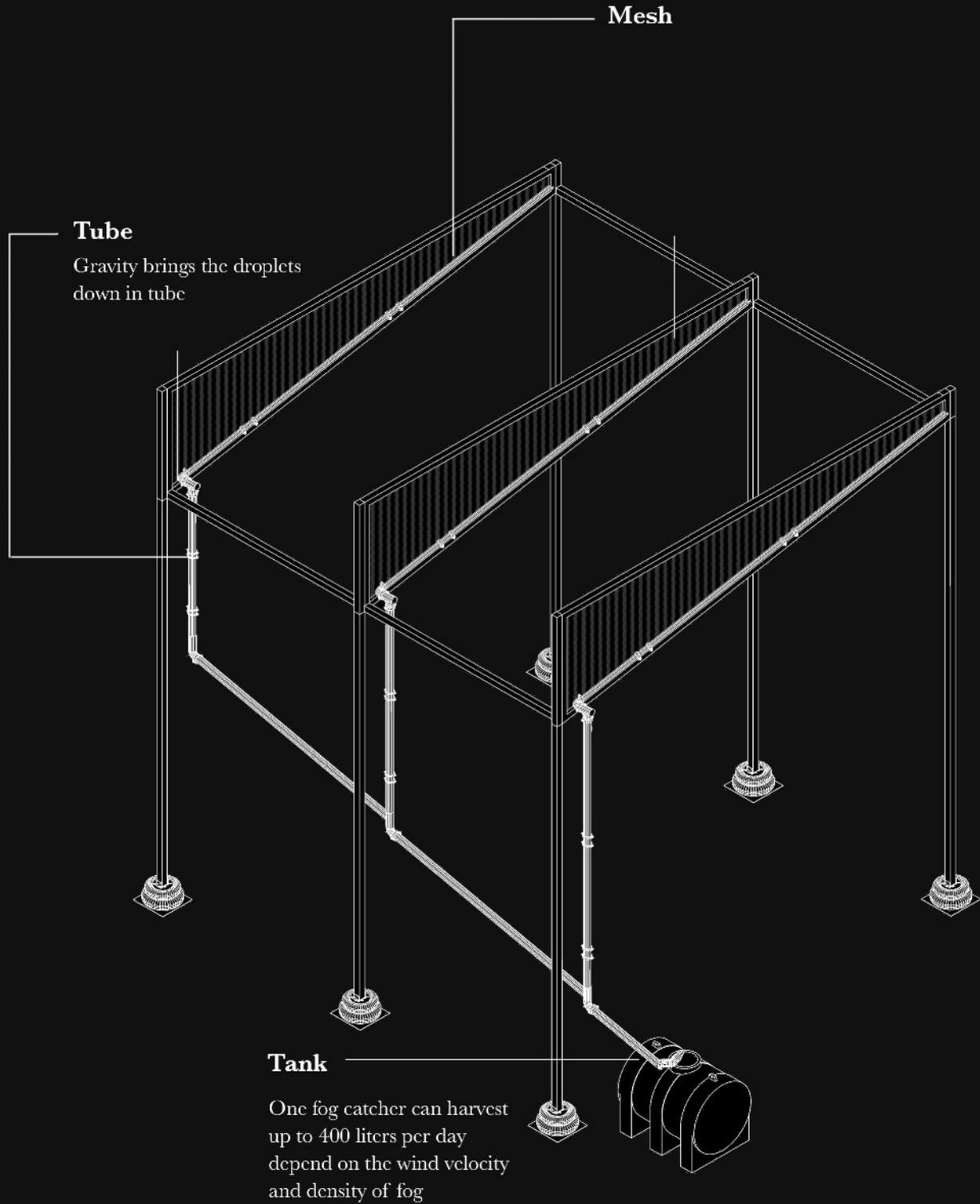
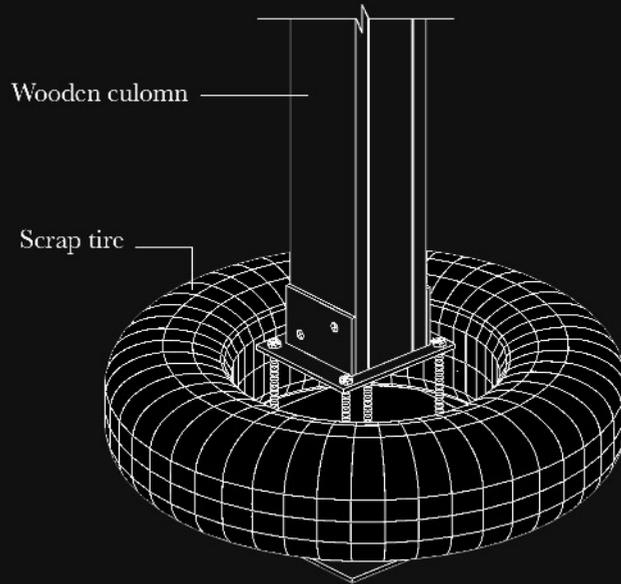
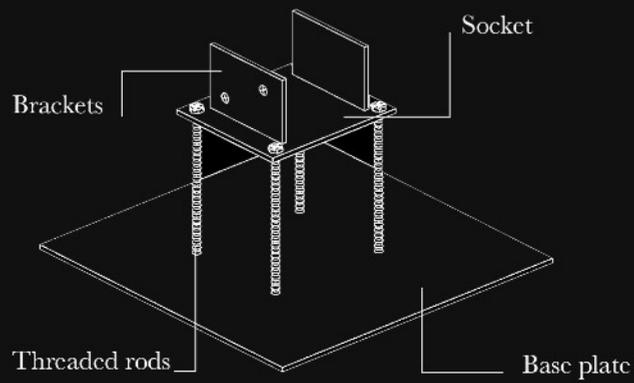


