



Sustainable By Default

Learning from the past, redesigning the future

Master's Thesis
Myrto Manoloudi

Examiner : Marco Adelfio
Supervisor : Nils Björling

MSc : Architecture and planning beyond sustainability
Department of Architecture and Civil Engineering
Chalmers University of Technology

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ABSTRACT

The earth's population is constantly increasing and moves towards more centralized ways of living. "By 2050 almost 70% of the world's population is projected to be urban" (United Nations, 2014), can all those people coexist without exceeding the planetary boundaries?

As people move to the cities they lose connection with their surrounding environment. Our ancestors, unlike us, had a strong connection with nature, as they were relying upon it for survival. At the same time they established communities and encountered challenges together. The building environment was also reflecting those values.

Vernacular infrastructures' construction is based on natural environment and availability of local materials. In vernacular architecture there is a coherence between human, community, shape, and nature. People were sustainable by default.

This thesis investigates how we can use the knowledge of vernacular architecture, transform and apply its qualities in urban environment. The principles of vernacular architecture are examined from environmental, social and architectural aspects. Is it possible to use the wisdom of vernacular architecture and adapt its values on contemporary societies to achieve being sustainable by default?

This master thesis aims to shift the way we shape the urban environment towards a more sustainable lifestyle. To establish the core values of vernacular architecture, by designing infrastructures which enhance the sense of community and connection with nature for a positive impact on the planet.

The design proposal consists of a housing building block which aims for a positive impact to the environment and enhance communication between inhabitants. The case study is stated in the city of Rethymno in Crete, Greece. The main objectives for exploration are how can we bring the architectural and social qualities of vernacular architecture in the urban environment contributing to a transition towards a more sustainable future.

ACKNOWLEDGMENTS

I would like to thanks Nils, my supervisor for his great guidance and feedback, and Marco, my examiner for always being by my side and pushing me to reach my limits. Thank you both for being supportive and encouraging especially in my toughest moments during this intense semester.

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STUDENT BACKGROUND



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INTRODUCTION

1.1 BACKGROUND

During recent years the world has been affected by a lot of changes. People are moving from rural areas to the cities to have more opportunities and accessibility to services. This movement to urbanization caused the increase of energy consumption and CO2 emissions (Millenium Ecosystem Assessment, 2005).

Industrial revolution shifted the way people treated the planet. It caused an uncontrollable development which helped humanity's welfare but at the same time led to the exploitation of natural resources (Pearson,2005). It also altered the way we build our cities, due to the large waves of people moving in them. The use of unsustainable practices to extract and produce construction materials and vast amounts of energy to function and maintain infrastructures is leading earth to destruction.

The exploitation of the earth's natural resources to satisfy our needs is one of the main challenges of modern societies. The Paris Agreement was the first united action to reverse the effects of climate change and adapt to it (United Nations, 2015). As climate change and lack of resources have become more visible (extreme events, flooding, high temperatures), environmental awareness began to rise to deal with these problems.

According to Pearson (2005) environmental awareness started with small moves, such as recycling and production of renewable energy instead of fossil energy(Pearson,2005, p.71). Those are the first steps towards a change to our lifestyle but is not enough. According to Naess, there is a difference between shallow and deep ecology. Shallow ecology is more concerned with reducing pollution and the exploitation of resources. Deep ecology, focuses on changing mindsets. Self-sufficiency, autonomy, creative diversity and an integrated approach are the most profound words of a deeper ecological awareness(Naess, 1973).

Before the industrial revolution and urbanization we used to have a high unconscious environmental awareness. Inhabitants in nonindustrial societies had no alternative but to use local available materials and depend on natural resources for the production of energy and water. At the same time to be conscious of the amount of natural resources not to exploit their environment. They built buildings which created consistency between people and the planet (Pearson,2005).

The solution maybe lies in those societies the small settlements in which people unconsciously lived sustainable, created communities and respect their environment and its resources. Vernacular architecture can be used as "a learning method by which new global challenges can be addressed, such as global warming, housing crises, and economic equality" (Kazimee,2008).

This master thesis investigates the possibility to transfer, not copy, the principles from another time to today's modern cities to revive the unconscious sustainability of the societies of the past.

The purpose is to analyze the values of vernacular architecture and test them in the urban environment. The starting point will be the exploration of traditional Greek settlement and the analysis of the main principles of its organization and structure. The settlements are going to be examined both from environmental, architectural and social aspects.

The proposal includes the design of a mixed-use residential building block which is based on the principles of vernacular architecture but adapted to the urban environment. The case study will be stated in the city of Rethymno in Crete, Greece (34.400 inhabitants in the inner city). A general analysis of the town is included, but the project focuses on the design of the buildings, the relationship between them and the intermediate connections and not urban planning.

The urban context was chosen for two reasons: the size of the city and the cultural context. The majority of Greek citizens are ignorant about the meaning of sustainability. The big economic crisis which Greece went through contribute to this as it made peoples' mind to focus on more emergent matters. People became more introvert, narrow-minded and stubborn, which led to segregation. Despite the results of the economic crises, though, Greece has a strong culture of solidarity, which can be seen in small cities where people have stronger connections. The base to change mindsets is there. Rethymno is a relatively small city, and there is still a sense of community among people. The location of the plot was also of high importance as it is located in the centre of the city and has good connectivity with the primary services.

1.2 PURPOSE & AIM

The purpose of this thesis is to investigate and evaluate the values of vernacular architecture and suggest a more sustainable way to build and live in the urban environment.

This thesis aims to prove that rather than copying the past, or on the other hand erasing it, as some movements suggest, we can use the good values of vernacular architecture to transform the building environment, achieve a smaller footprint on the planet and a sense of community among people.

1.3 QUESTIONS

MAIN QUESTIONS

How can we use the principles of vernacular architecture to change the way we built the urban environment today?

SECONDARY

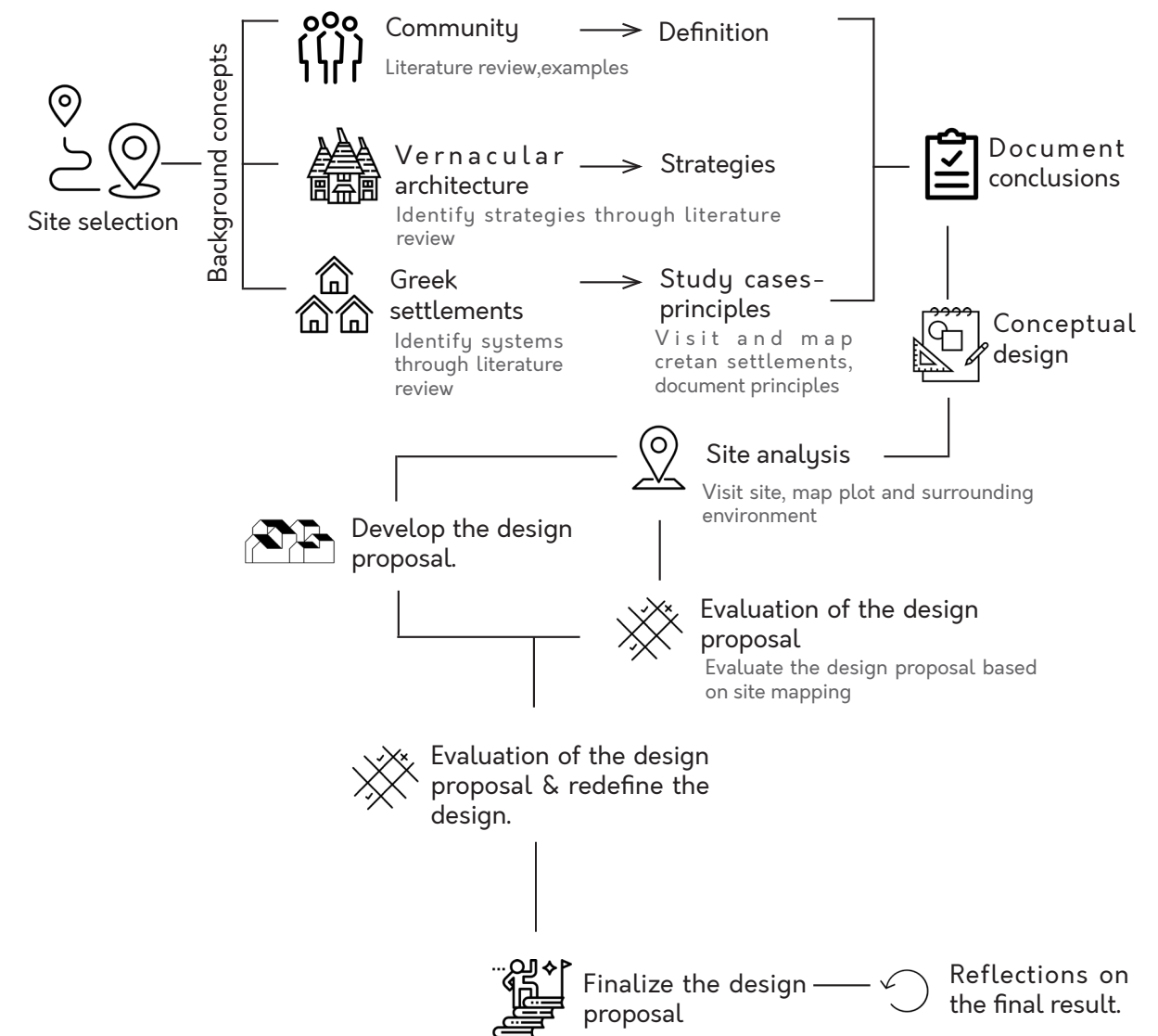
Can the knowledge of the past be used to achieve a more sustainable future?

Can architecture support and create communities and introduce sustainable living by default?

1.4 RESEARCH STEPS

The starting point for this project was the question of how we can use the values from vernacular architecture to transform the urban environment today. That led to the selection of the site in order to explore the potentials of the village in a modern context. The specific site was selected as a study case as it is located a key location of Rethymno city, between the old and the new city.

In order to answer the problem the following methodology was followed :



1.5 TERMS

Community : “the people living in one particular area or people who are considered as a unit because of their common interests, social group, or nationality”(https://dictionary.cambridge.org/dictionary/english/community).

Vernacular architecture : “comprises the dwellings and all other buildings of the people. Related to their environmental contexts and available resources they are customarily owner- or community-built, utilizing traditional technologies. All forms of vernacular architecture are built to meet specific needs, accommodating the values, economies and ways of life of the cultures that produce them “(Oliver, 1997 & 2003 retrieved from Oliver P., Bridge A. , 2007).

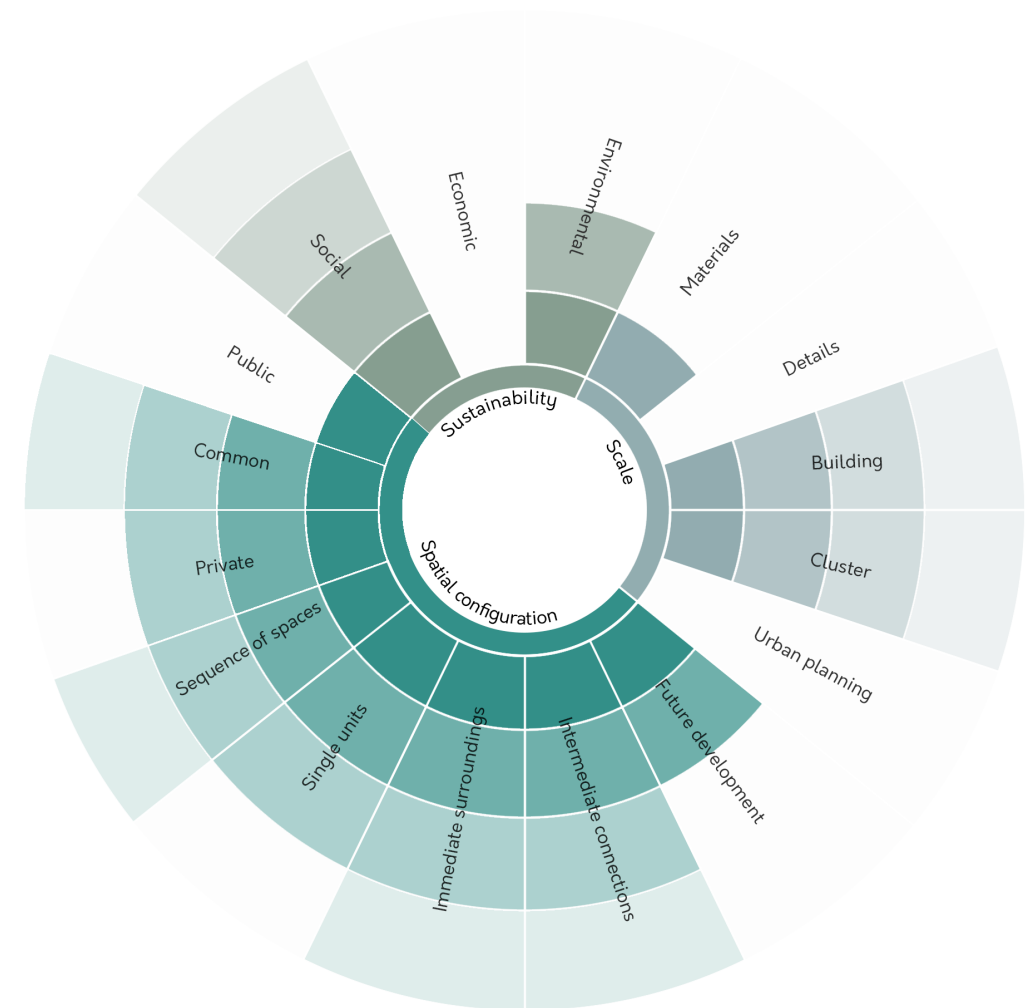
Village : settlement usually found in a rural setting. It is generally larger than a “hamlet” but smaller than a “town”(Evers. J., 2013).

Greek Village/ settlement : settlements which were developed between the 15th and 19th century in rural areas in Greece and built by local residents. The examination of the Greek settlement case studies , in this master thesis, refers to an analysis during 1920s-1950s.

1.6 DELIMITATIONS

The design proposal aims to implement the knowledge of vernacular architecture in the modern urban environment and the adjustment in the local context. The economic feasibility of the design proposal is not taken into consideration.

Even though this master thesis investigates vernacular architecture in the scale of the village and also includes a general analysis of the city’s local context, this thesis is not focusing on urban planning but in building design, intermediate connections and the immediate surroundings. The main focus is on the form and the spatial configuration of the buildings, and the sequences between private and common.



THEORY & LITERATURE REVIEW

2.1 COMMUNITY

Communities are usually formed by individuals who are linked with each other through live contact or virtual networks. The individuals have something in common, which leads them to connect in everyday life (Gallent, N., & Ciaffi, D. , 2014).

Communities can be either local (socio-spatial), defined by place, or global, defined by shared beliefs or interests. The socio-spatial communities are connected to a physical space (ex. residential area), but that does not automatically mean that the residents desire to interact with each other as they may not have strong bonds due to lack of common interests. On the other hand, people who share interests have a reason to interact, which potentially generates strength and vibrancy (Gallent, N., & Ciaffi, D. , 2014). According to Delanty(2003) socio-spatial communities are static and lack any deeper motivation for interaction. Communities that are formed based on cultural beliefs, sexuality, lifestyle choices, politics, technology, etc., are not tied to a fixed space, thus they are more flexible (Delanty, 2003).

Today, due to the rapid technological growth and globalization, new forms of communities have appeared, the virtual communities. Technology connects people who share the same opinions, mindset and beliefs through virtual networks and social media. Nevertheless these groups are ephemeral, as they can decay as fast as they developed when a threat rise or a goal has achieved (Gallent, N., & Ciaffi, D. , 2014).

In every type of community, individuals with different opinions co-exist, either in physical or virtual space. Panelli (2006) supports that even though social interactions will connect people, the same interactions can provoke division when different notions arise (Panelli,2006). In the virtual world, it is easy to exit the community as someone can unfriend those with divergent views and search for others with common beliefs. On the contrary, in the real world, individuals coincide in socio-spatial communities, which makes it difficult to leave the community when distinct interests collide. The diverse opinions might drive the formation of sub-groups or cliques (Gallent, N., & Ciaffi, D. , 2014). In general, conflicts are part of communities and part of the dynamic social groups development and social exchange.

Matthews (2014) supports that communities are constructed through identities, memories and the sense of place-belonging

(Matthews, 2014). In the modern world, the sense of community has been lost. Technology, urbanism, consumerism have taken over and prevent people from creating secure attachments with others as well as the surrounding environment. People nowadays are in continuous movement. They do not stay in one location for a specific period of time, and they are not rooted in one place. They may, therefore, develop various attachments to different places (Gallent, N., & Ciaffi, D. , 2014).

Reflections

Modern communities differ a lot in relation to communities of the previous years, which they were mainly developed in rural areas and characterized by **spatial borders**. That benefited the establishment of roots with a place and the community. On the other hand, the mobility of modern societies changes the dynamics between different individuals and does not support the creation of **strong relationships** with others or a place. The **virtual networks**, of course, give the illusion of being part of a bigger group but as it is mentioned before they could be dissolved fast as it is easy to leave the group since there is no live/personal contact involved.

Although the way we perceive communities is constantly changing due to the implementation of new factors (**lack of spatiality, mobility, technology, connectivity**), the meaning is still the same: having something in common and the **sense of belonging**. People have the need to be part of a group, to have roots to feel connected. **Conflicts, social control, power relations** will always emerge in the different groups as there is a diversity of opinions between the different individuals, but that is part of **social exchange** and part of building a dynamic community.

Architecture has been a significant factor in the shaping of communities. The arrangement of the space, the distances, the densities of infrastructures are elements which contribute to the development of human relationships. But this is not a one-way relationship. Cultures, traditions, natural environment have also shaped architecture. The communication between architecture and human relationships is bidirectional.

Architecture can influence the creation of communities by designing elements that can empower the relations and grow the community feeling. Planning a system for social interaction but also respect the need for privacy and personal space.

2.2 VERNACULAR ARCHITECTURE

Since the beginning of the world one of humanity's basic needs was to be protected from the weather, the enemies and other species. To have a shelter, a home, a place you can belong and feel safe. That hasn't changed today. People still need a place to call home. The primary need is still there. The changing factor is the development of technology and its effects on the modern world. Technology development has resulted in the invention of new materials and facilities which we use in our everyday life (Piesik S, Souch C. ,Lott G. , Miliken W. ,Singer A., Coleman J.,Fletcher H., 2017, p.14).

Human habitat is characterized by many factors: climate, the surrounding nature, the physical environment, buildings' design, materials etc. Although when we are referring to habitat we must not forget that is a concept which is constantly changing with time because of humans' actions (Piesik, Sandra, 2017, p.14). Climate change, urbanization, natural disasters are challenges which humanity have to deal, and eventually to refine to adapt to changes.

According to Pearson (2005) Vernacular buildings are the evidence of lifestyles of the past, of people which they were trying to " find a sustainable way of life to perish, just as we will have to now." The new importance of vernacular building is that it has vital ecological lessons for today" (Pearson, 2005, p.95).

In the past inhabitants didn't have the advantage of modern technology or the production of fossil energy. They had to adapt to the environmental conditions and work with the climate. In hot, dry climates, for example, they needed cooling during the summer. Since they didn't have mechanical energy, the form of the building itself was used to create cooling conditions. Tall vegetation, rock overhangs, massive thick walls, openings to create cross ventilation are some of the techniques they were using (Pearson, p.95).

In Vernacular buildings there was also the absence of cheap imported materials. They were constructed by available materials using the skills of local labor hands. Since the materials were part of the surrounding environment, the buildings were in harmony with their settings.

Pearson (2005) observes that the most essential characteristic of vernacular architecture is that the vernacular buildings were not a separate single-purpose unit, as today's buildings. Homes were part of larger self-sufficient communities. We may not be able to go back in these kinds of autonomous communities, but we can try to learn from them and obtain the knowledge to reform communities today.



Figure 1. Taos Pueblo, adobe dwellings , built in 13th-14th century, (Elisa. rolle - Own work, CC BY-SA 3.0)

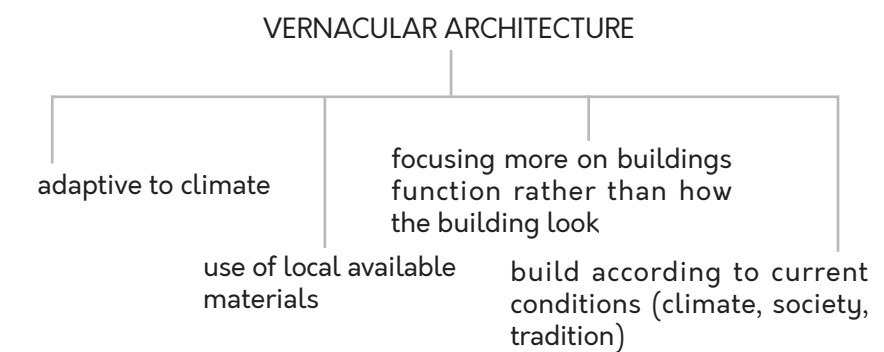


Diagram showing main characteristics of Vernacular architecture

Reflections

Vernacular buildings are fragments from the past from which we can extract knowledge about construction techniques based on the availability of materials and skills, adaptability on local environments and climate and about previous traditions and lifestyles which were based unconsciously on sustainability principles.