Figure 80. Fog-cathcher

Scrap Tires are used as foundation. They will be filled with gravel



Inside the tire will be filled with gravel



The steel socket which is holding the column is made out of three pieces of steel. The objective is to obtain a socket that correctly holds the column

Figure 81. Tire details

WATERBOX

The water harvested from fog catcher is being used to grow plants and seeds. The baharaque facade on the South-West will be covered with plants that take the water needed from the pipes passing from the facade. Since the main direction of the wind is south-west, therefore the wind will pass from these plants, cools down and then enters inside the house. The water can be used for growing trees as well. However, growing a tree might need water for a longer period of time. Therefore, a method is needed that helps to grow the seeds while using less water. Waterbox is a planting technology that can be used also in deserts with a small amount of water to grow trees as well as vegetables. It consists of a closed box that will be filled with water and will be dropped over an extended period of time.

“Furthermore, it stimulates the capillary formation of the soil; prevents the evaporation of groundwater; steadies the temperature around the roots; fights competitive weeds near the planted tree; and can even prevent damage by rodents. In this way, the Groasis Waterboxx® and Growboxx® plant cocoon stimulate optimal growth of the young tree.” [51]

The seeds start to grow with the water that drips every day. The box which is made from recycled paper provides shading on the soil which does

not let the dripped water to be evaporated. The closed box creates a microclimate. The closed box will be covered by the insulation layer in order to not let the water evaporate and due to temperature difference inside and outside of the box, water will be produced due to condensation. The plant can grow within a central empty part of the box which has a tubular opening. The box will be removed when the root of the tree is established in the soil. The box can be placed on or under the soil. Figure 81 shows the details of the waterbox and figure 82 shows shows an overall view to the final stage of the unit, figure 83 shows a section from all the details.

Diameter. Height: 47 * 25 cm
weight : 1400 Kg
Cost 2 euor each box
Waterbox package costs 26.99 euros

Reuse of the waterbox

The water box can be removed after the plant has grown enough and be used again. then as a replacement a piece of cloth will be placed on the soil

Tubular opening

where one or two seeds or trees can be planted. the roots are connected to the soil and start to develop under the water box

Insulation cover

Water box will be filled with water and an insulation will be placed underneath the cover in order to produce water by condensation

Collecting water

Thanks to the design of the cover, the water will be transported inside of the box through small pipes

Wick drips water to the root

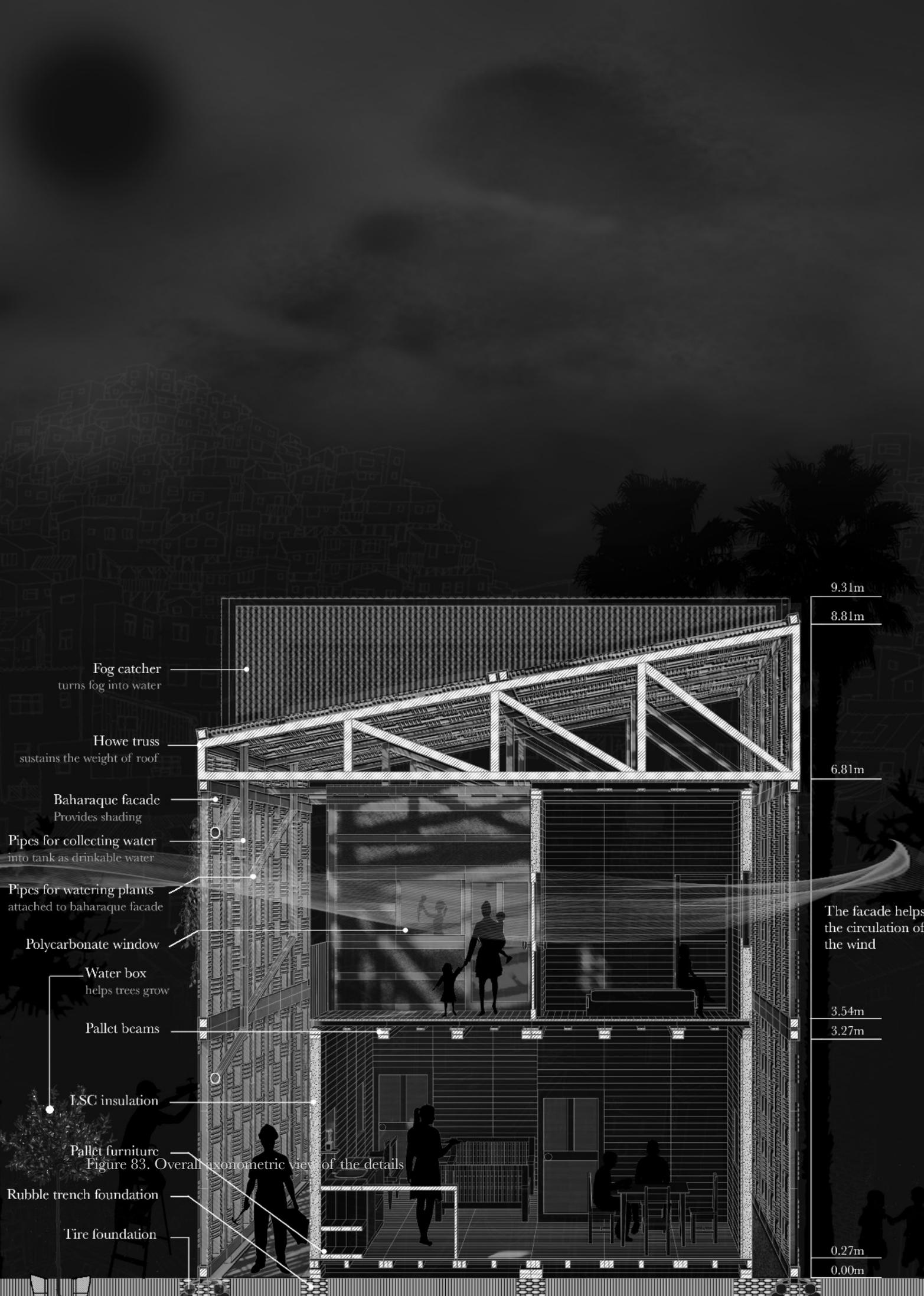
A wick inside the box drips water everyday and due to the shading created by the box on the soil it creates a capillary water column under the box



Figure 82. Waterbox



Figure 83. Overall axonometric view of the details



9.31m
 8.81m
 6.81m
 3.54m
 3.27m
 0.27m
 0.00m

Fog catcher
 turns fog into water

Howe truss
 sustains the weight of roof

Baharaque facade
 Provides shading

Pipes for collecting water
 into tank as drinkable water

Pipes for watering plants
 attached to baharaque facade

Polycarbonate window

Water box
 helps trees grow

Pallet beams

I.S.C insulation

Pallet furniture
 Figure 83. Overall axonometric view of the details

Rubble trench foundation

Tire foundation

The facade helps
 the circulation of
 the wind

CONCLUSION AND FURTHER CONSIDERATIONS

The study has begun with a question that if housing is human right then why there is always a housing deficit and slums continue to expand in Lima as the only solution for the inhabitants? In order to answer this question, it was necessary to first understand what were the improvement programs already implemented by the government in order to understand if they have acted effectively on this matter. Analyzing the mentioned case studies of social housings for low-income people projected by the government, demonstrated that constructing houses and providing social housing is not just an answer to housing deficit in case of numbers and census. It is to create places in which people can answer to their social and cultural needs, where they can flourish, a matter in which the government had mostly failed to implement. However further investigations are needed to study the circumstances to figure out reasons for failure or success of each different project at all levels.

By studying the human rights linked to adequate housing it turned out to be apparent that, the criteria of adequate housing have been neglected in the mentioned projects especially culture adequacy. There is no doubt that housing as a human right should be at the center of any

decision-making policies by the government and policymakers, a subject that has been studied on most previous studies, but the more important question is what strategies can be implemented in order to keep the human values and culture at the center of housing proposals? In this regard, probably housing needs to be re-conceptualize and should be considered as a cultural process in order to be responsive to its inhabitants. Since the thesis focuses on the human values, among the criteria of adequate housing, culture adequacy, and affordability have been analyzed, however, the human right based approach likely occurs just when housing as a human right will be practically placed in the center of housing policy in all scales and not only partially or theoretically. Therefore, future proposals might include all the criteria under investigation.

It also needs to be mention that lack of housing is associated with a low budget of the government and since it is essential to guarantee all people can have access to adequate housing, possibly the ideal approach as a result of particular inevitable progression of slums is recognizing self-help and considering people as one of the protagonists and include them as active members.

It is also to mention that a human rights-based approach will be successful only if people can participate in the process and even in decision making.

The proposal introduced in this thesis as a shelter for settlers has been analyzed only in the scale of a block, however, it is needed to investigate the proposal on the urban scale in relation to the neighborhood. The importance of further research will help to have a wider perspective and investigate the relations and might bring new indications.