2.3 CRITICAL APPROACH

MOVEMENTS TRIED TO REVIVE VERNACULAR ARCHITECTURE

The recent years, movements that are trying to approach vernacular architecture in the urban environment, have appeared. New urbanism, urban villages, traditional neighborhood development, even co-housing are attempts to recreate the sense of the village. However, most of them focus on the form of the buildings or the “obvious” aspects of a village. In other words, they focus on the large scale without investigating the micro-scale and the deeper qualities and values of it. These movements, described below, attempt to implement the “village” in the modern context.

NEW URBANISM

New urbanism was developed in US in the early 1980s and focuses on mixed-use neighborhoods which have all the needed amenities in walking distance. New urbanism is based on three fundamental organization aspects: the neighborhood, the district and the corridor. According to Duany and Plater-Zyberk (Katz, 1994) neighborhood is defined as an urban area with a balanced mix of human activity, district as an area in which a single prevailing action takes place and corridors as connectors or separators of neighborhoods or districts (Katz, 1994). New urbanism’s design principles are structured to provide to the residents with a sense of place and identity, walkable environment, public gathering spaces, variety of housing types etc. (Beyer, 2010).



Figure 2. New urbanism Sankt Eriksområdet quarter in Stockholm, Sweden, built in the 1990s (199pema - Own work, CC BY-SA 3.0)

TRADITIONAL NEIGHBORHOOD DEVELOPMENT

Traditional neighborhood development (TND) gives another scale on New urbanism. The TND is focused on the neighborhood- town scale, and it is different than New urbanism, which consists of the general planning-region scale. TND design was inspired by historic neighborhoods and aimed to create pockets of communities by revitalizing the traditional neighborhood idea (mixed-use dwellings, front porch etc.), (Steuteville, 2017).

URBAN VILLAGE

The urban village concept was an idea of Prince Charles of Wales. It first appeared in the late 1980s in the UK and was aiming to create well-designed, mix used areas which promote identity and a sense of place (Biddulph, M., Franklin, B. and Tait, M., 2003). The urban village has similar principles as the movement of new urbanism: amenities in walkable distance, mix-use of spaces, walkable streets, public gathering spaces and also local architecture style.

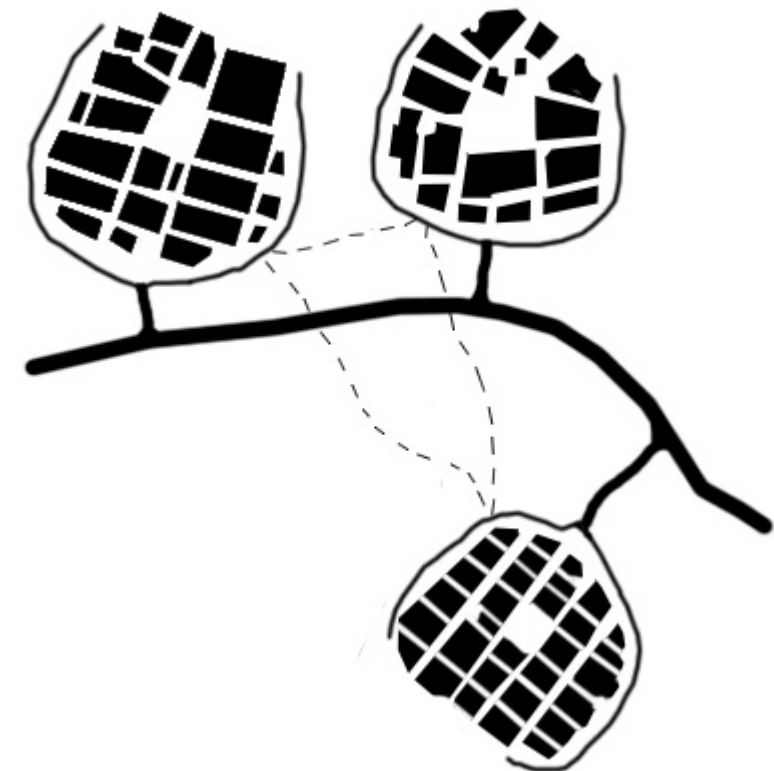


Figure 3. Clustered urban villages, (adapted from Biddulph 2000)

	New urbanism		TND (Krieger, 1991)	Urban village development (Aldous, 1992, 1995)
	Neighbourhood Plan (Dudley Report, 1994)	Pedestrian Pockets (Calthrope, 1989)		
Population	10.000 people	2000 housing units	-	3000-5000 people
Physical definition	Open space, road or railway buffer between neighborhoods	Three urban blocks from the transit station in each direction	-	maximum possible self-sufficiency
Defined centre	Definite centre in every neighborhood	Homes are within walking distance of a neighborhood center	Discernible centre	Focal village square
Physical extent	Every house should have shops within 0.25 miles	5 minute walk to a transit centre	5 minute walk to a transit centre	Small enough for everything to be within a walking distance
Housing	Variety of dwelling types	Low rise, high density, mixed tenure	Variety of dwelling types	Mix of housing tenures, ages and social groups
Mix of uses	Mixing uses within the community	Housing, offices, retail, day-care, recreation and parks	Shops & offices at the edge of the neighborhood	Retailing mixed with other uses throughout the scheme
Pattern of open space	Continuous park and playground pattern	Several parks act as carfree routes, group play areas, courtyards for elderly	Playgrounds near dwellings	Pattern of open spaces should be considered
Street network	Connected streets and culs-de-sac	Pedestrian routes connected to a central park, commercial core and station	Connected street network	Connected street network
Housing groupings	Housing enclaves (100- 300 units) linked by pedestrian ways	Variety of groupings depending on position in the life cycle	Streets and squares	-
Vehicles and pedestrians	Some separations of pedestrians and vehicles	Some separation, careful attention to sub- regional & regional public transport needs	Traffic calming	Traffic calming

Comparison between New urbanism, TND and urban village,
(information taken from Biddulph, 2000)

COHOUSING

Cohousing is a movement that first appeared in Denmark in the 1960s, and it was created by people who took a conscious decision to live in a community. Jan Gudmand-Hoyer , the founder of Cohousing, decided to react to the 20th-century realities. According to Gudmand-Hoyer these realities included moms working outside of home, fewer children per family, more single individual households, the increasing desire for practical economic and exciting lifestyle and an easier way to live a little lighter on the planets (p.6, McCamant, Kathryn, Durrett, Charles ,2011).

Cohousing is not a new idea. People lived together and worked together to achieve their goals. Cohousing residents cook together, organize childcare and engage in social activities. Those lead to the creation of social relationships and keeping a common front to deal with the practical needs of the community(p.24, McCamant, Kathryn, Durrett, Charles ,2011).

Cohousing represents a contemporary approach to traditional communities. The main difference between conventional communities and cohousing is that in cohousing inhabitants can be part of a diverse group and to choose the level of interaction within the everyday activities (p.25, McCamant, Kathryn, Durrett, Charles ,2011).

Most of the cohousing projects are applied in rural areas. The cohousing communities are characterized by: buildings in clusters, a common house usually at the entrance of the community, car-free roads, proximity between dwellings, common functions of homes looking towards the inner “yard” private functions towards the outside (McCamant, Kathryn, Durrett, Charles ,2011).

Design

Cohousing development is based on the design of a physical environment that increases the possibilities for social interactions, in order to create the atmosphere of a strong neighborhood (p.27, McCamant, Kathryn, Durrett, Charles ,2011).

Size

The optimal size of a cohousing community is 50 adults, and the average is 16-34 households. More significant numbers tend to divide into smaller clusters and smaller number it is rather as a small family (p.31,McCamant, Kathryn, Durrett, Charles ,2011).

Environmental advantages

Cohousing developments require fewer materials for construction as the future habitats share resources and knowledge. That led to the conscious choice of sustainable, better quality materials. At the same time when the development is finished the residents share products and tools (cooking together, sharing cars) which lead to less energy consumption (p.34, McCamant, Kathryn, Durrett, Charles, 2011).

Cohousing					
People	Housholds	Defined centre	Housing	Pattern of open space	Vehicles and pedestrians
optimal size 50 adults	16-34	Village square	Clustered dwellings	Common house in the entrance of the block	Keep cars in the entrance of the settlement

Cohousing characteristics

Reflections

New Urbanism, TND, urban village are all attempts to resurrect the traditional village -neighborhood to help in the city planning. The result was the creation of “islands” which copy the form of the village, to create “cute neighborhoods” and be used for marketing purposes. They had no focus on the everyday interactions, and they didn’t transform to adapt to another environment.

Biddulph argues that the above concepts are attempts of making the city being conceived by cells, but that doesn’t mean that the idea is successful. He supports that this would rather divide the city more, creating neighborhoods which do not interact with each other rather than creating connections and active communities (Biddulph, 2000).

The movements are focusing mostly on the **bigger scale** and not on the microscale. They are referring to the general planning of the city trying to create **micro villages** within the city. That leads to **copy paste solutions** which do not adapt to the urban environment.

Cohousing, in my opinion, seems the more consistent approach to the revival of living in a community as the residents organize it and it focuses on the **everyday relations** between the residents. Although cohousing is created from a **conscious decision** of a group to choose another lifestyle and it is developed mostly in **rural areas**.

The qualities and sustainable lifestyle of the “original” village were created mostly from the relations and interaction which were taking place in the micro scale, the familiar faces of neighborhoods, the kids playing across the street, the courtyard outside the front door, the common workplaces, the social interactions in everyday life. By designing a solution that “fits all” (places, characters, culture traditions) it is not possible to create communities, it is more probable to create further segregation between the different clusters.

2.4 GREEK SETTLEMENT

The settlements in rural environments developed between the 15th and 19th century. After the 19th-century inhabitants moved towards urban areas which caused the degrowth of the settlements.

The settlements were built from local residents depending on the current needs. The buildings were constructed following the landscape and to protect from the climate conditions and enemies.

The residents created strong relationships as they had to rely on each other for help in everyday challenges. The economy was based in agriculture and stock breeding. They were producing their food, clothes and accessories. They were producing minimum waste as they were reusing the remainings and transform them in a useful way. People were also sharing knowledge and tools.

The dwellings were constructed with small distances between them, creating a network of paths between them which are connecting the buildings and define the communication between private and public space. The dwellings and the development of the village differ from the houses and how the city is developed. In the village each resident used to design their home based on the current needs (food storage, size of the family) and that is how the settlement was developed. There wasn't an existing plan, but they were following some basic rules for hygiene, weather protection, proximity and connectivity between living and working environment. An existing plan develops the city and the residents cannot transform the buildings according to the current needs (Lais, 2008).

The construction of the traditional houses was based on empirical knowledge and was developed and changed through the years, as societies were developed and new knowledge was gained. The form of the buildings was defined by the climatic conditions, natural events (earthquakes), conservation of resources and give solutions to everyday life problems.

Although the buildings were following the same characteristics, in general, they might differ a bit in shape as there are different aspects which led to the transformation of the basic structure. These were: the natural topography in which all the structures had to adjust as they didn't have the resources to transform it, the existing buildings which caused lack of space, the needs of each family as it has to adjust to the amount of new members, the economic and social state of the family, wealthier families had larger and higher dwellings (Lais, 2008).

The structures of the village also had bioclimatic character. The residents used their empirical knowledge of the climatic conditions and the sun movement to built. Trying to keep a warm micro-climate during the winter and a cool micro-climate during the summer (Lais, 2008). The building's orientation was towards the south with big openings to take advantage of the sunlight. Towards the north, they had small openings and secondary spaces to protect from the north winds. They used the high thermal mass of the walls as well as the thermal mass of the land (basement, semi-underground spaces) to keep a steady temperature. Regarding the bioclimatic characteristics on the planning scale, they chose positions which could provide the south orientation.

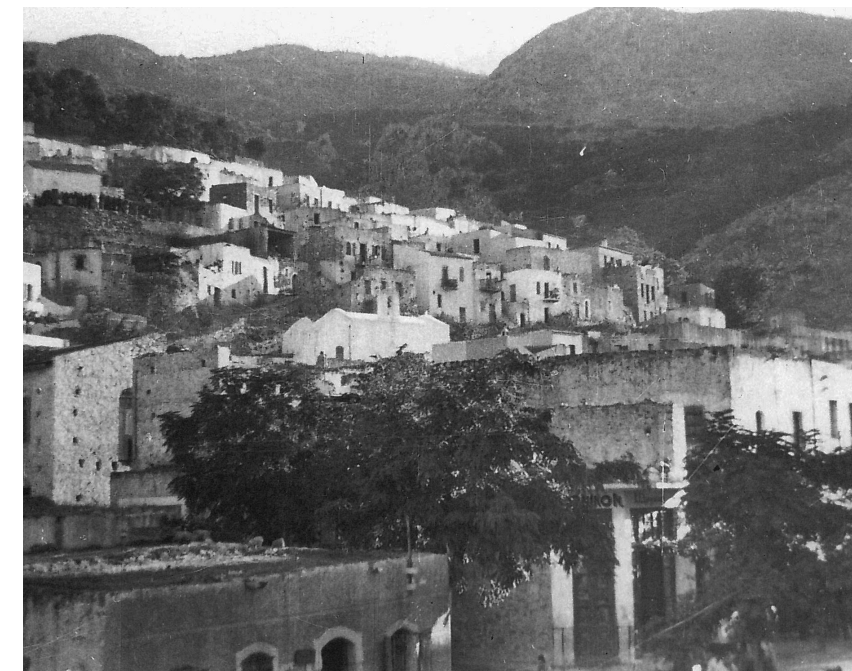


Figure 4. Village in Crete (Zagorissiou , p. 173, 1996)

The structures in the village were constructed by local builders with materials which were available on site. The primary construction materials were stone, earth and wood. The materials were collected on site and went through small or none process(Lais, 2008).

The buildings were designed to satisfy the needs of the inhabitants. The form of the buildings was simply focusing on the function of the structure. Each one of the buildings was autonomous but at the same time was part of a whole. The inhabitants took advantage of old tools and items and reused them with a practical and beautiful way (Zagorissiou, 1996, p.22). The inhabitants respected the natural environment and therefore didn't have a negative footprint on the planet.



Figure 5. Wood and stone (Vassilliadis,1983)

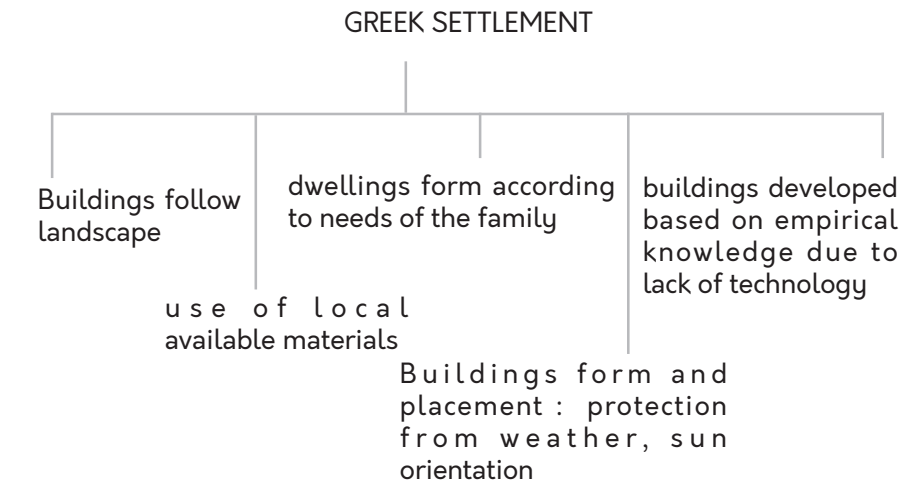


Diagram showing main characteristics of Greek settlement

Reflections

The Greek settlements are an example of how agricultural societies were structured in Greece before the 19th century and the development of urban societies. Their organization was based on the relationships between inhabitants as well as the surrounding environment. The way that the settlements were built shows the high consciousness of rural communities regarding their resources and how to use them. Since they lacked the amenities of the modern world, they had to take advantage of their available resources and collaborate to overcome challenges, which further led to the creation of strong ties with nature and other individuals.

HOUSES' TYPOLOGIES - FOCUS ON CRETAN SETTLEMENTS

The shape of the Cretan rural house was developed through the years according to needs, available materials and knowledge of the inhabitants. There is evidence of three main types of houses: the curvilinear (built in the mountains mostly for shepherds), the rectilinear with roofs/terraces supported on beams, and the rectilinear with roofs/terraces supported on arches. The last two categories also separate in narrow-fronted or wide-fronted. The houses were evolved during time with another floor, more rooms etc (Vassiliadis,1983).

1. Curvilinear house
2. Rectilinear houses with flat roofs/terraces on beams
 - a. Narrow - fronted
 - b. Wide - fronted
3. Rectilinear houses with flat roofs/terraces on arches
 - a. Narrow - fronted
 - b. Wide - fronted

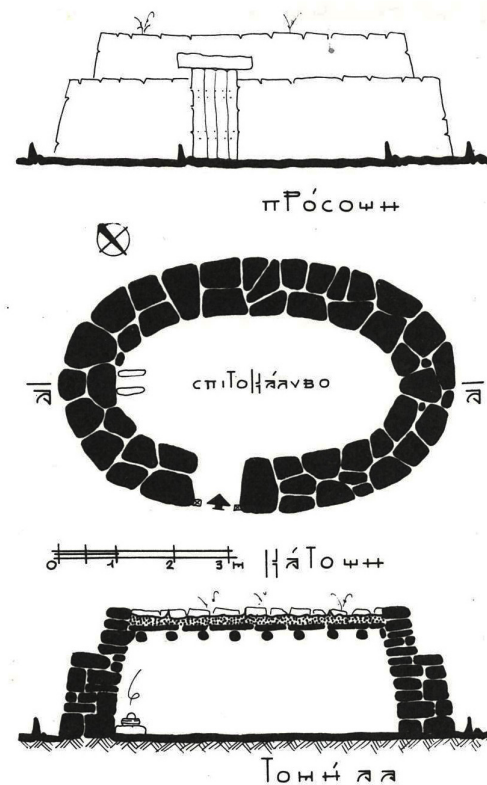


Figure 6. Type 1,curvilinear house, mostly for shepherds (Vassiliadis,1983)

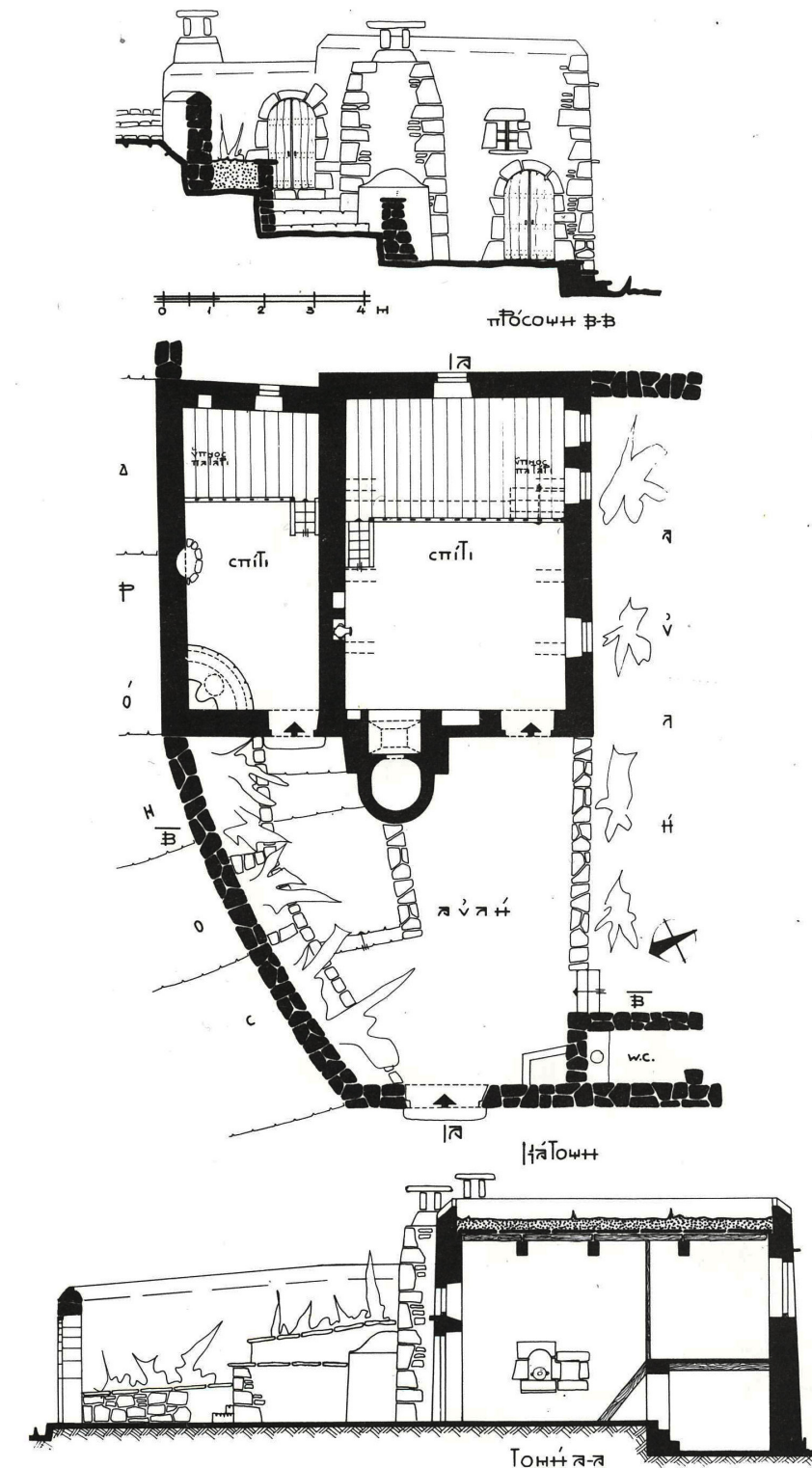


Figure 7. Type 2a ,Rectilinear narrow fronted house, (Vassiliadis,1983)

*all drawings presented are from villages around Crete

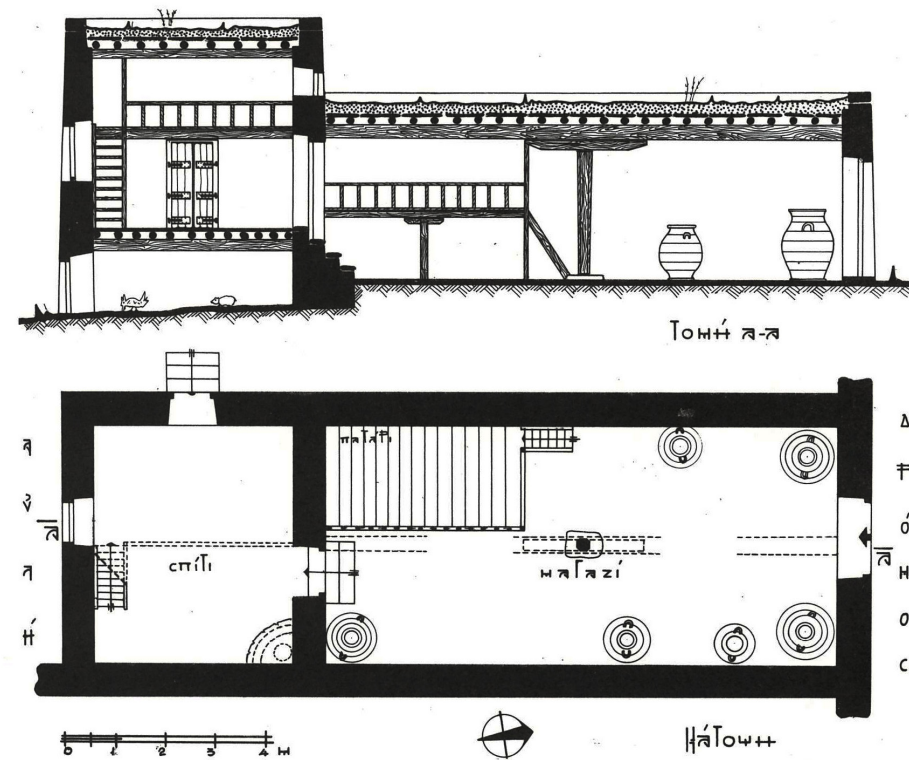


Figure 8. Type 2a ,Rectilinear narrow fronted house with post,
(Vassiliadis,1983)

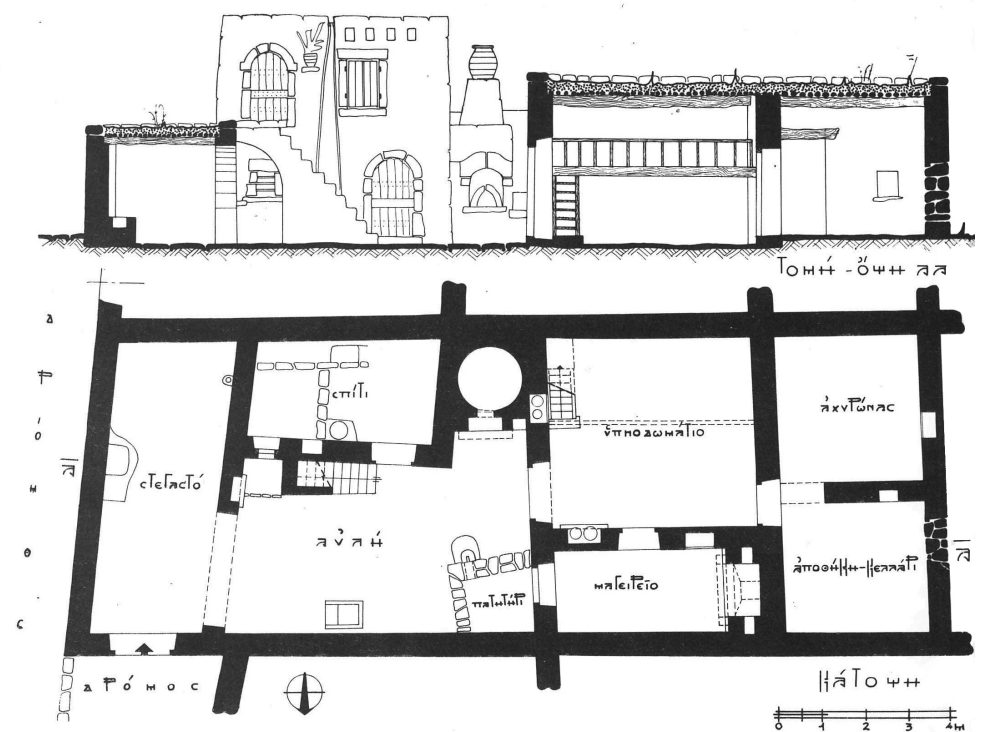


Figure 9. Type 2b ,Rectilinear wide fronted house without post,
(Vassiliadis,1983)

*all drawings presented are from villages around Crete

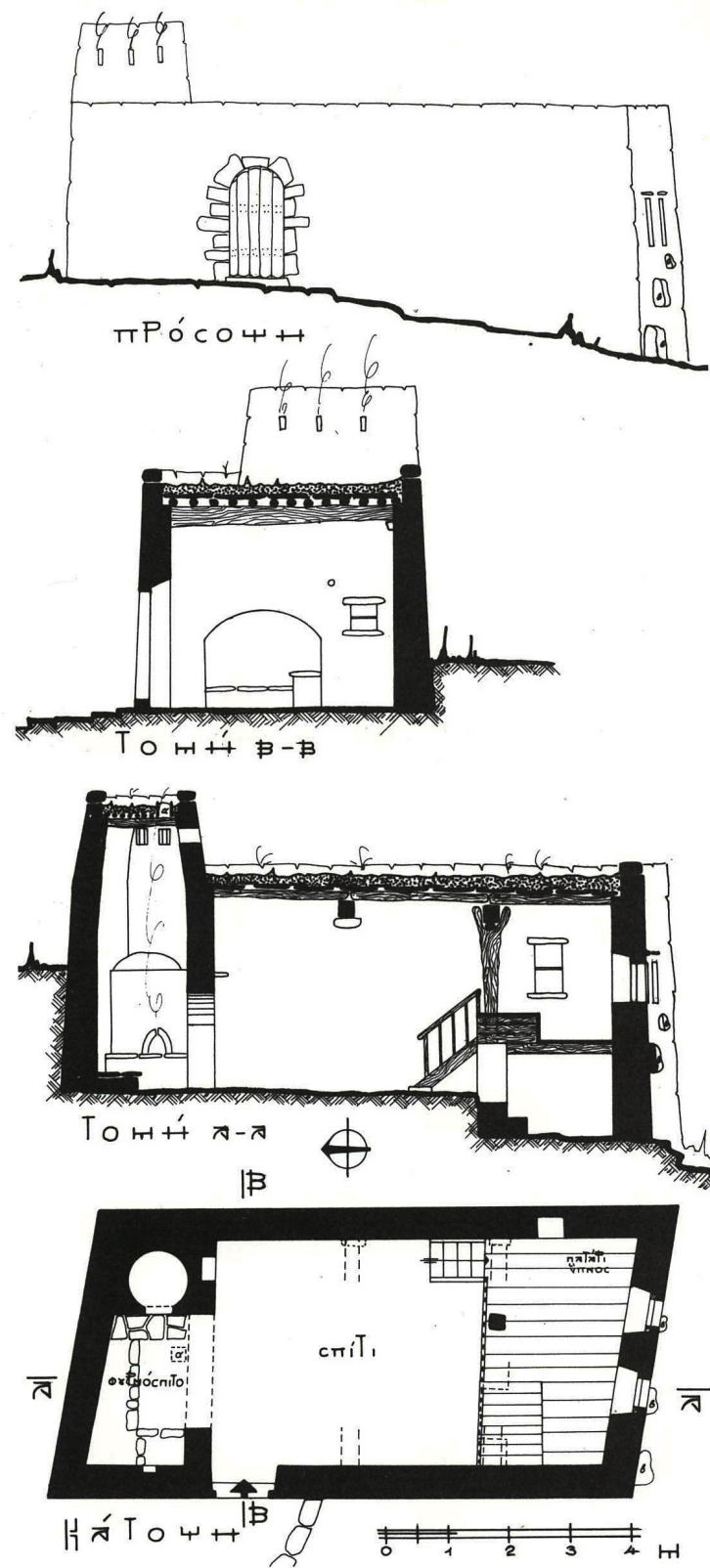


Figure 10. Type 2a ,Rectilinear wide fronted house with post,
(Vassiliadis,1983)

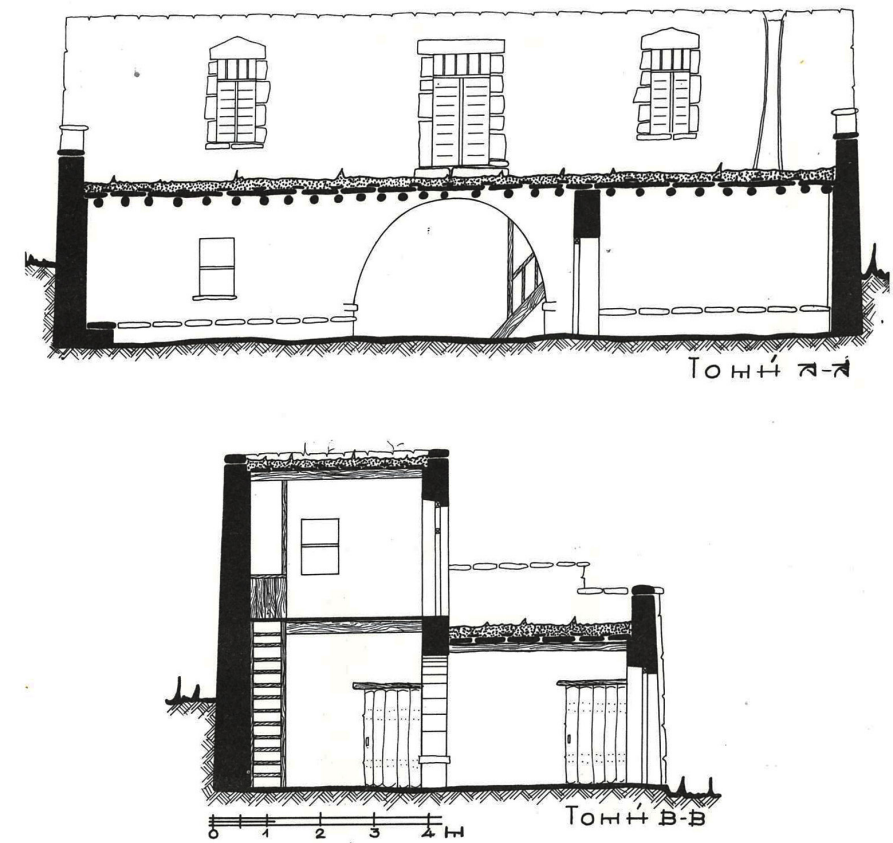


Figure 11. Type 3b,Rectilinear wide fronted house with arch,
(Vassiliadis,1983)

*all drawings presented are from villages around Crete

2.5 CRETAN SETTLEMENTS CASE STUDIES

This chapter consists of the analysis of two typical settlements in the context of Crete. The settlements are analyzed regarding their placement in the context, the dwellings as well as the interactions between the inhabitants.

Krya Vrysi

Population : 432 (1945)

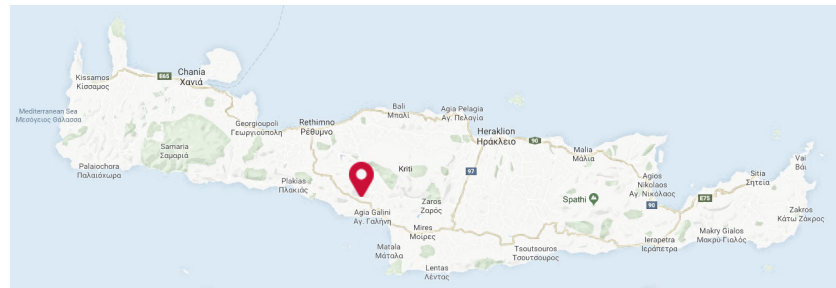


Figure 12. Map of Crete (adapted from Google maps)

Krya Vrysi is a small village located in a mountain in the southern Crete. The village is built amphitheatrically on the hill and is orientated towards the south. The mountain protects the north side of the village. The square with the church is the center of the village. All the buildings are expanding from the square. Inhabitants used to gather on the square to celebrate the big holidays. The village had three traditional coffee places which the inhabitants spend their time during the evenings. The square was also the place which the kids were playing. The parents didn't need to worry because the adults who were in the coffee places or the surrounding buildings were keeping an eye on them.

The typology of the buildings is rectilinear wide-fronted, and most of them have a courtyard and a flat roof which is used as a terrace. The courtyard is working as a transition space. The entrance door would be open during the summer to allow the cool breeze to come in the courtyards, but it also enhanced the social interactions. The dwellings' height is one or two floors, and they are built in clusters.

Social characteristics :

Sharing : products, knowledge, tools, Celebrate-working-take decisions for the community together ,Kids playing free without supervision

Architectural characteristics :

Central open public space- square, buildings follow the surrounding environment, narrow streets(density-proximity), buildings in clusters, accessible flat roofs,houses with indoor courtyard

Environmental characteristics :

farming, stock breeding,water management, use of natural materials, reuse waste

Environmental characteristics in buildings :

use of local available materials, orientation, thick walls, small openings



- Streets which got accessible by cars after 1950s
- Square- meeting space
- Traditional cafe
- Church
- Common water collection for farming

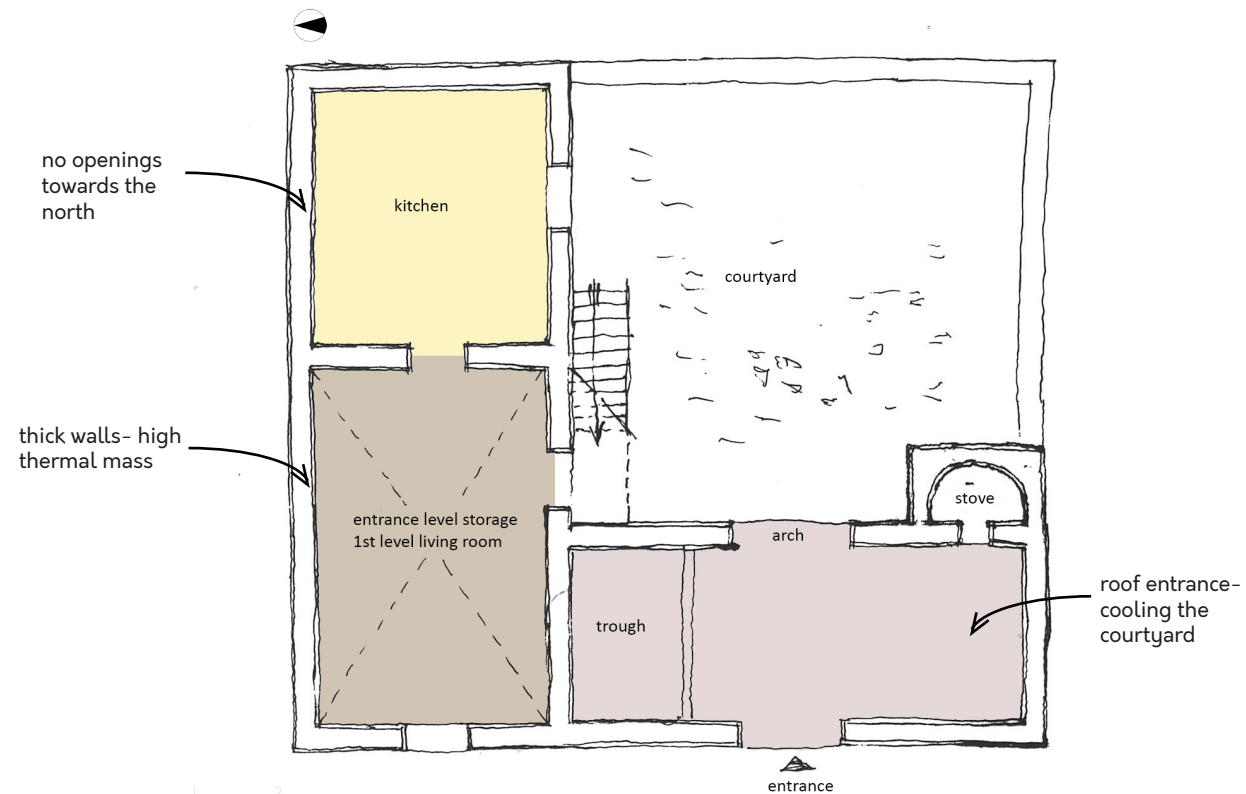
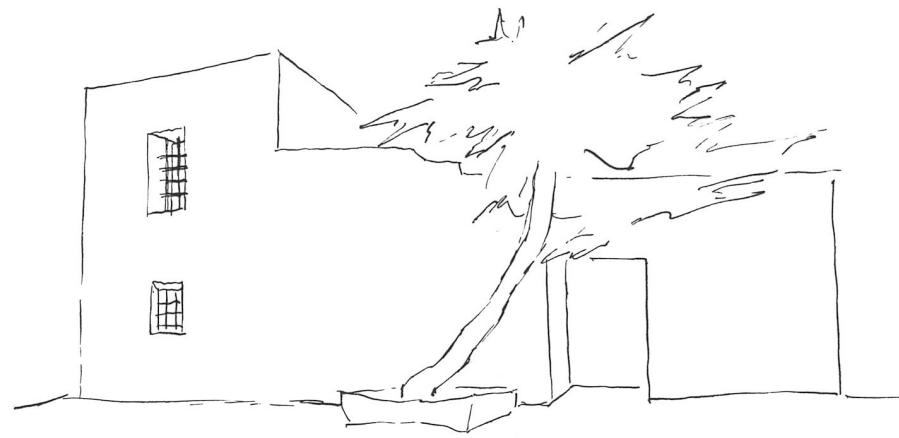


Figure 13. Typical house at Krya Vrysi settlement
(adapted by Zagorissiou ,1996)