REFERENCES

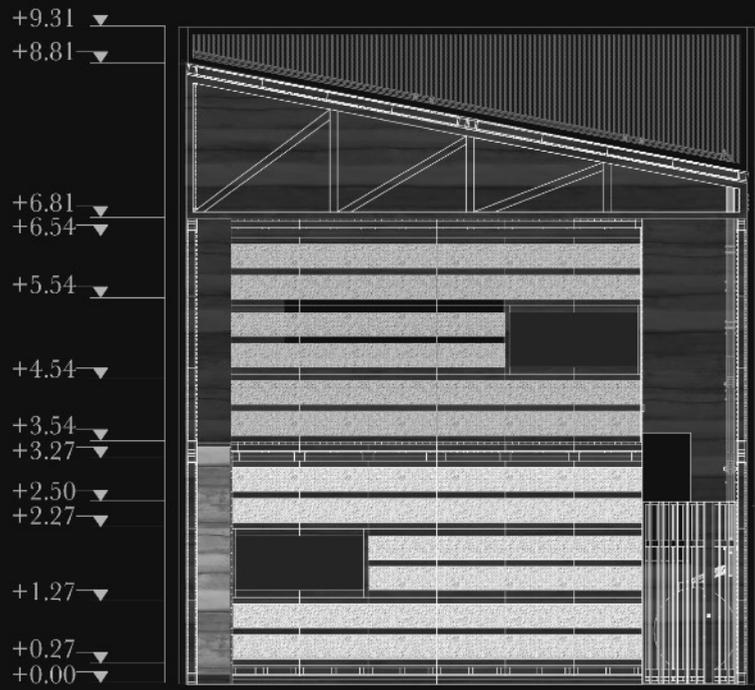
- 1-United Nations - World Population Prospects. Lima, Peru Metro Area Population 1950-2020. www.macrotrends.net. Retrieved 2020-06-21.
- 2-Jaiyeoba B, Aklanoglu F (2012). Socio-economic Issues in 'Socially Produced' Low Income Housing: Theory and Case study in Nigeria. *ASEAN Conference on Environment-Behaviour Studies, Bangkok, Thailand. Procedia-Social and Behavioral Sciences*.
- 3-Crino, J (March 2016) Las Barriadas: An Informal Answer to Lima's Housing Problems?. Retrieved in June 2020 from <https://umdpolicyperu2016.wordpress.com/2016/03/24/las-barridas-an-informal-answer-to-limas-housing-problems/>
- 4-Malmberg, G (1988) Metropolitan Growth and Migration in Peru, *Geographical report*, no9.
- 5-Kahatt, Sh (2011). Urbanity as a project of modernization. Urban design and progressive housing strategies in Lima 1954-1984. *CLARA, No4*.
- 6-UN World Urbanization Prospects. Retrieved in June 2020 from <https://worldpopulationreview.com/world-cities/lima-population/>
- 7- The 2021: Bicentennial Projects.(April 2018), Habitat for inhabitats, Lima. *Competition brief*
- 8-Stark, J, Guillén, S, Brady, C (June 2012). Follow the Water: Emerging Issues of Climate Change and Conflict in Peru. *CMM Discussion Paper*, No. 5
- 12-Carlowicz, M, Schollaert Uz, S (February 2017).El Niño, Pacific Wind and Current Changes Bring Warm, Wild Weather. Retrieved in June 2020 from <https://earthobservatory.nasa.gov/features/ElNino>
- 13-NOAA (February 2020).What are El Niño and La Niña?. Retrieved in June 2020 from <https://oceanservice.noaa.gov/facts/ninonina.html>
- 14-Live Science Staff (August 2015), What Is El Niño? Retrieved in June 2020 from <https://www.livescience.com/3650-el-nino.html>
- 15- Riofrío, G. The case of Lima, Peru. A summery from *UN-Habitat* (2003) Global Report on Human Settlements (2003), The Challenge of Slums, *Earthscan*, London; Part IV: 'Summary of City Case Studies', pp195-228.
- 16-Rodriguez, C (2015). The Transformation of Squatter Settlements into Urban Cities through the Effects of Tenure Security in Housing and Infrastructure Investments : The Evidence of Three Squatter Settlements in Lima, Peru, pp. 42.
- 17-Climate consultant Software
- 18-UN-Habitat (2011), Affordable land and housing in Latin American and the Caribbean
- 19-A summery from *Un-Habitat*, (2008) , *Un-Habitat*, 2006, *FJP* (2005) , *MInVU* (2004)