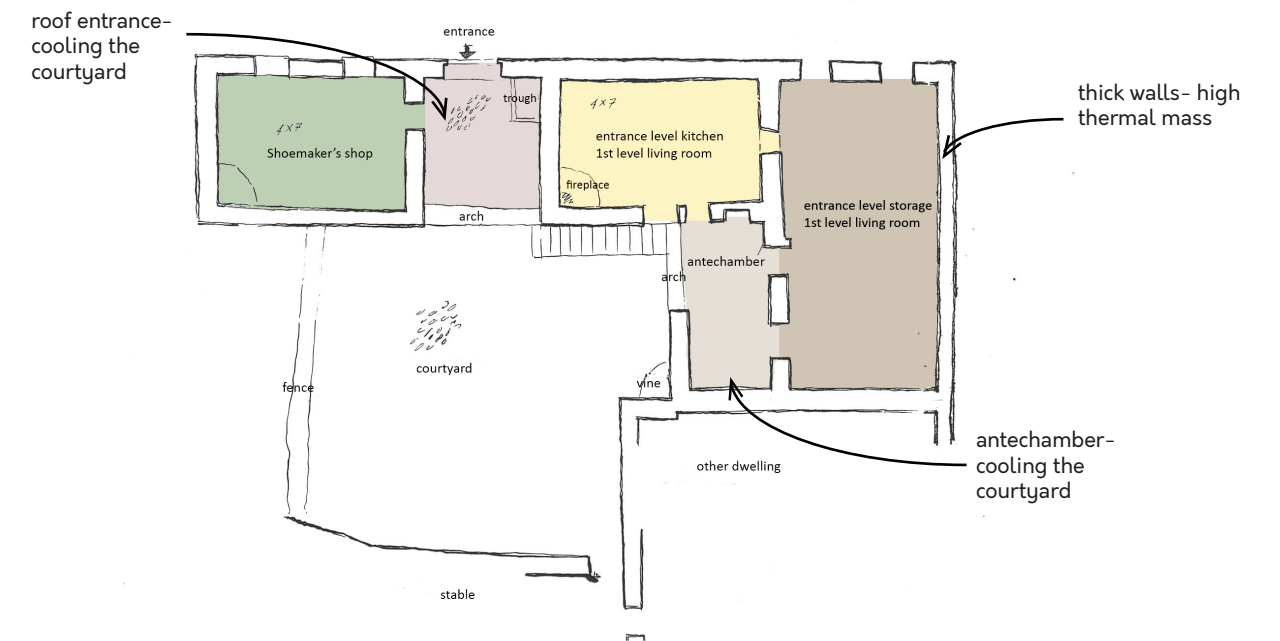
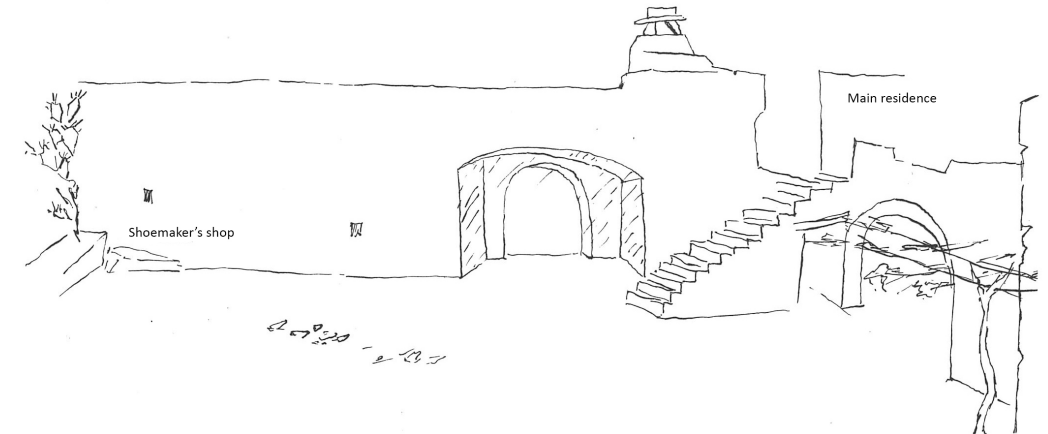


Figure 14. Typical house at Krya Vrysi settlement,
(adapted from Zagorissiou ,1996)

Kerames

Population : 505 (1945)

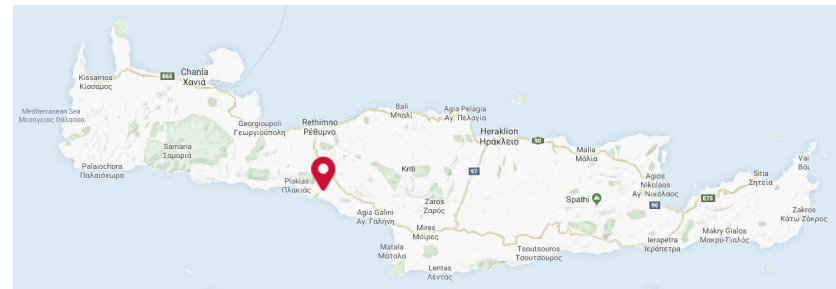


Figure 15. Map of Crete (adapted from Google maps)

Kerames is located 300m high above the sea level in the southern Crete. The village was recognized officially as a settlement on 1925, although there are records the settlement since 1571. Main occupations of the inhabitant were farming, stock breeding and fishing, as the sea was only 3 kilometers away. The village is built amphitheatrically on the mountain and is orientated towards the south and the Libyan sea. Inhabitants used to have a spirit of cooperation. Families would create “couples”. That means that two families would work together in each others estates, they would join forces to help each other with different tasks. Shepherds were also organized to take turns on the care of the sheep. One or two shepherds would take care of the herd some day of the month. That benefited the residents to deal with other tasks. People would gather at the center of the village with a big tree to celebrate the big holidays. The village had one traditional coffee place which the inhabitants spend their time during the evenings.

The dwellings are either rectilinear wide-fronted either rectilinear narrow fronted. The settlement’s form is compact with narrow streets and paths. Most of the buildings have a covered courtyard on the ground floor and an accessible roof terrace above. Some of the terraces are connected above the roads, creating covered spaces which are used for sun protection during the summer.

Social characteristics :

Sharing : products, knowledge, tools, Celebrate-working-take decisions for the community together, Kids playing free without supervision

Architectural characteristics :

Central open public space- big tree, buildings follow the surrounding environment, narrow streets(density-proximity), buildings connected over buildings, buildings in clusters, accessible flat roofs, houses with indoor courtyard

Environmental characteristics :

farming, fishing, stock breeding, sharing resources, use of natural materials, reuse waste

Environmental characteristics in buildings :

use of available materials, orientation, thick walls



- Streets which got accessible by cars after 1950s
- Meeting space arranged around a big tree
- Traditional cafe
- Church

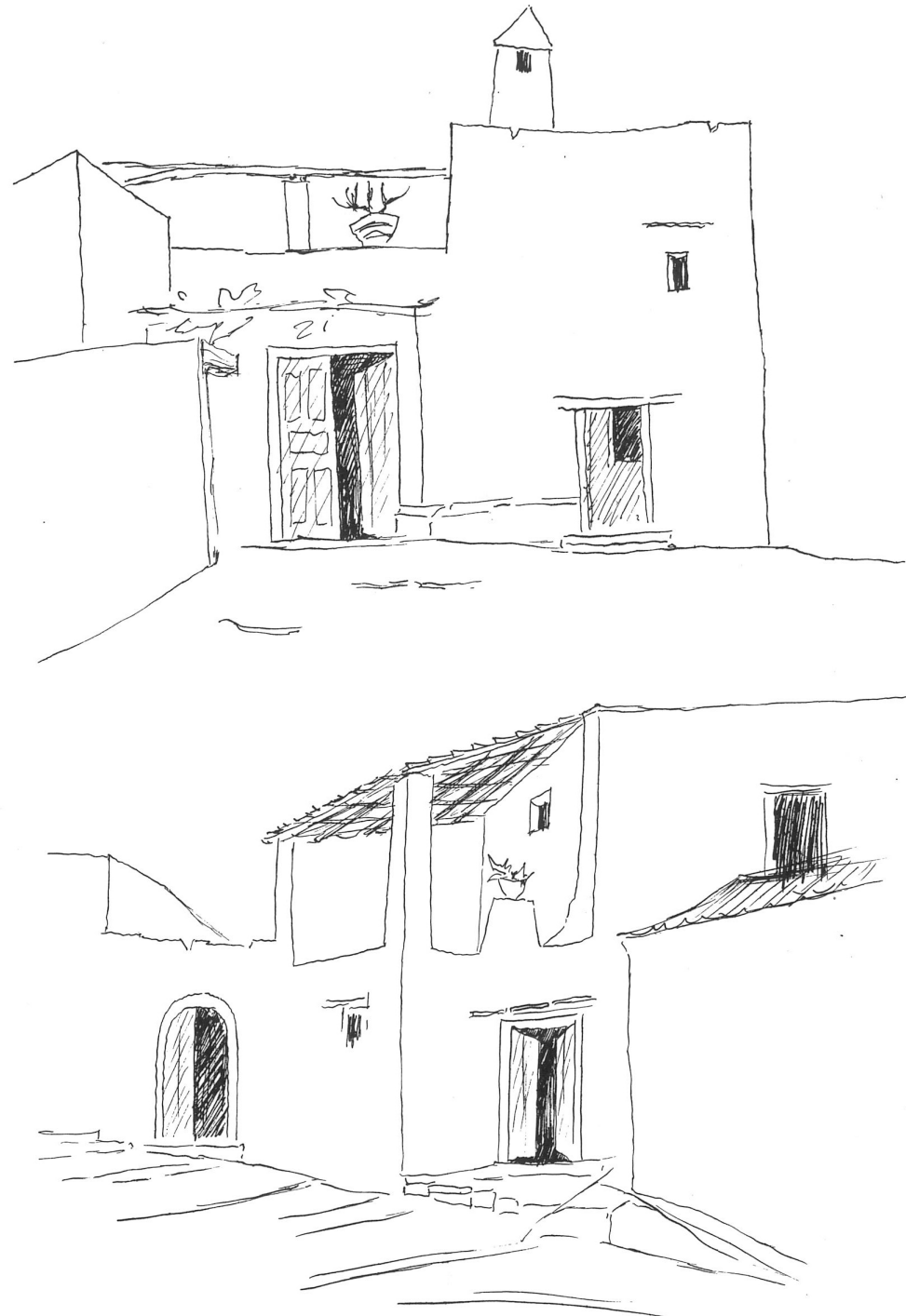


Figure 16. Typical house at Kerames settlement
(Zagorissiou ,1996)

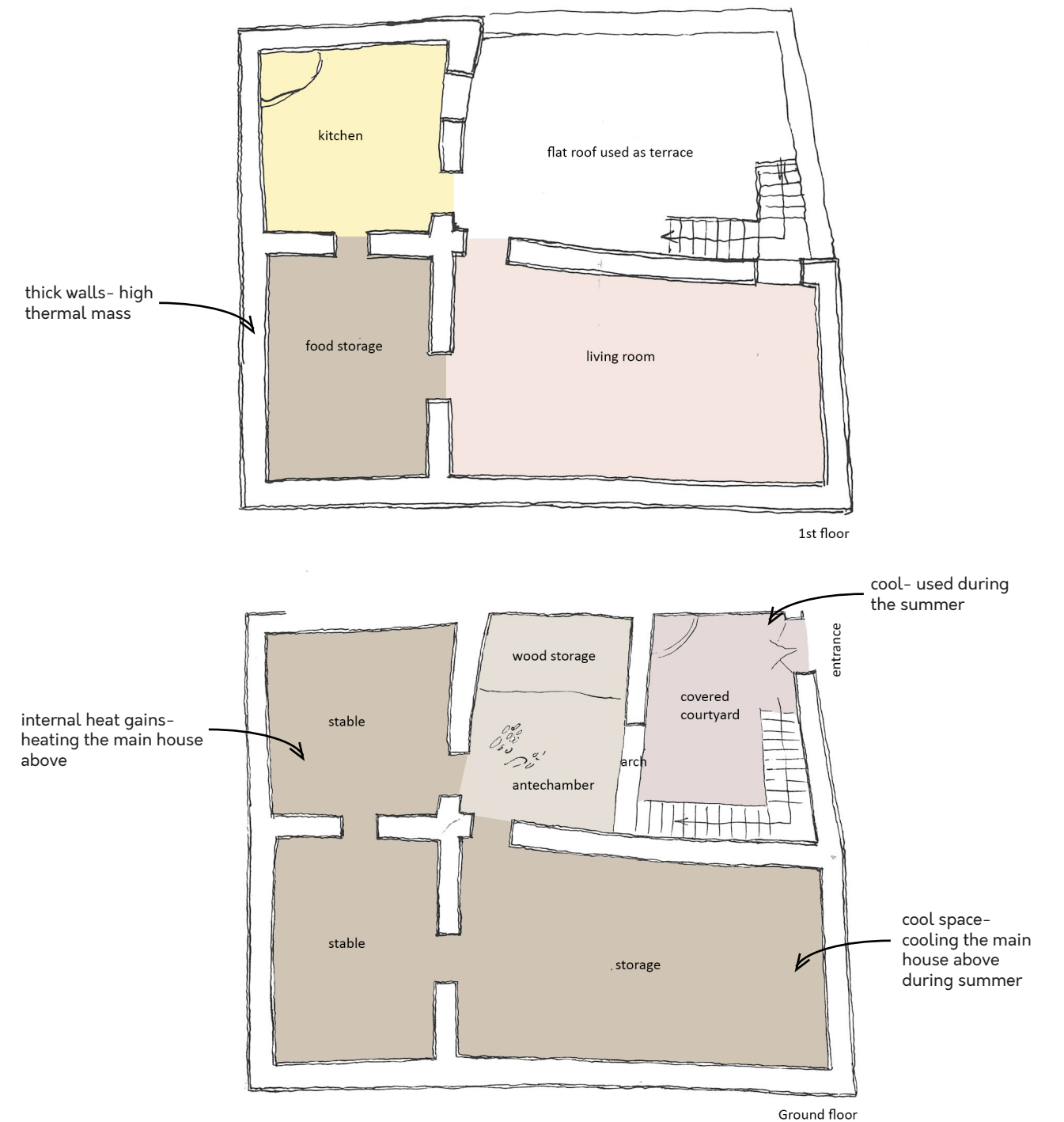
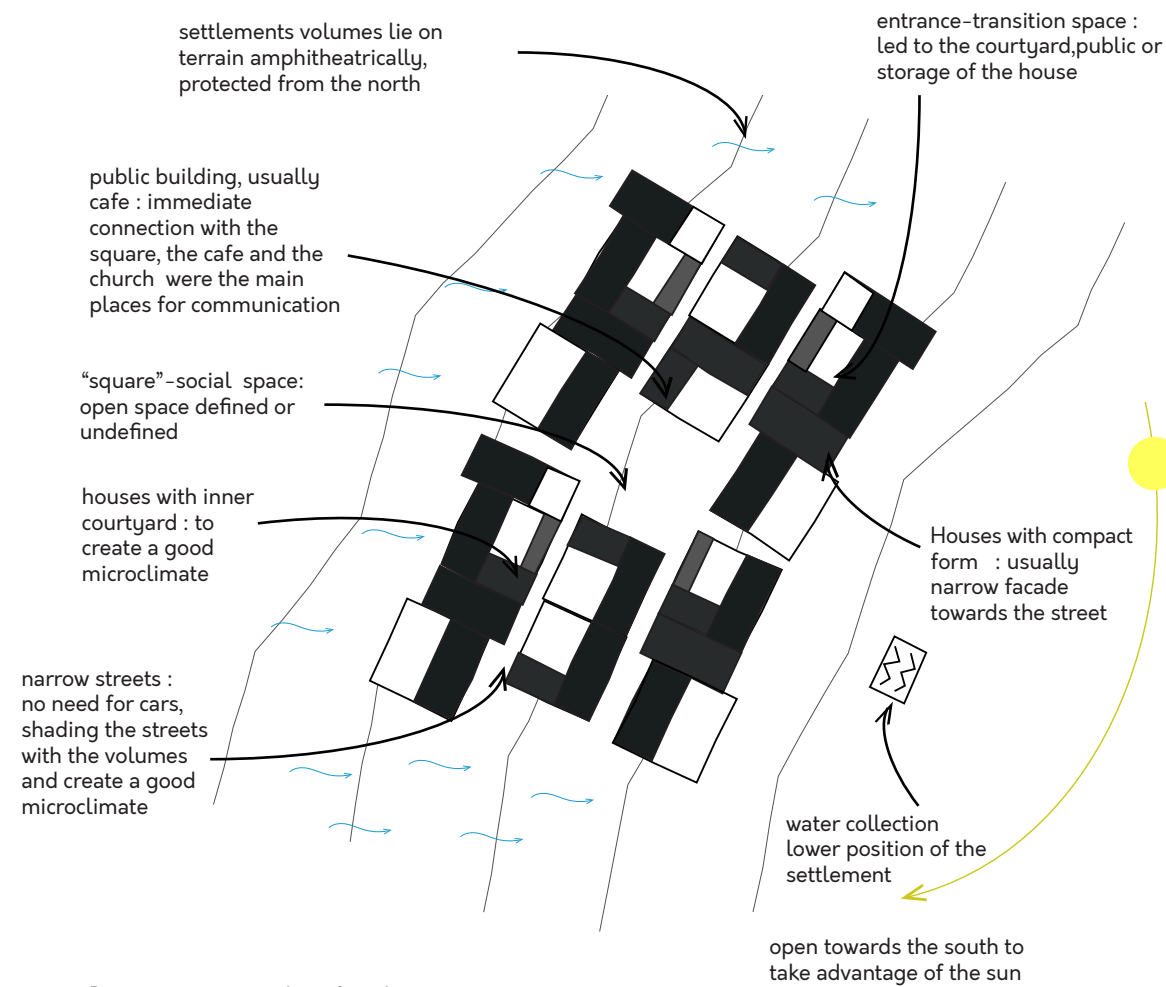
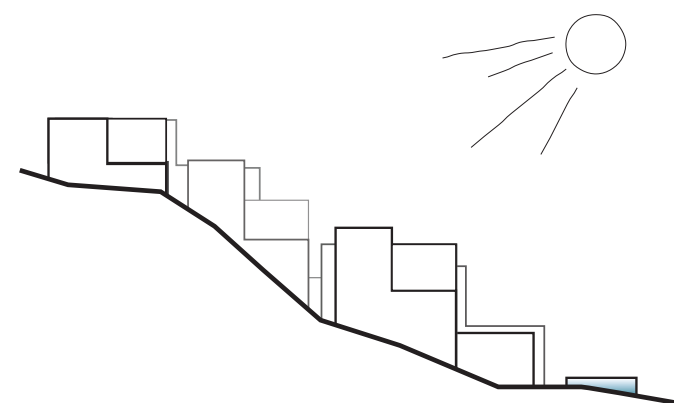


Figure 17. Plan of typical house at Kerames settlement
(adapted from Zagorissiou ,1996)

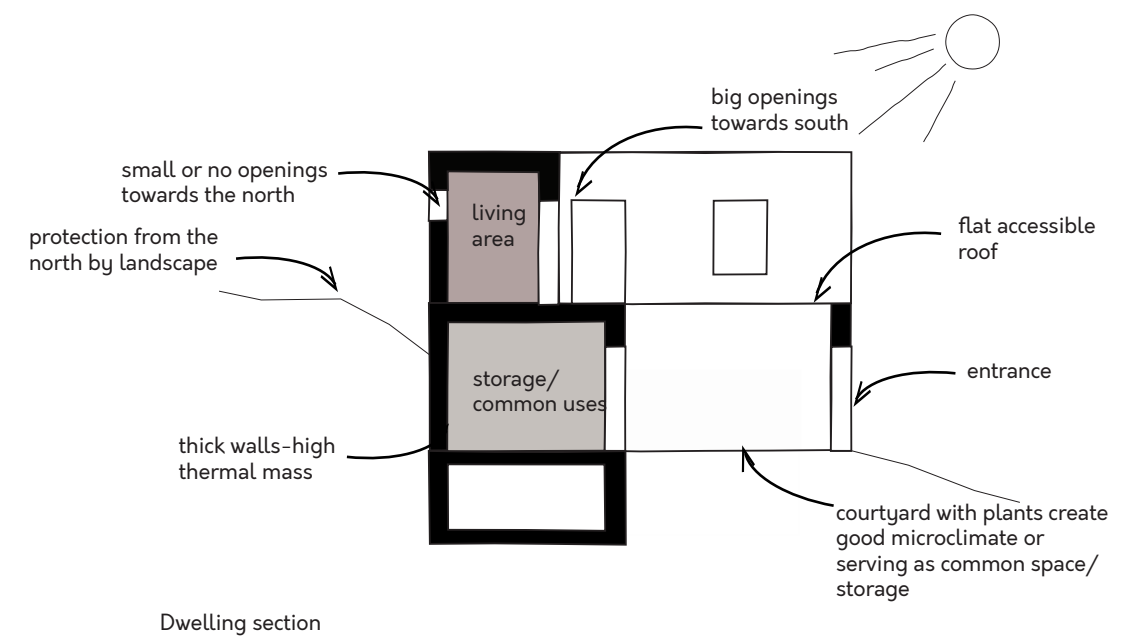
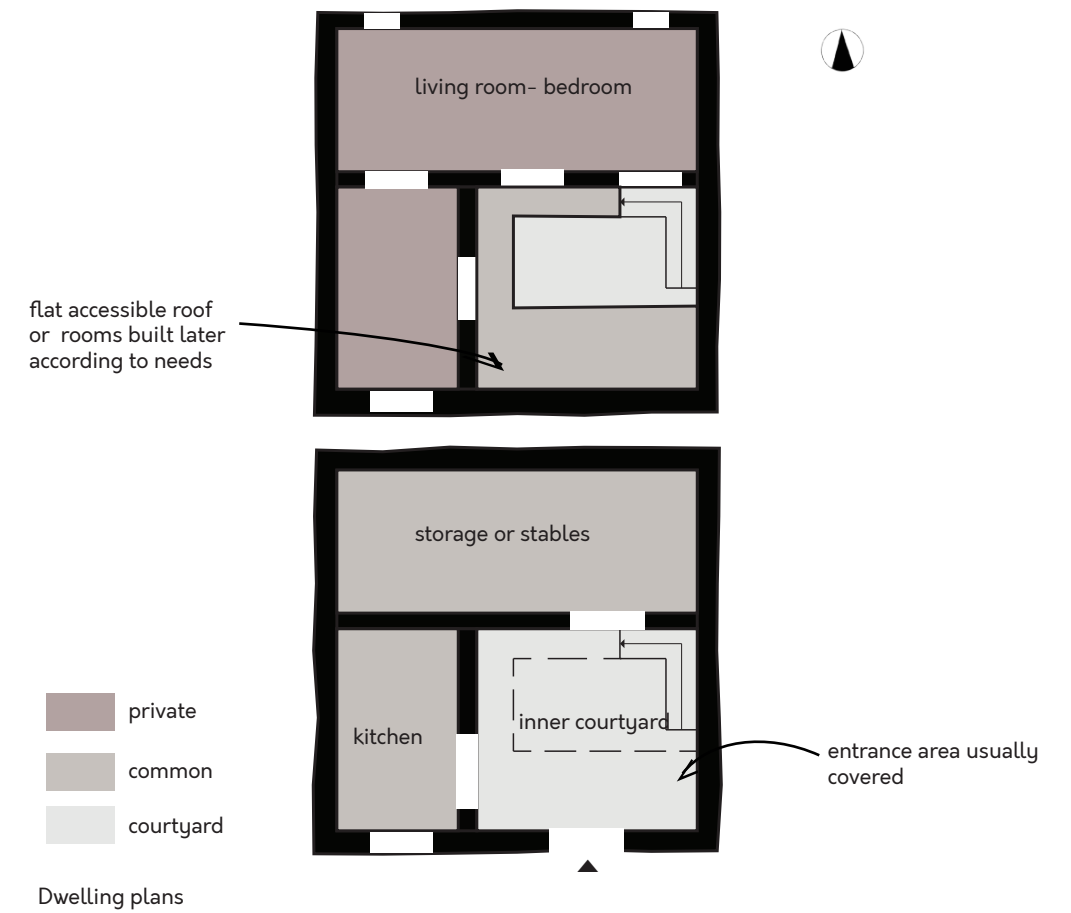
2.6 CONCLUSIONS