- 20-Fay, M. (Ed.) (2005) *The urban poor in Latin America International Bank for Reconstruction and Development, World Bank, Washington, DC.*
- 21-Riofrio, G. (1996) Lima: mega-city and mega-problem. In Gilbert, A. (Ed.) *The Mega City in Latin America. Tokyo United Nations University Press.*
- 22-Bartesaghi Koc, C. Squatter settlements as social catalysts towards a sustainable urban development: A positive look at the case of Villa El Salvador, Lima- Peru. Retrieved in June 2020 from http://sedici.unlp.edu.ar/bitstream/handle/10915/56107/Documento_completo.pdf-PDFA.pdf?sequence=1&isAllowed=y
- 23-Fernández-Maldonado, A. M., Bredenoord, J., Progressive housing approaches in the current Peruvian policies, *Habitat International* (2010), doi:10.1016/j.habitatint.2009.11.018
- 24-Williams, S.M (2005). Young Town growing up, Four decades later: self-help housing and upgrading lessons from a squatter neighborhood in Lima. Thesis (M.C.P)--*Massachusetts Institute of Technology, Dept. of Urban Studies and Planning; and, (S.M.)--Massachusetts Institute of Technology, Dept. of Architecture,*
- 25-Skrabut, K. Housing the Contingent Life Course: Domestic Aspiration and Extreme Poverty in Peruvian Shantytowns. *City & Society*, Vol. 00, Issue 0, pp. 1–26, *Harvard University*
- 26- Kapur, P. From Ideas to Practice (June 1989), "Self-Help" in Housing From Interpretation to Application, Thesis in *Massachusetts Institute of Technology, Dept. of Urban Studies and Planning; and, (S.M.)--Massachusetts Institute of Technology, Dept. of Architecture,*
- 27—Un-Habitat. Government of Malaysia. Implementing the new urban agenda (February 2018), Special Sessions A. Strategic delivery of the New Urban Agenda, *WUF9 session background note- Housing at the center, The ninth session of the world urban forum, Malaysia*
- 28-United Nations Human Settlements Programme (2003), *The challenges of slums, Global report on human settlements*, Earthscan Publications Ltd London and Sterling, VA019
- 29-UN-habitat (2014), *The Right to Adequate Housing, Fact Sheet No. 21/Rev.1, Office of the United Nations High Commissioner for Human Rights.* Retrieved in June 2020 from <https://www.un.org/ruleoflaw/files/FactSheet21en.pdf>
- 30-UN-Habitat (2017), *The Human Rights-Based Approach to Housing and Slum, Human rights in cities, Handbook series, Volume 1*
- 31-UN Committee on Economic, Social and Cultural Rights (CESCR), *General Comment No. 4: The Right to Adequate Housing (Art. 11 (1) of the Covenant)*, 13 December 1991, E/1992/23, available at: <https://www.refworld.org/docid/47a7079a1.html> [accessed 22 June 2020]
- 32-Nix-Hodes, P. Heybach, R (2003), *Is Housing a Human Right? Chicago Coalition for the Homeless*

- 33-Edelman, D. (2018) Managing the Urban Environment of Lima, Peru. *Advances in Applied Sociology*, **8**, 233-284. doi: 10.4236/aasoci.2018.83014.
- 34-Painter, J. (2007). Peru's Alarming Water Truth, *BBC News*, Retrieved in June 2020 from <http://news.bbc.co.uk/2/hi/americas/6412351.stm>
- 35-Land, P (2015), The experimental housing project (PREVI) Design and Technology in a new neighborhood, *Universidad De los Andes Colombia. Compartit. Graham foundation*
- 36-Mukhija, V(2001), Upgrading Housing Settlements in Developing Countries , The Impact of Existing Physical Conditions, University of California Los Angeles ,*Cities*, Vol. 18, No. 4, pp. 213–222, 2001
- 37—Habitat III Regional report (2016), Latin American and the Caribbean, *United Nations 2017*
- 38-UNDP-UNESCO (2014). Widening local development pathways, *Creative economy report, United Nations/UNDP/UNESCO, 2013*
- 39-UN-HABITAT(2011), Affordable land and housing in Latin America and the Caribbean, *United Nations Human Settlements Programme*
- 40-McTarnaghan, S. Martín, C. Srini, T. Collazos, J (2016), Literature Review of Housing in Latin America and the Caribbean, *Urban Institute*
- 41- McGuirk, J, PREVI, Retrieved in June 2020 from <http://architectuul.com/architecture/previ>
- 42-Catarino, A. Bakker, M (2012), Expect the Unexpected: PREVI-Lima and the customization of home, *Architecture and dwelling*
- 43-McGuirk, J (2013), PREVI Experimental Housing Project, Lima, Peru. Part III, Retrieved in June 2020 from <https://iqbalaalam.wordpress.com/2013/02/03/previ-experimental-housing-project-lima-peru-part-iii/>
- 44-Bredenoord, J., van Lindert, P., & Smets, P. G. S. M. (2010). Equal access to shelter: coping with the urban crisis by supporting self-help housing. *Habitat International*, *34*(3), 274-277. <https://doi.org/10.1016/j.habitatint.2009.11.017>
- 45-Tunas, D. Peresthu, A (2010) The Self-Help Housing In Indonesia: The Only Option for the Poor? *Habitat International, Volume 34, Issue 3*
- 46-Marais, L. Ntema, J. Venter, A. (2008), State control in self-help housing: evidence from South Africa , *Centre for Development Support University of the Free State Bloemfontein 9300*
- 47-Turner, JFC. Fichter, R. Macmillan, EC (1972), Freedom to build, dweller control of the housing process
- 48-Fioravanti, M., (2013) The Earth Auger Toilet: Innovation in waterless sanitation - Various documents on results from research grant. *Sustainable sanitation alliance*.
- 49- Creating water foundation, Retrieved in June 2020 from <https://www.creatingwater.nl>