Diagrammatic site plan of settlement



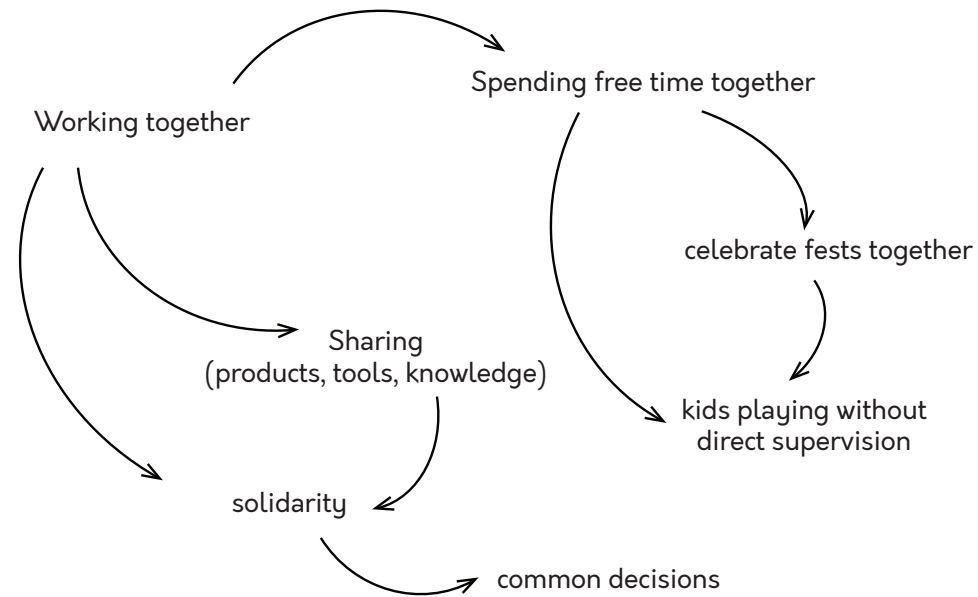
Diagrammatic elevation of settlement



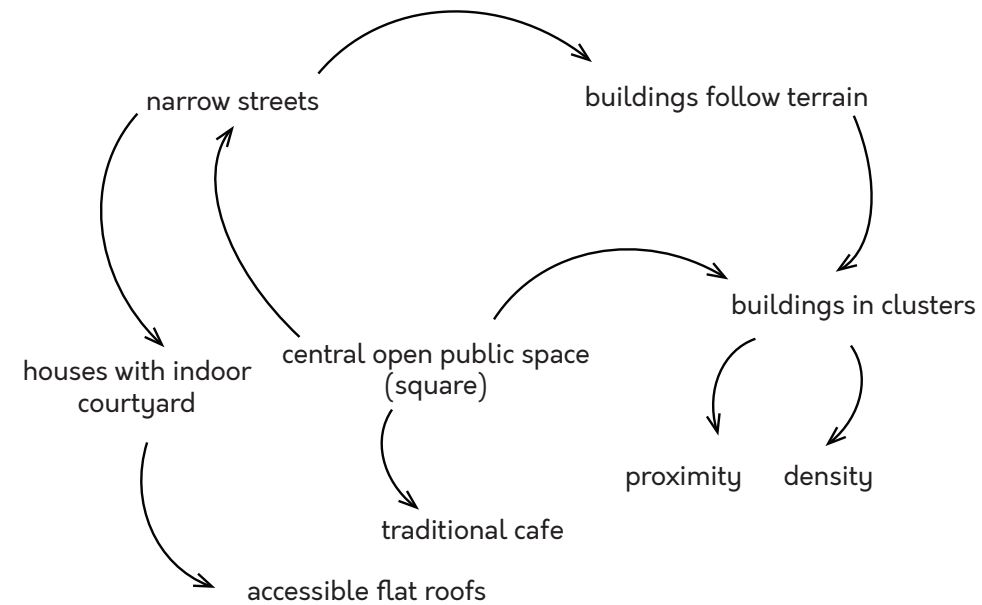
SYSTEMS

After the research and the analysis of case studies, an identification of the main characteristics of the villages was created. The identification is shown in the form of systems design as a try to determine also the connection between the different elements.

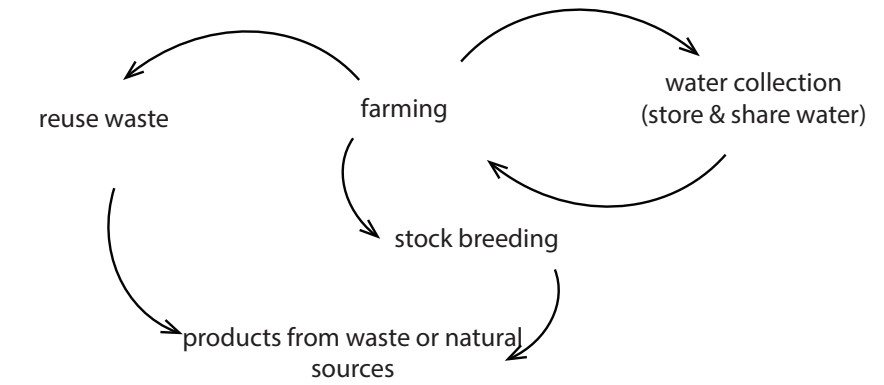
SOCIAL CHARACTERISTICS



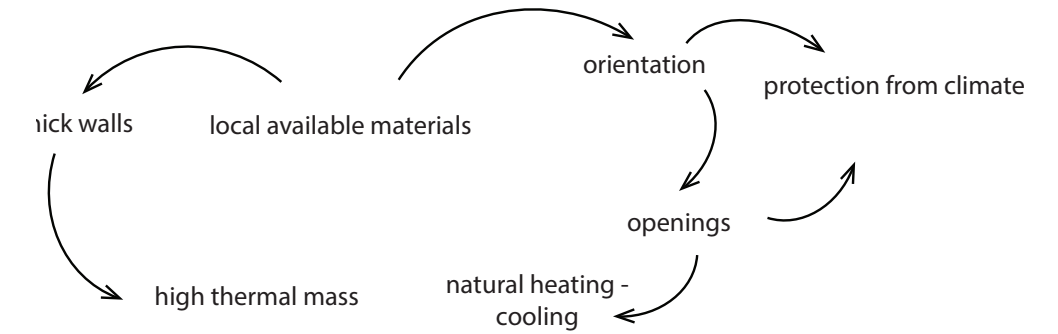
ARCHITECTURAL CHARACTERISTICS



ENVIRONMENTAL CHARACTERISTICS



BUILDINGS ENVIRONMENTAL CHARACTERISTICS

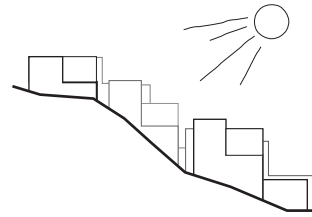


Reflections

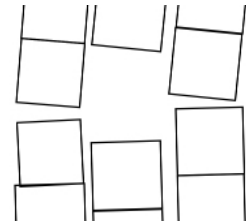
In recent days there is a lack of the interconnectivity that is shown in the systems above. Due to the mobility of urban societies and the virtual connectivity individuals have lost the relationship with their surrounding environment. The built environment also represents this result as the scale of the city does not promote social interactions or physical contact with the natural habitat.

VILLAGE'S VALUES

The documentation of characteristics and systems which structure the village led to the identification of village's values.



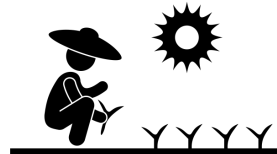
Building in clusters, thick walls, orientation, natural heating - cooling techniques



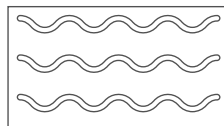
Central square/open space



Use of local available materials



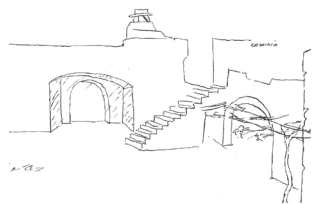
Farming, stock breeding/ connection with nature



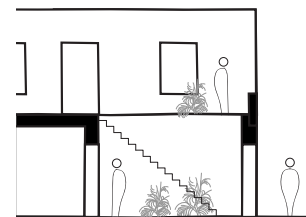
Sharing & preserve water



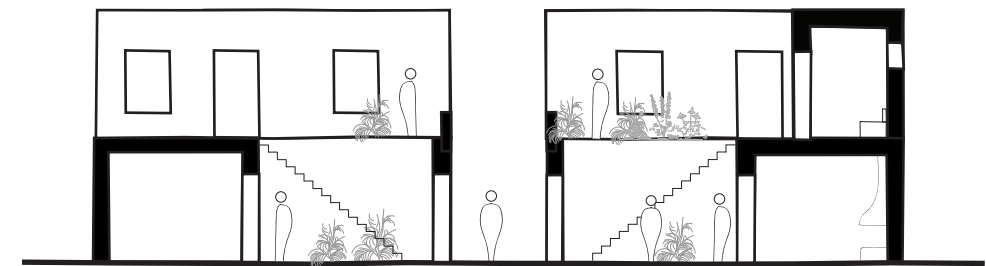
Sharing products, tools, knowledge



Inner courtyard-meeting space



Common spaces - entrance/private spaces level above



Village, relationship between dwellings

Reflections

The values of the village can be used as guidelines to change the way we build today. Of course, it is not possible to copy-paste them in the urban environment, as the dynamics in rural societies are distinctly diverse in relation to modern cities. But there is the possibility to use them as a tool to reduce our footprint and create sustainable communities in contemporary societies.

SITE ANALYSIS

3.1 THE SITE

The chosen plot is located in the center of Rethymno city close to the entrance of the old town of Rethymno. It is owned by the municipality and is approximately 9.000 s.m. Currently is used as a parking lot. The future plans of the municipality suggest the construction of underground parking and a building for municipality administration functions.

The position of the site is of high value but underrated as it could be a recreational space for the inhabitants. The selection of the plot was based rather as a test case and not on the municipality plans. Since it is located on an essential position of the city it could work as a recreational space, with housing and facilities for the inhabitants.

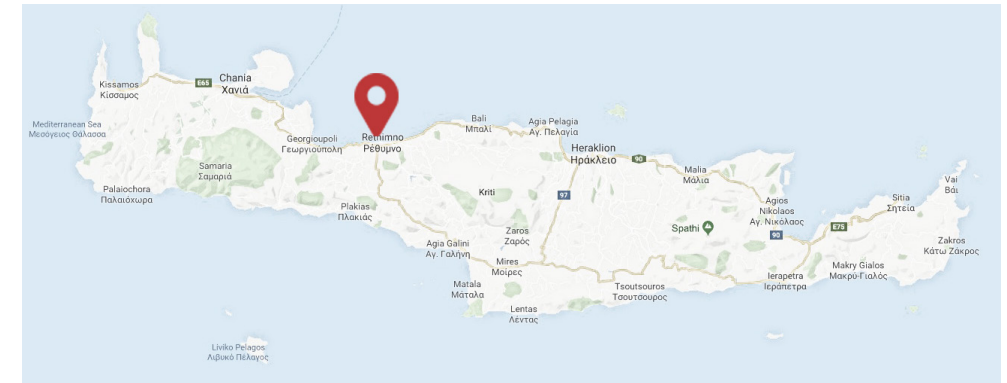
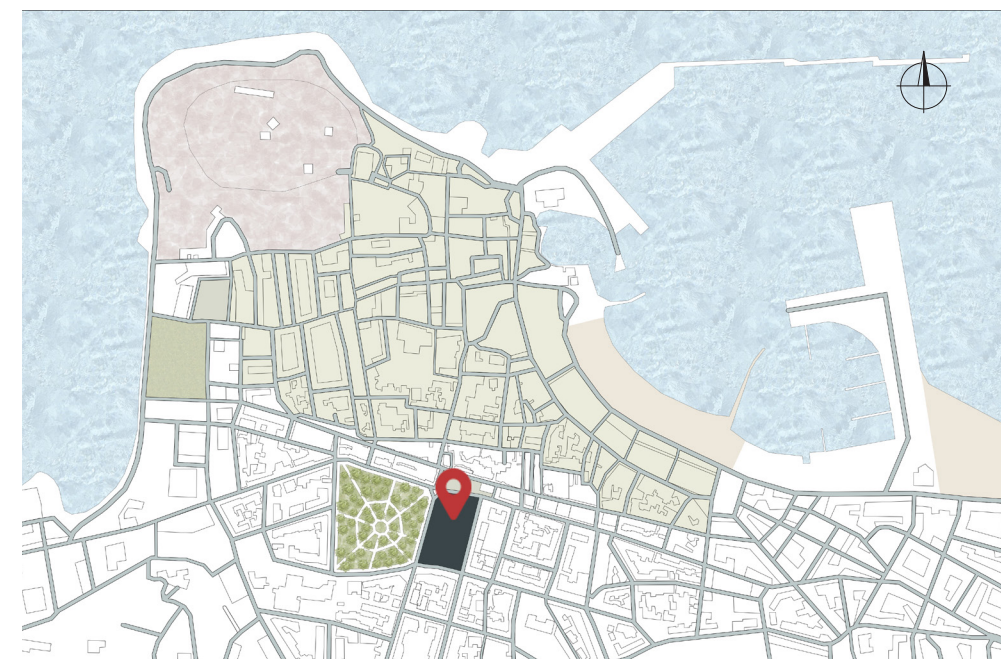


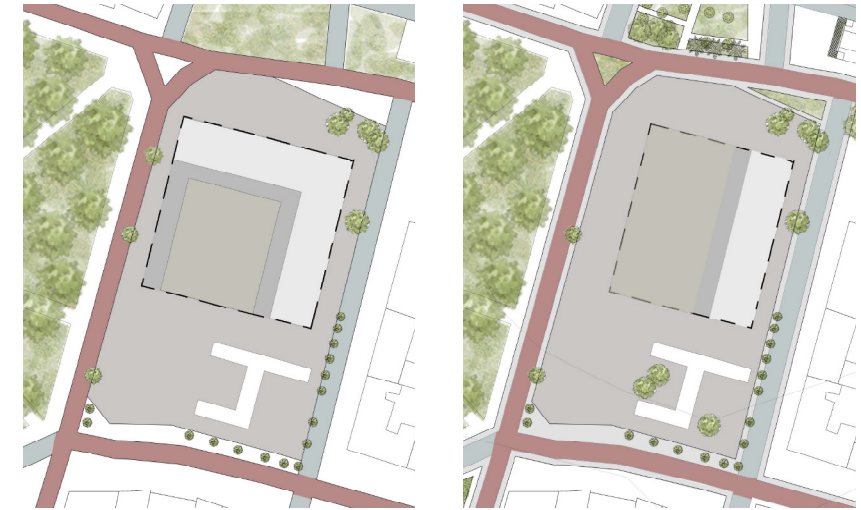
Figure 18. Map of Crete (adapted from Google maps)



Rethymno City & site location



Municipality's thoughts for the future development of the city, focuses on the creation of infrastructure with offices for the municipality and underground parking.



(site plans of possible scenarios interpreted by the author)

Possible scenarios if it would be built as a normal city block based on the surroundings.



(site plans of possible scenarios interpreted by the author)

- Parking
- Buildings
- Green areas/Square

3.2 HISTORY OF THE CITY

Rethymno is located on the south of Greece, on the island of Crete. It is built by the sea and it is the third largest municipality of Crete with 34.400 habitants in the city area. The history of Rethymno is traced back to the neolithic era. Although the most significant eras which influence the modern city was the Venetian (1204-1669) and Ottoman occupancy (1669-1898).

City development through the years

The first known urban cell, Castel Vecchio, was created during the Byzantine period. During the 13th century (Venetian occupancy) the city started growing further. After an ottomans raid in 1538, the Venetians built walls around the city to protect it. The walls were not effective as with a new raid in 1571 the ottomans burnt parts of the city. The result was the construction of the castle, Fortezza, with the intention to move the whole city there. The city was reconstructed (outside of the castle). The main architectural elements of the city at the time were a piazza (square) with a fountain, and Loggia, a building for nobles (Kolyvaki ,2014).

The Ottoman occupancy didn't alter much the character of the city. The city was expanded towards the south and north along the seacoast. The new buildings were also two floors' high, new districts were created, and the streets became wider (Kolyvaki ,2014).

At the beginning of the 20th century, the walls around the city start falling and the city is developed further towards the south. The "gate" of the wall is still standing and marks the entrance to the old town.

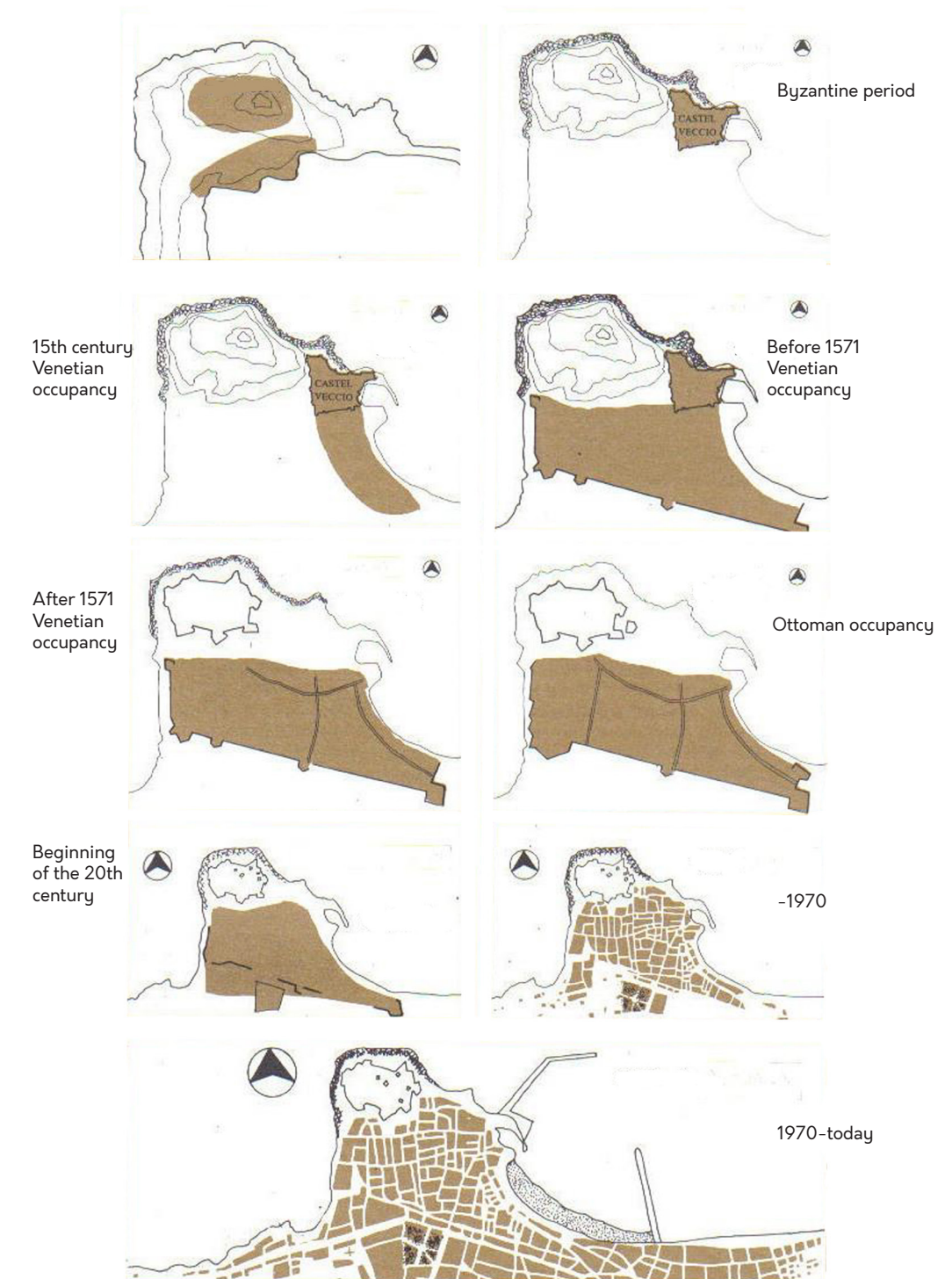


Figure 19. City development from the ancient years until today (Kolyvaki ,2014)

Residence typology venetian period

The architecture of the houses was based on renaissance but with adjustments to adapt to the local climatic conditions and local climate. The houses were two to three floors high with an indoor courtyard. Some of the buildings also had basement. The volumes are in the form of L or C shape and the spaces inside are organized according to sun orientation and to succeed good ventilation conditions. The placement of the courtyard was the main factor for the above. The facades towards the street are robust with a large decorated entrance, and small openings which were place higher to separate the public from the private space (Kolyvaki, p.27 ,2014).



Figure 23. Typology of venetian residence (Kolyvaki ,2014)

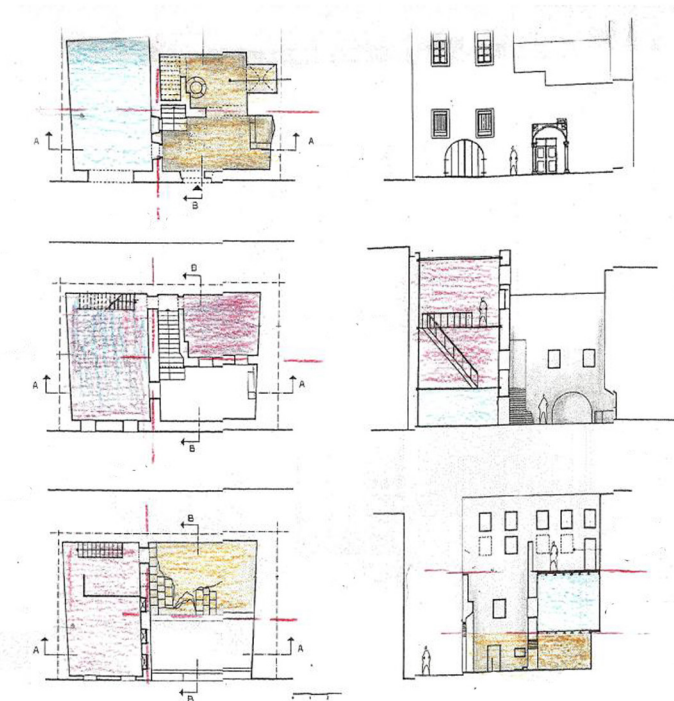


Figure 20. Typology of venetian residence (Kolyvaki ,2014)

Residence typology ottoman period

The architectural style of the buildings is distorted as there is a new addition on the facades, a wooden covered balcony on the second floor. The final form of the houses is a mix of Venetian, Ottoman, and local Cretan architectural style.

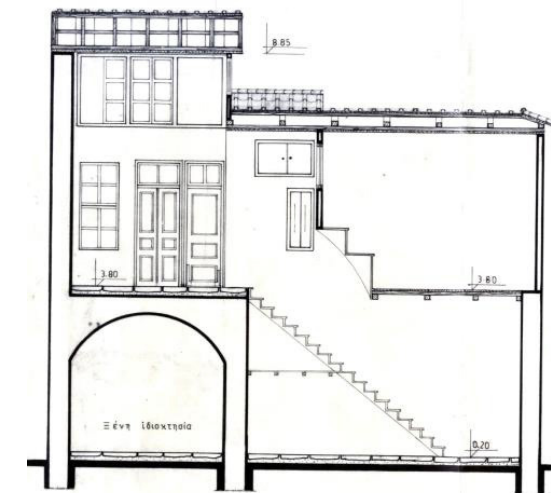


Figure 25. Typology of ottoman residence (Kolyvaki ,2014)

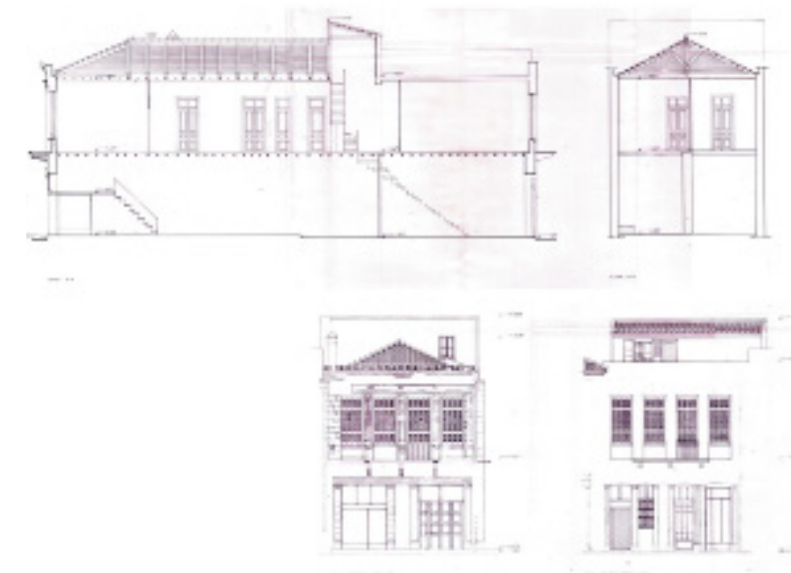


Figure 21. Typology of ottoman residence (Kolyvaki ,2014)

3.3 THE CITY TODAY

Rethymno is a vibrant city with a lot of tourists during the summer and many students during the winter. The municipality is taking actions towards sustainability to transform the city both for the visitors and the locals. The city is involved in the European Reference Framework for Sustainable Cities. (<http://civitas.eu/destinations/rethymno>), which is an online toolkit (www.rfsc.eu) for local European authorities which are aiming to start a process of integrated and sustainable urban development. (<http://www.ccre.org/activites/view/25>)

The parking and traffic are significant problems in the city. The primary transportation means are cars and buses. The inhabitants prefer to transport by car although the size of the city and the distances between services are in walking or bike distance. The parking spaces in the inner city are not enough for this amount of cars, especially during the summer that the population is doubled in size.

There are many suggestions from the municipality to solve this problem. The first phase of redevelopment, which was the widening of the sidewalks and the formation of bike lanes, has already completed. The second phase includes the relocation of the majority of parking on the entrances of the city, east and west but still at a close distance from the center. The aim is to create “park and ride” areas to reduce the number of cars in the inner city and emphasize on bikes and pedestrians.

The public space of the city is also under consideration the recent years. The main public areas now are a park and two squares. Regarding the facilities of the city center there is a mix of commercial, residential, working places and services for locals and tourists (hotels, travel agencies etc.).

The recent years have been noticed lack of housing in the city. The financial crisis had, as a result, the fall of the construction industry. Also, the focus on the tourist industry has caused the lack of focus on the possible new residents which come to the city to work or to study.

The design proposal aims to deal with the lack of housing and at the same time create a village in the city. A neighborhood which suggests a more sustainable lifestyle but also creates the sense of community which tends to disappear in the big cities.



Figure 22 . Old town entrance (Rethymno municipality)

3.4 CLIMATE

The climate of Rethymno resides in Mediterranean climate. It is characterized by mild winters and hot dry summers. The average annual maximum temperature is 21°C and the minimum yearly temperature is 14°C. The warmest periods are during the summer months with the warmest to be in July, as the temperature reaches 30°C. Rethymno has dry periods from May until September. The coolest month is February, and the wettest is January. The average yearly amount of rainfall in Rethymno is 653mm(<https://weather-and-climate.com/>).

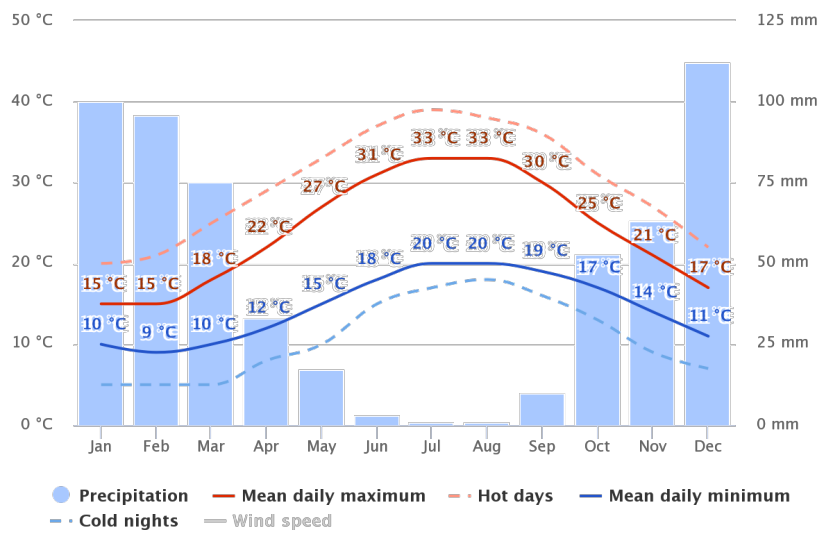


Figure 23. Average temperatures and precipitation (Meteoblue BY-NC)

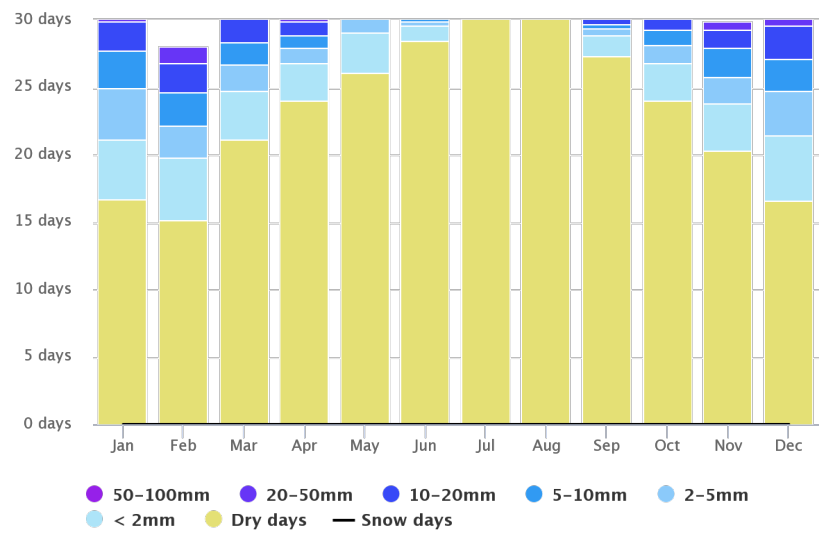


Figure 24. Precipitation amounts (Meteoblue BY-NC)

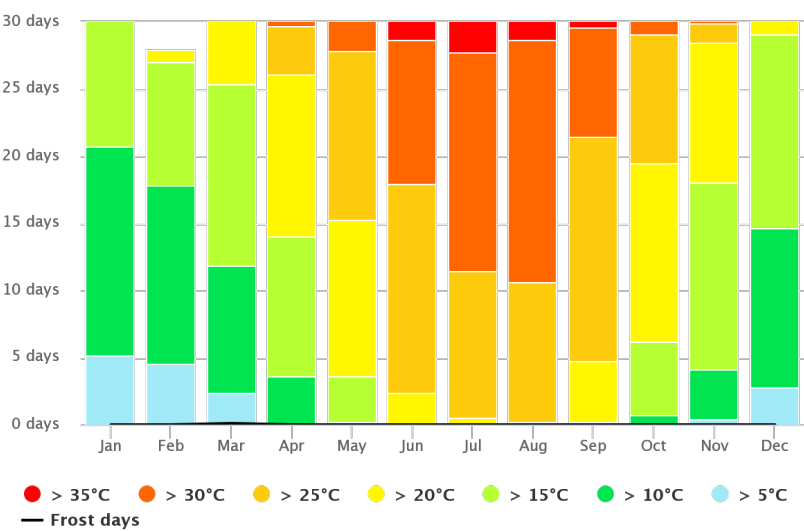


Figure 25. Maximum temperatures (Meteoblue BY-NC)

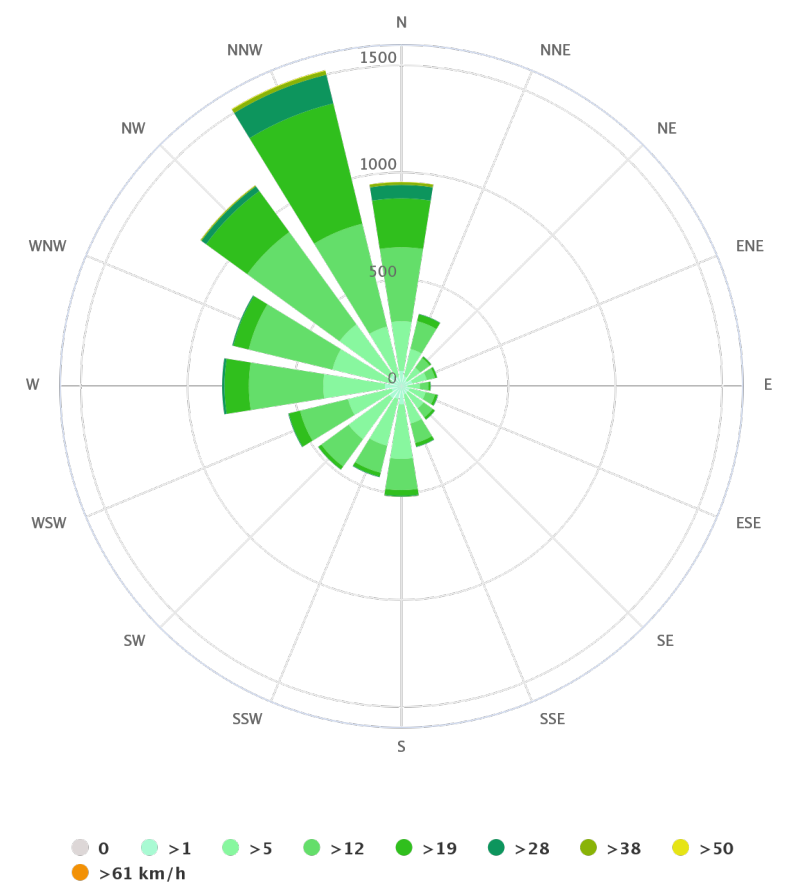


Figure 26. Wind rose (Meteoblue BY-NC)

As in the rest of the world, areas with Mediterranean climate are affected by climate change too. In case of Greece, in agricultural areas, are expected dry days to increase, winter precipitation to decrease, whereas autumn precipitation is projected to increase in most areas (Giannakopoulos, C., Kostopoulou, E., Varotsos, 2011).

In urban areas are projected higher temperatures during the day and night flash floods events are expected to occur more frequently. Another impact of climate change in urban regions is the increasing energy demand for cooling in summer (Giannakopoulos, C., Kostopoulou, E., Varotsos, 2011).

Based on the above, there is a need to design buildings which correspond and adapt to climate change to reduce our negative impact on the planet as well as to achieve our comfort without consuming extra energy. To succeed this, we need to design infrastructures based on passive strategies. The following psychrometric chart was created by climate consultant software (University of California energy design group) based on climate data of the area. It shows the hours of indoor comfort in a residential building and how it can be achieved using passive strategies. Based on the above strategies, the software propose design guidelines some of them are presented on the next page.

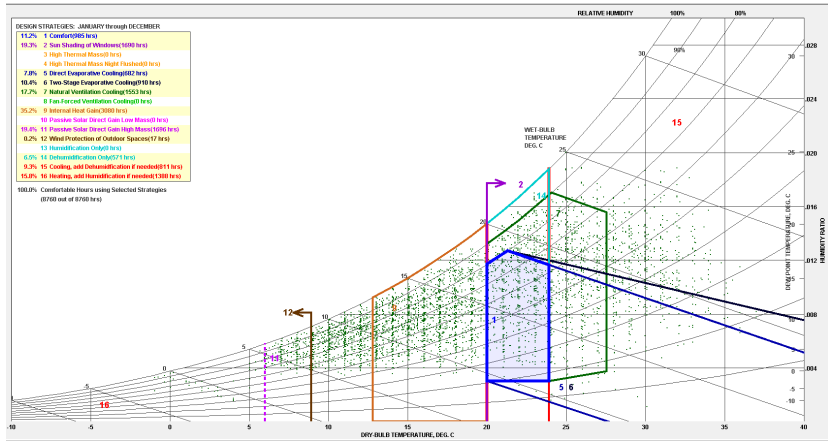


Figure 27. Psychrometric chart (©2008, 2014 Regents of the university of California)

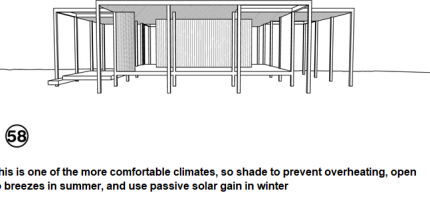
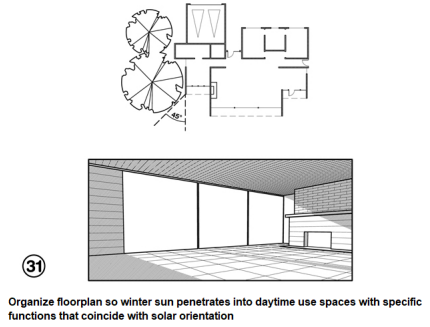
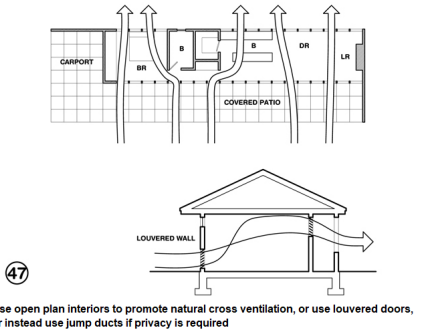
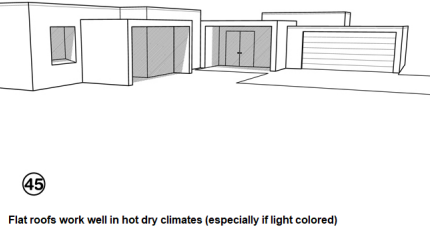
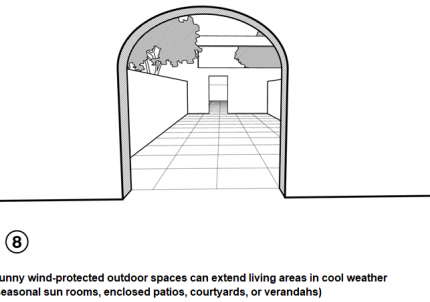
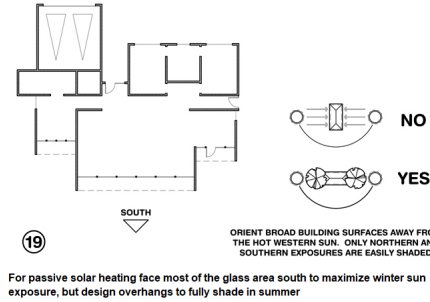
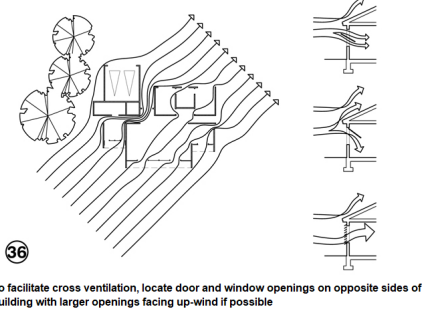
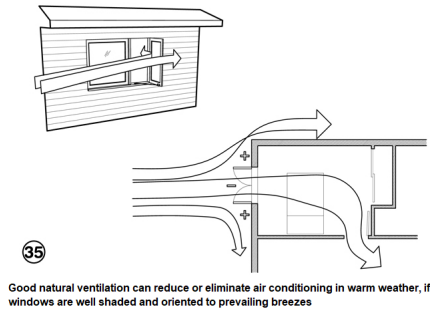
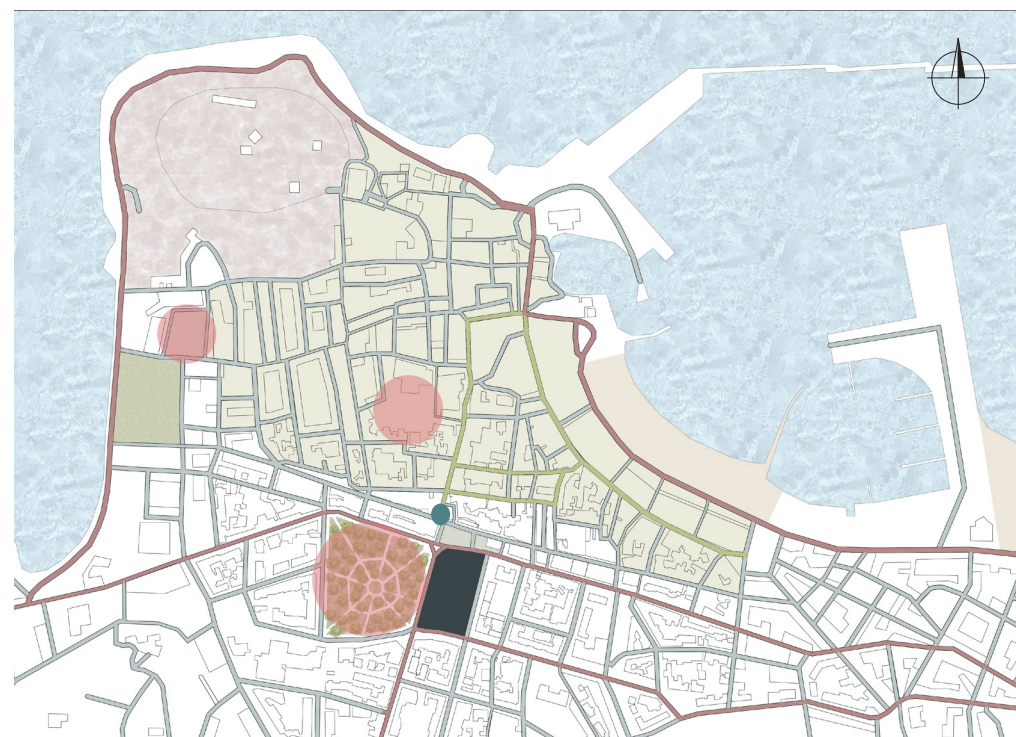