50-Tyre foundations (2019), *Critical concrete*, Retrieved in June 2020 from <https://criticalconcrete.com/tyre-foundations/>

51-Groasis Ecological Water Saving Technology, Retrieved in June 2020 from <https://www.groasis.com/en/technology/how-does-the-reforestation-and-anti-desertification-technology-of-groasis-work>



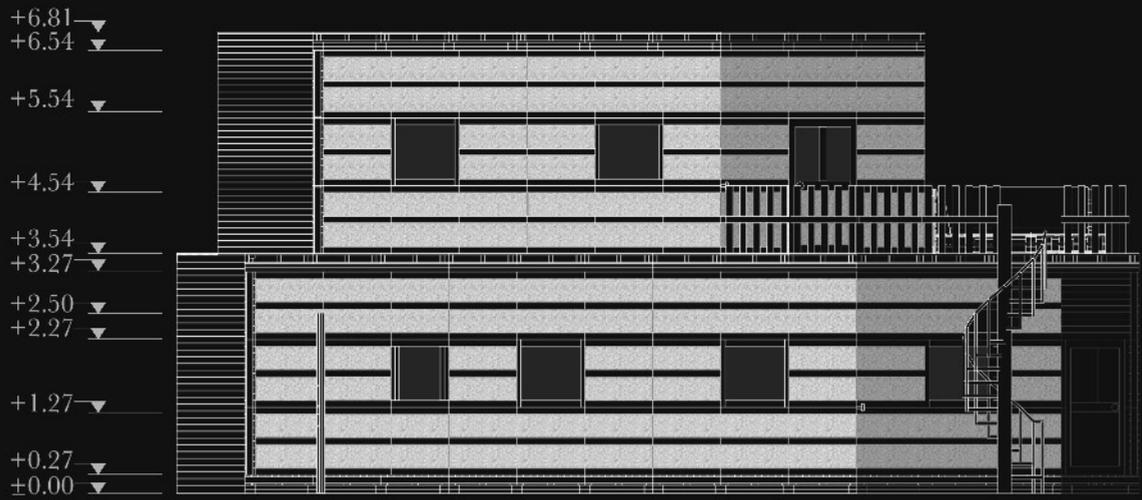
Meters

Front facade - North-West - Scale 1/100
Final stage

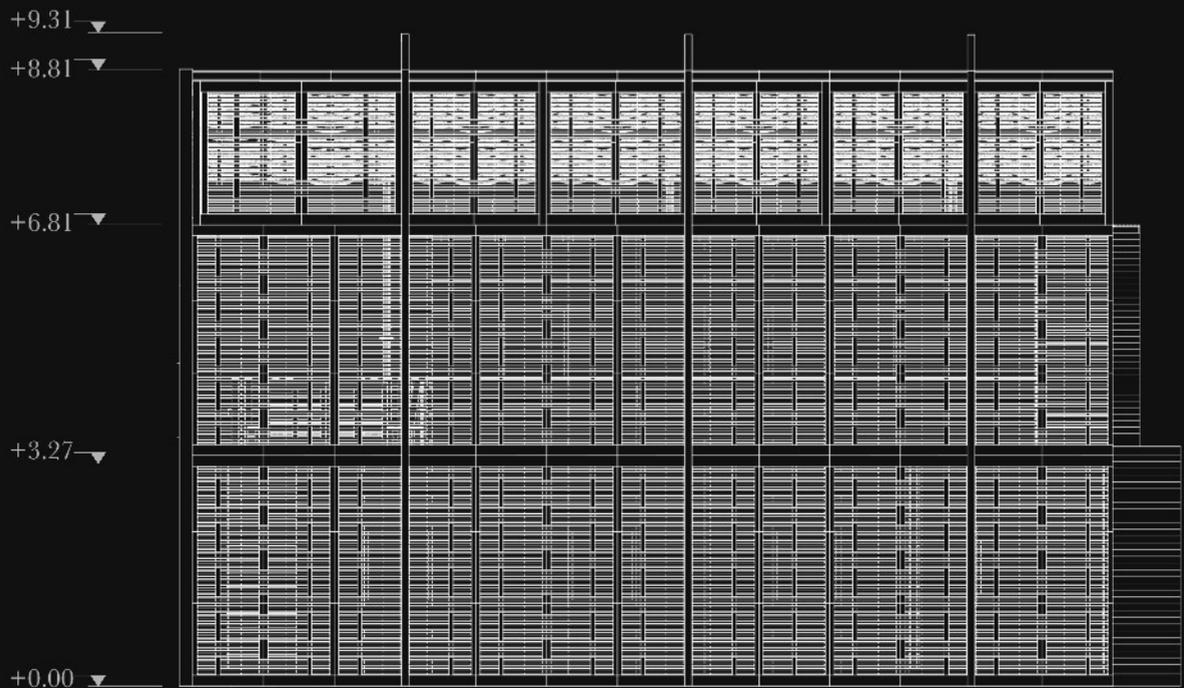


Meters

Back facade - South-East - Scale 1/100
Final stage



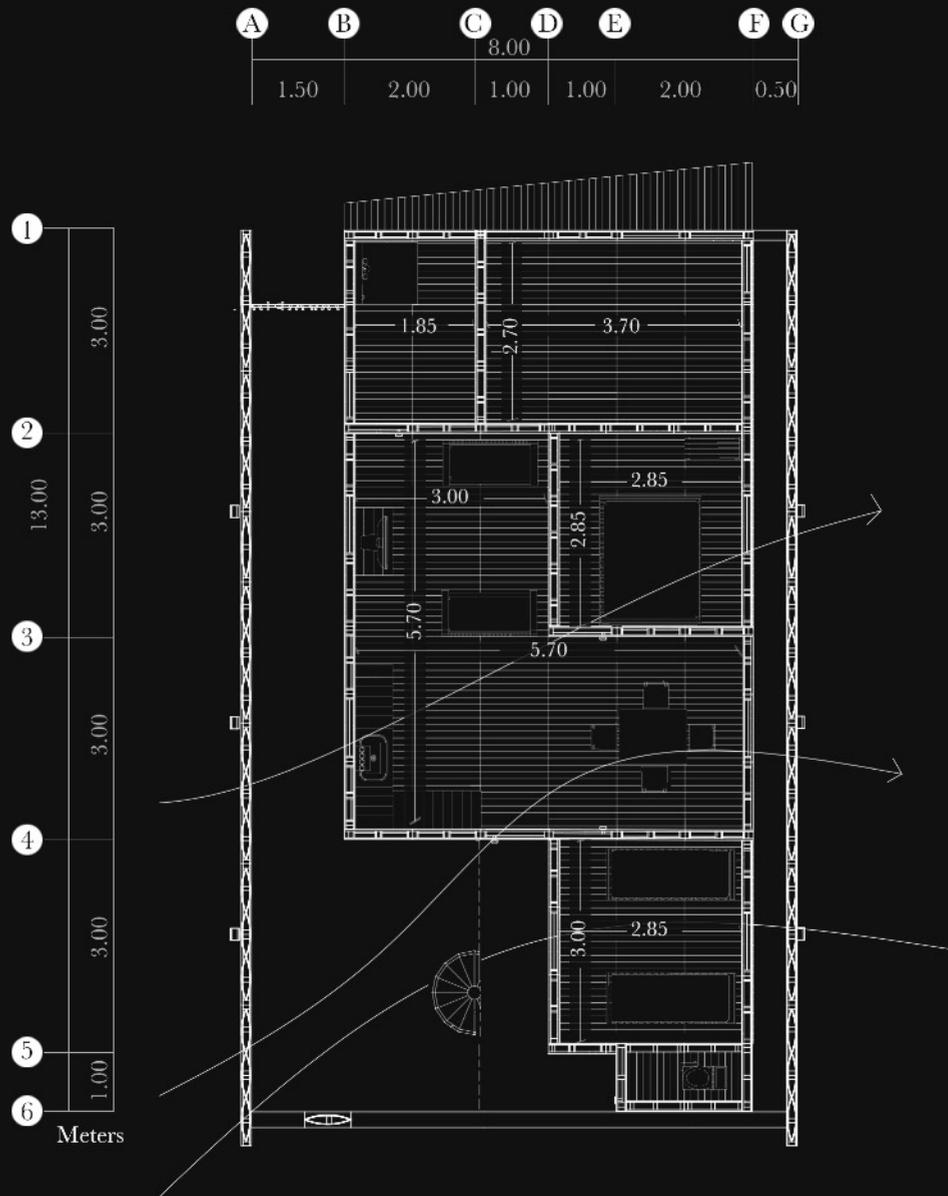
South-West internal facade- Scale 1/100
Final stage