Figure 28. Passive strategies, (©2008, 2014 Regents of the university of California)

3.5 SITE MAPPING



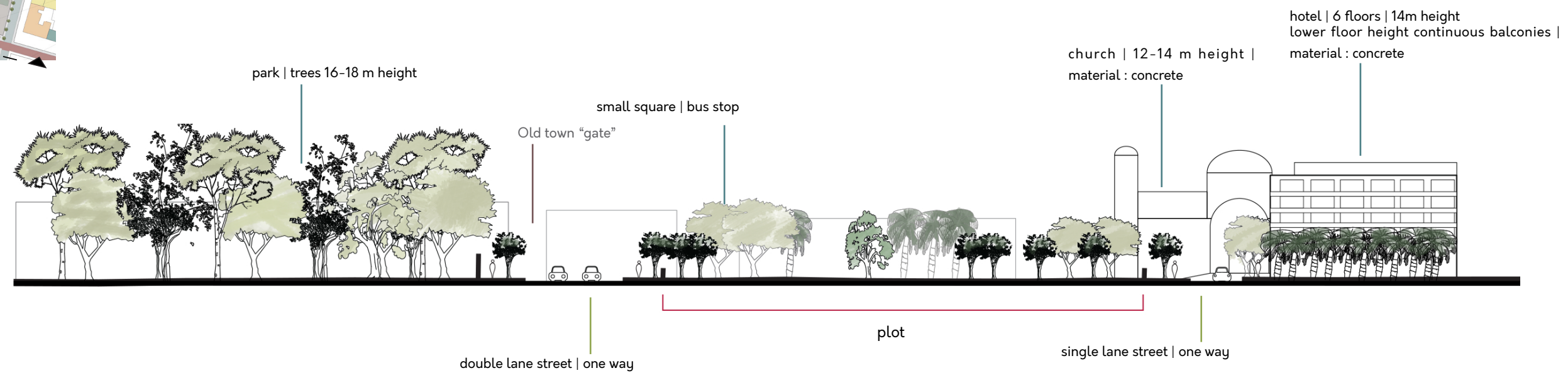
- Basic axes of car circulation
- Basic axes of pedestrian circulation
- Plot
- Public space
- Old town "gate"

Rethymno City & site location

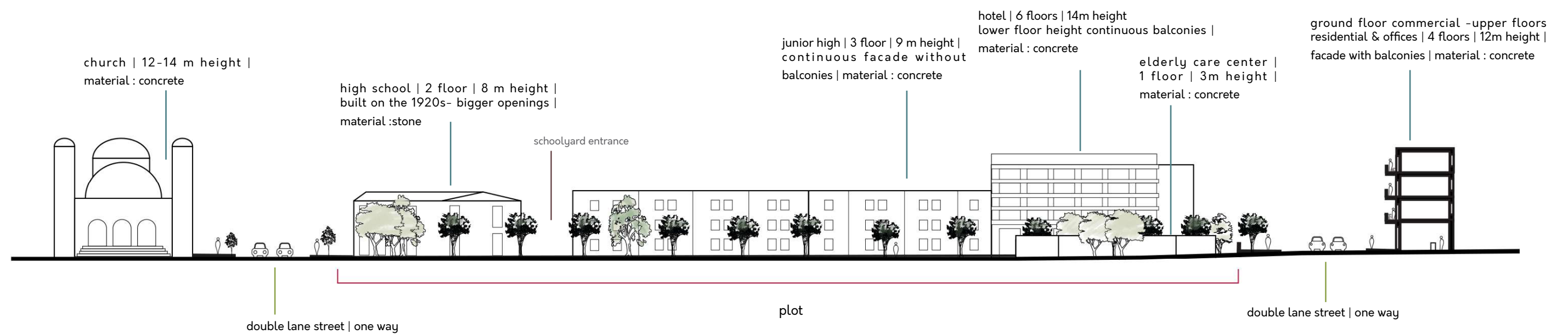


- Basic axes of car circulation
- Former kindergarten - currently elderly care center
- Buildings with commercial use on the ground floor and residential above
- Cafe
- Church
- School
- Hotel

Site plan



Diagrammatic North Section



Diagrammatic East Section

DESIGN PROPOSAL

The design proposal is a result of the implementation of the conclusions from the theory as well as the mapping of the site (climate, functions, surrounding environment). The design strategies are focused on climate adaptation, the sequence of private, common public space in the block and the building scale and the everyday meeting places.

The goal was to design a block which combine different functions which help build the community as well as to be adjusted on its local context and be flexible in future development.

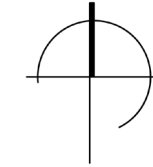
Program

30-40 apartments (students ,families ,elderly ,single)
 Cooperative office spaces
 Study cafe
 Small shops
 Common rooms for residents
 Common courtyard
 Storage
 Repair workshop
 Recycle workshop
 Farming area
 Water management
 Farming workshop
 Storage
 Parking
 Waste house
 Bigger common house when the plan is further developed

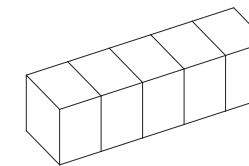
4.1 DESIGN STRATEGIES



Density- Proximity :smaller distances between clusters -bigger distances between common and public space.



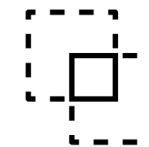
Orientation : towards south, protection from prevailing wind but also be aware of humans' activities (intimacy, safety, common space, public space)



Building in clusters : using less materials, creating proximity



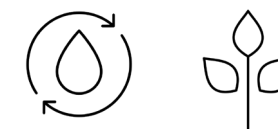
Passive techniques : clusters,high thermal mass, bigger windows towards the south-smaller towards the sun, cross ventilation



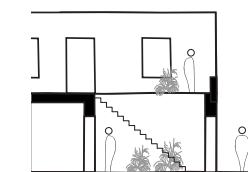
Levels of privacy : private common, public.



Shared values : Diversity of residents- mix use housing/ working/common spaces.

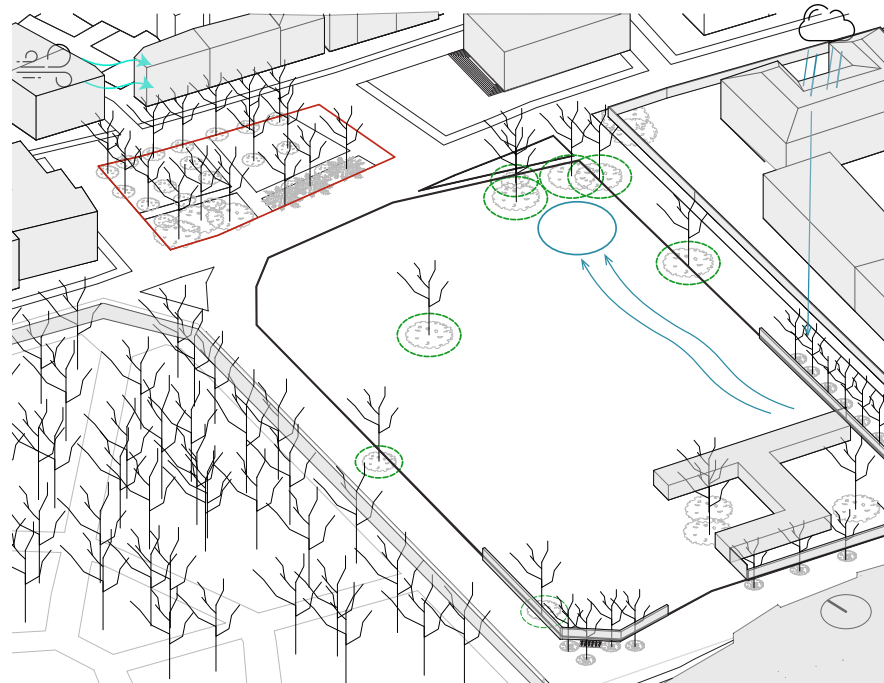


Green spaces, urban farming and water management, use them as tools to reconnect with nature and reduce footprint

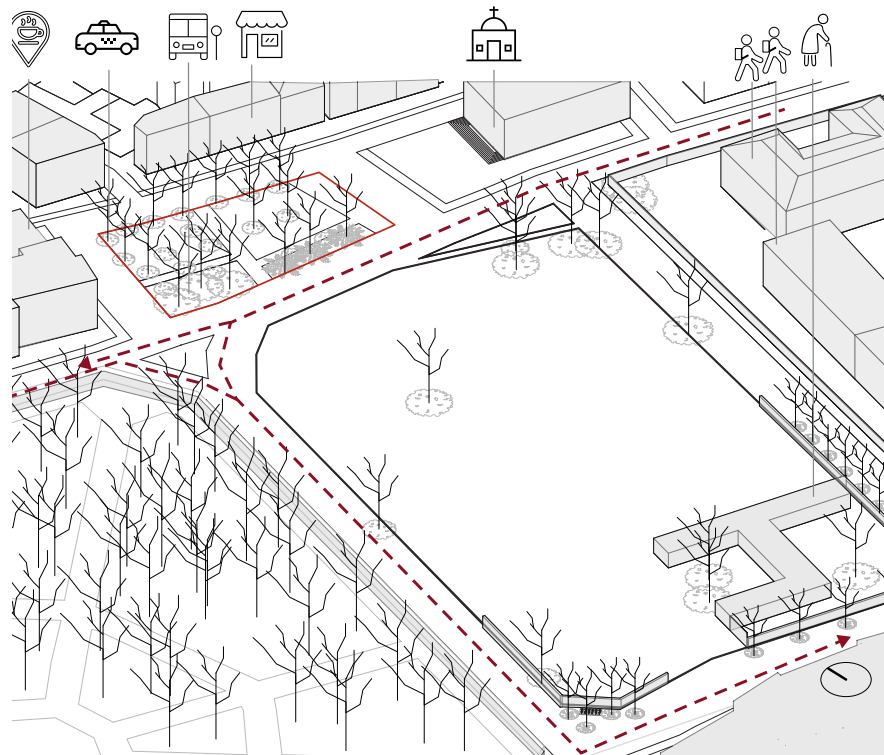


Common courtyard and entrances, used as transition spaces

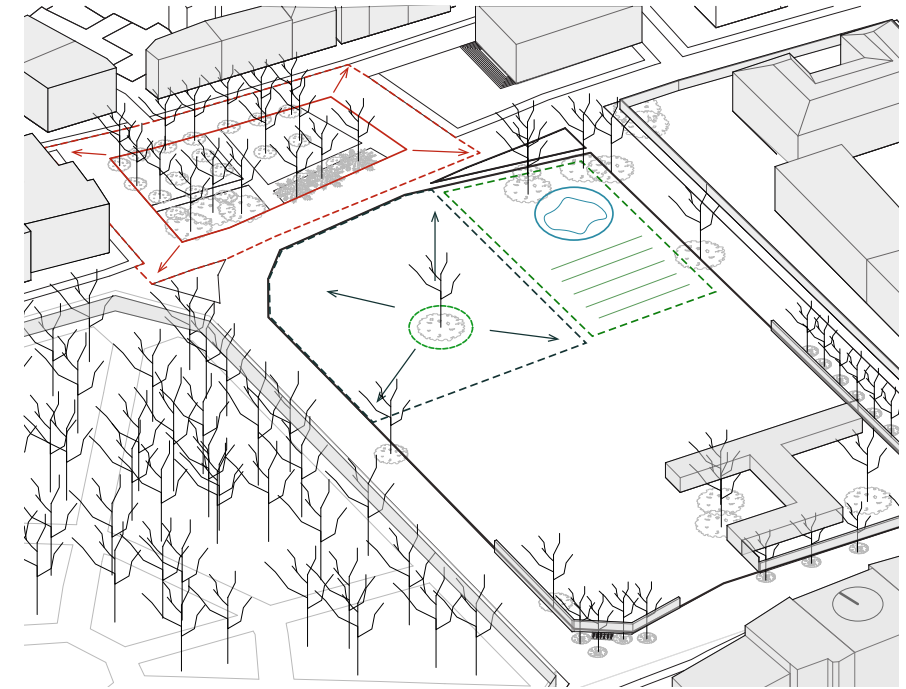
4.2 DESIGN PROCESS



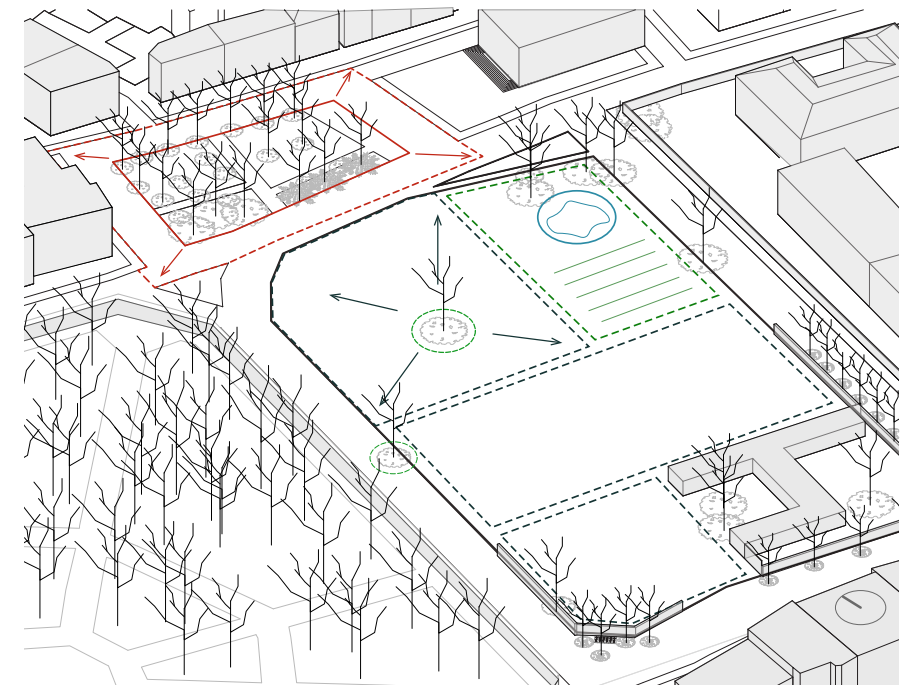
Natural elements : prevailing wind NW,
lowest point of site towards the north placement of water collection
Roots of trees leave- do not build in radius



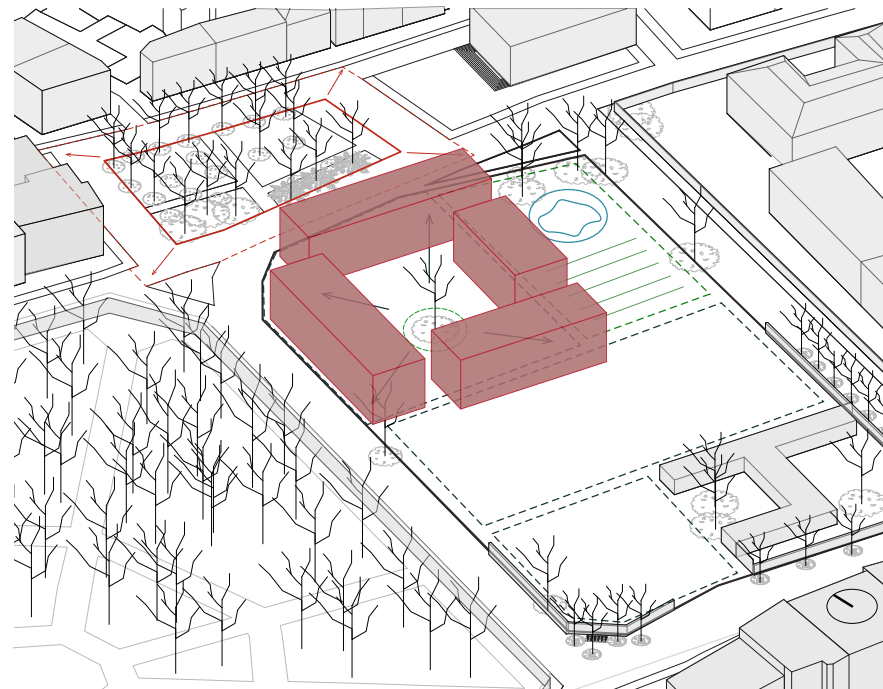
Surroundings functions & main car circulation



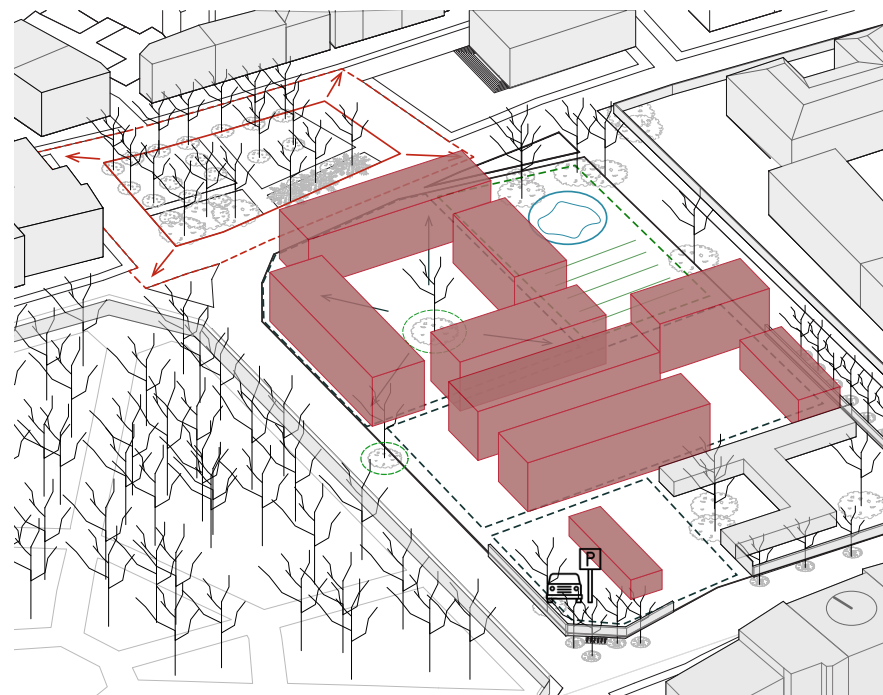
Develop master plan based on surroundings, expand existing square,
existing tree used as central element to develop "village square, lowest
point of the site water management and urban farming



Division of site in 3 zones for the possibility to be developed in phases

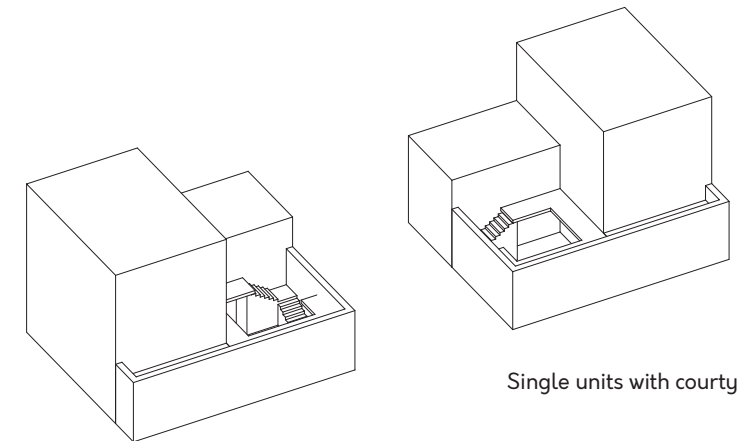


Placement of first cluster- organized around existing tree, north side facing existing square