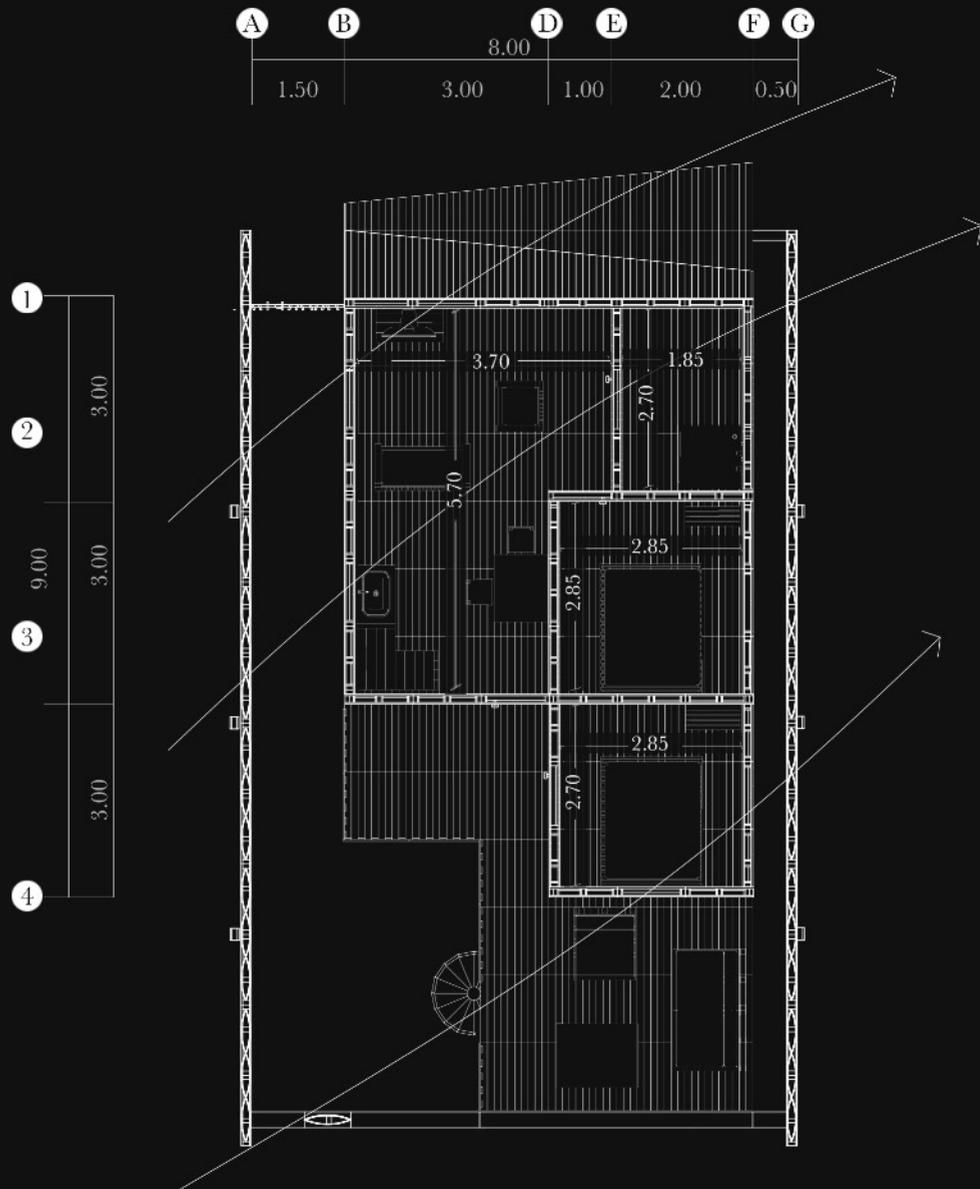
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North-East external facade - Scale 1/100

Final stage



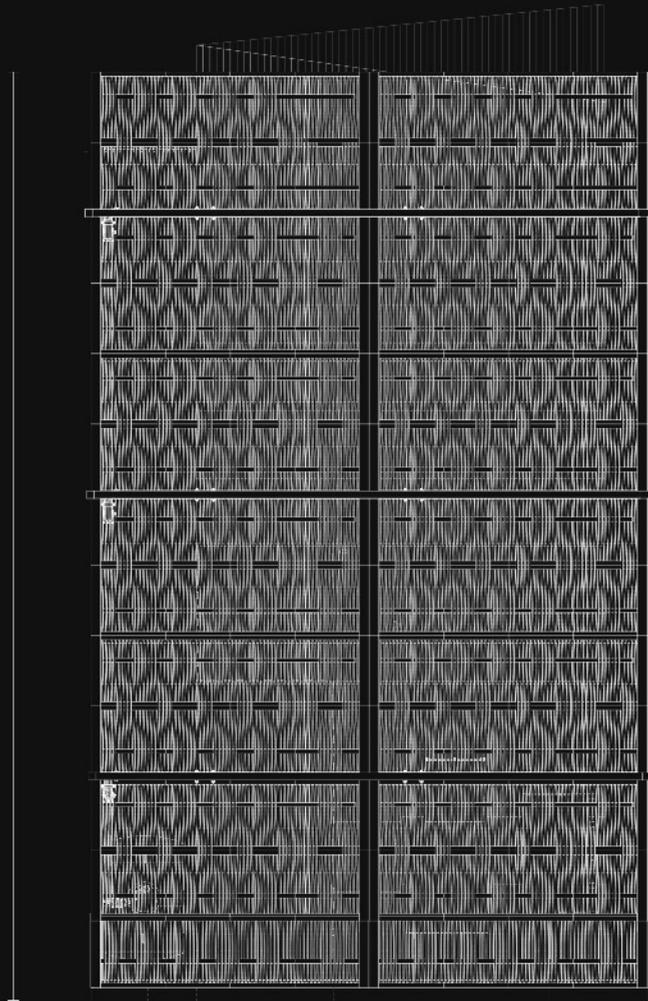
First floor plan of final stage- Scale 1/100



Second floor plan of final stage- Scale 1/100

8.00 Meters

13.00 Meters



Plan of final stage- Scale 1/100