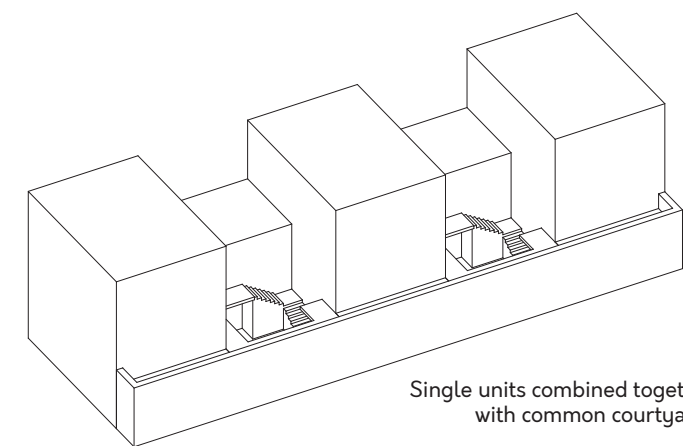


Master plan-placement of parking in the southwest corner-keep cars outside the block

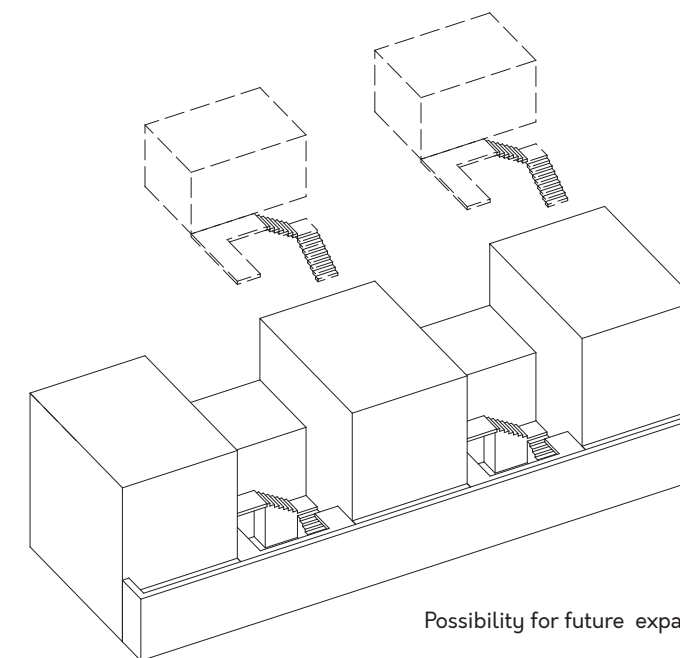
DEVELOPMENT OF BUILDING FORM



Single units with courtyard

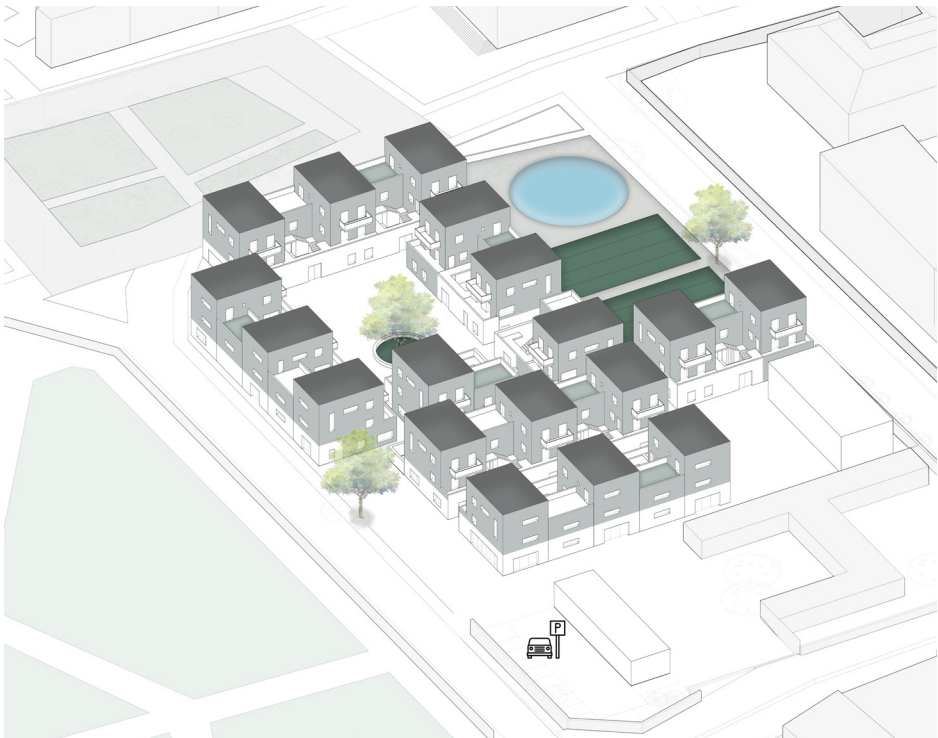


Single units combined together with common courtyards

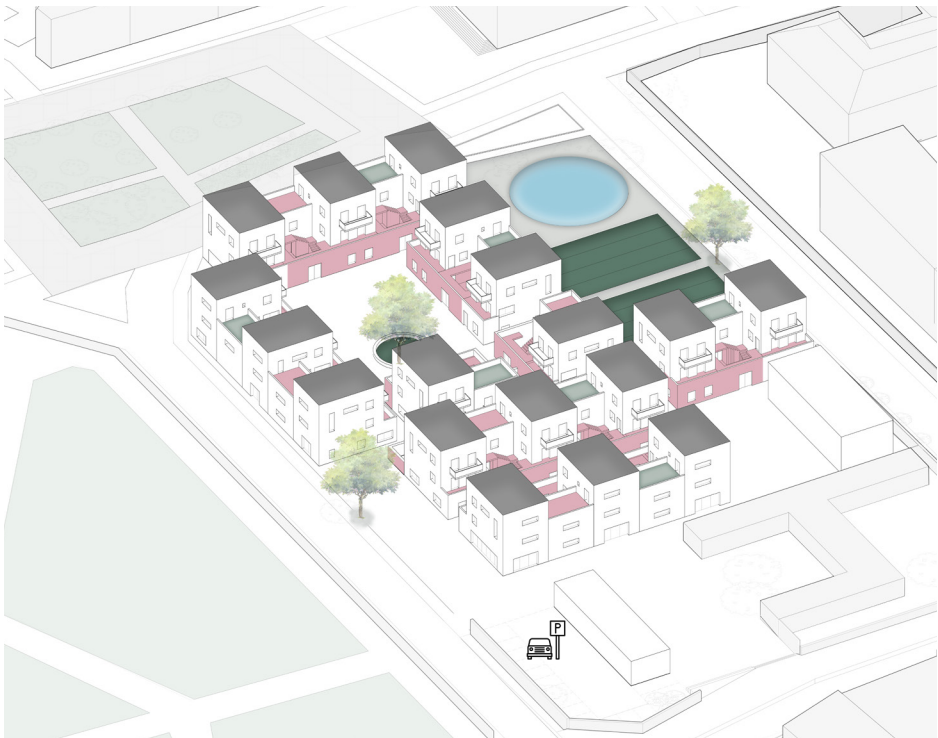


Possibility for future expansion

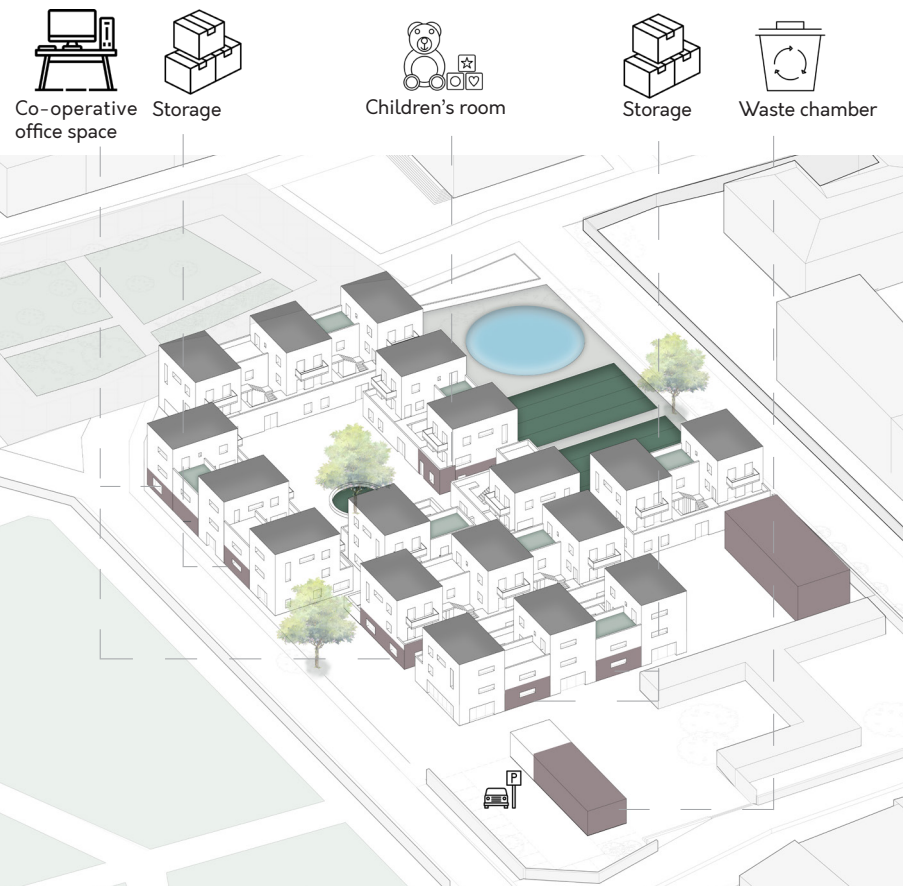
SEQUENCE OF SPACES



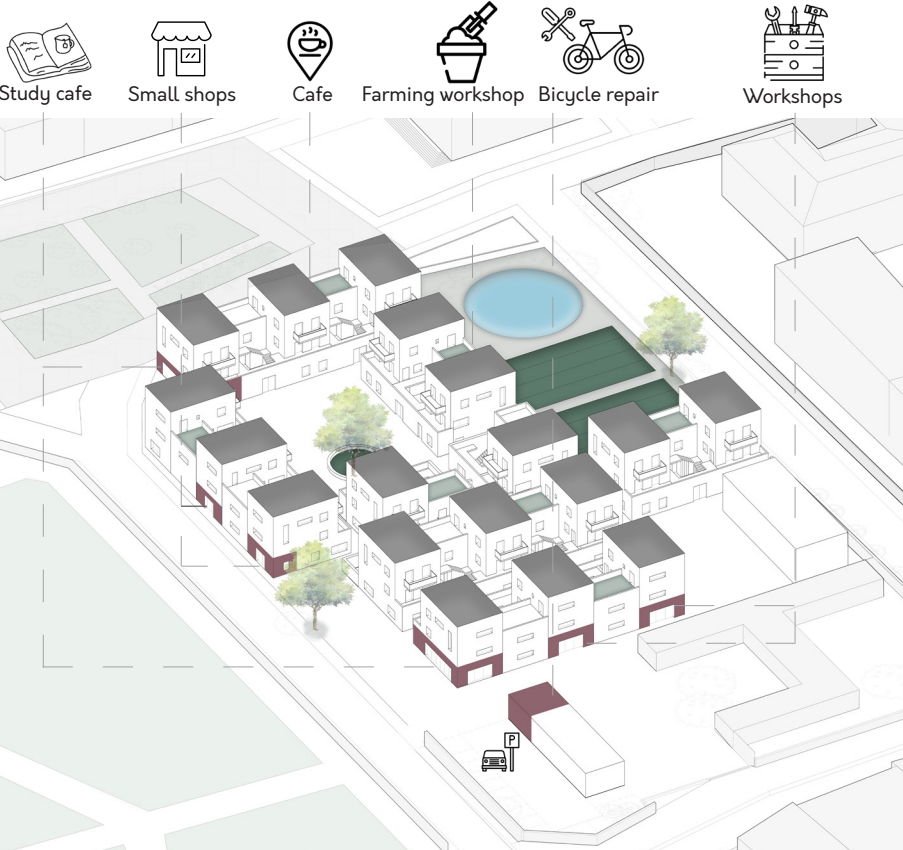
RESIDENTIAL



COMMON BETWEEN RESIDENTS IN THE SAME CLUSTER

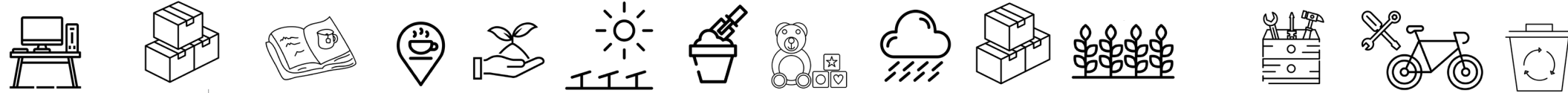















COMMON BETWEEN RESIDENTS



PUBLIC

AXONOMETRIC



- | | |
|--|--|
|  Common between residents in the same cluster |  Residential |
|  Common between residents |  Public |
|  Co-operative office space |  Café |
|  Children's room |  Study café |
|  Waste Chamber |  Farming workshop |
|  Storage |  Workshops |
| |  Bicycle Repair |

4.3 DRAWINGS

1ST PHASE

Program

- 5 clusters, 3.010 s.m.
- 24 adults
- 7 students
- 19 apartments (sizes from studio to 3bedroom)
- Cooperative office space
- Study cafe
- Small shops
- Common spaces for residents
- Storage
- Workshops
- Farming area
- Water management
- Farming workshop
- Storage
- Parking
- Waste house



Ground floor 1st phase

2ND PHASE

Final Program

8 clusters, 6.270 s.m. (in total)

38 apartments in total (plus 3 after transforming common spaces which were facing public space before the addition, sizes from studio to 3bedroom)

48-50 adults

14 students

Cooperative office spaces

Study cafe

Small shops

Common spaces for residents

Storage

Repair workshop

Recycle workshop

Farming area

Water management

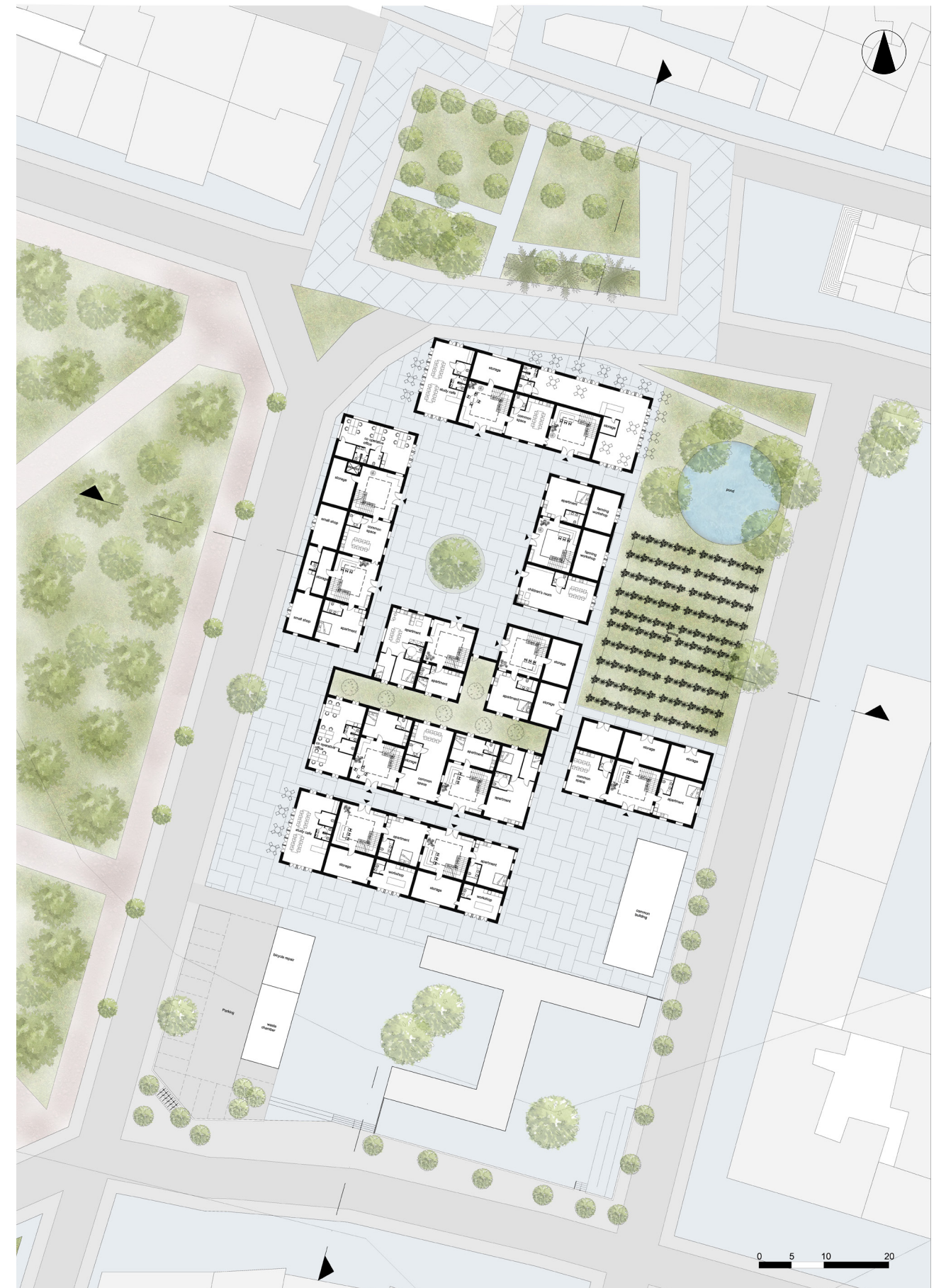
Farming workshop

Storage

Parking

Waste house

Bigger common house when the plan is further developed



Ground floor after 2nd phase



1st floor plan



2nd floor plan

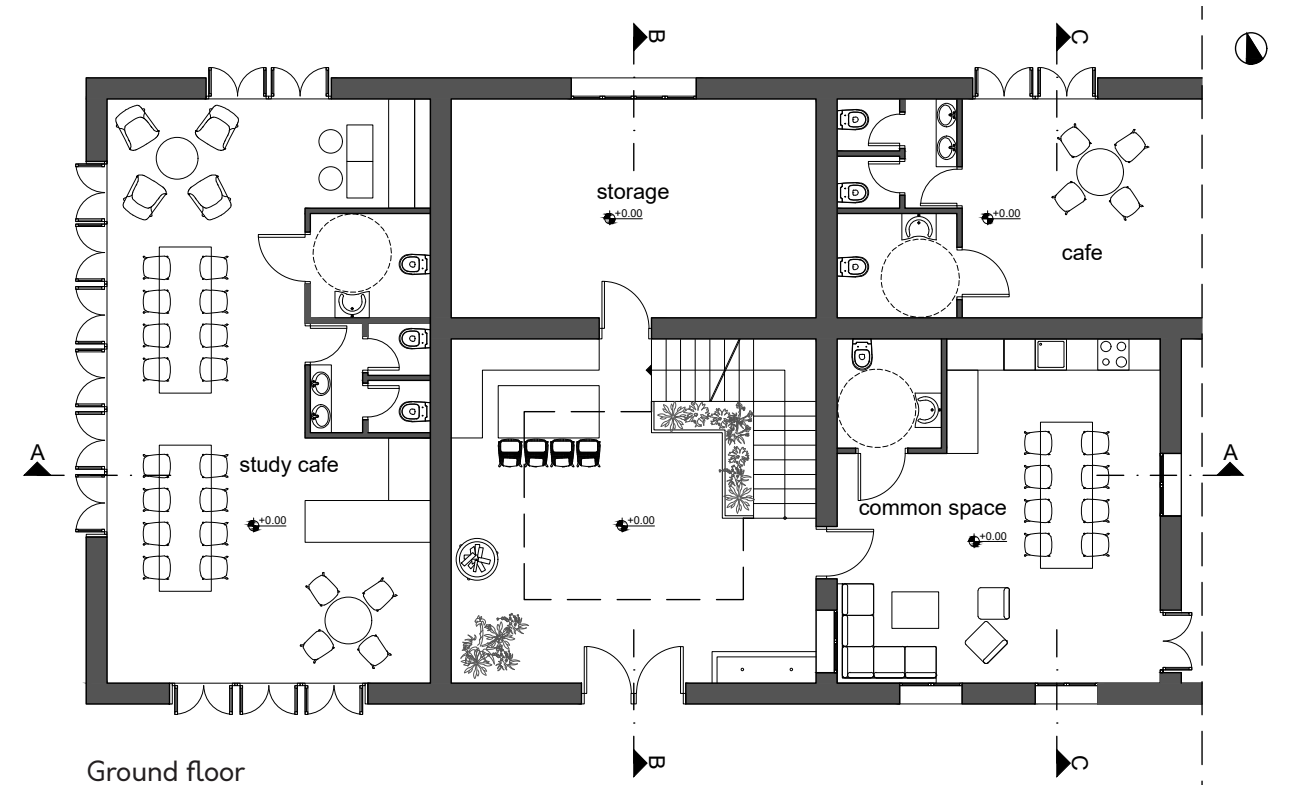
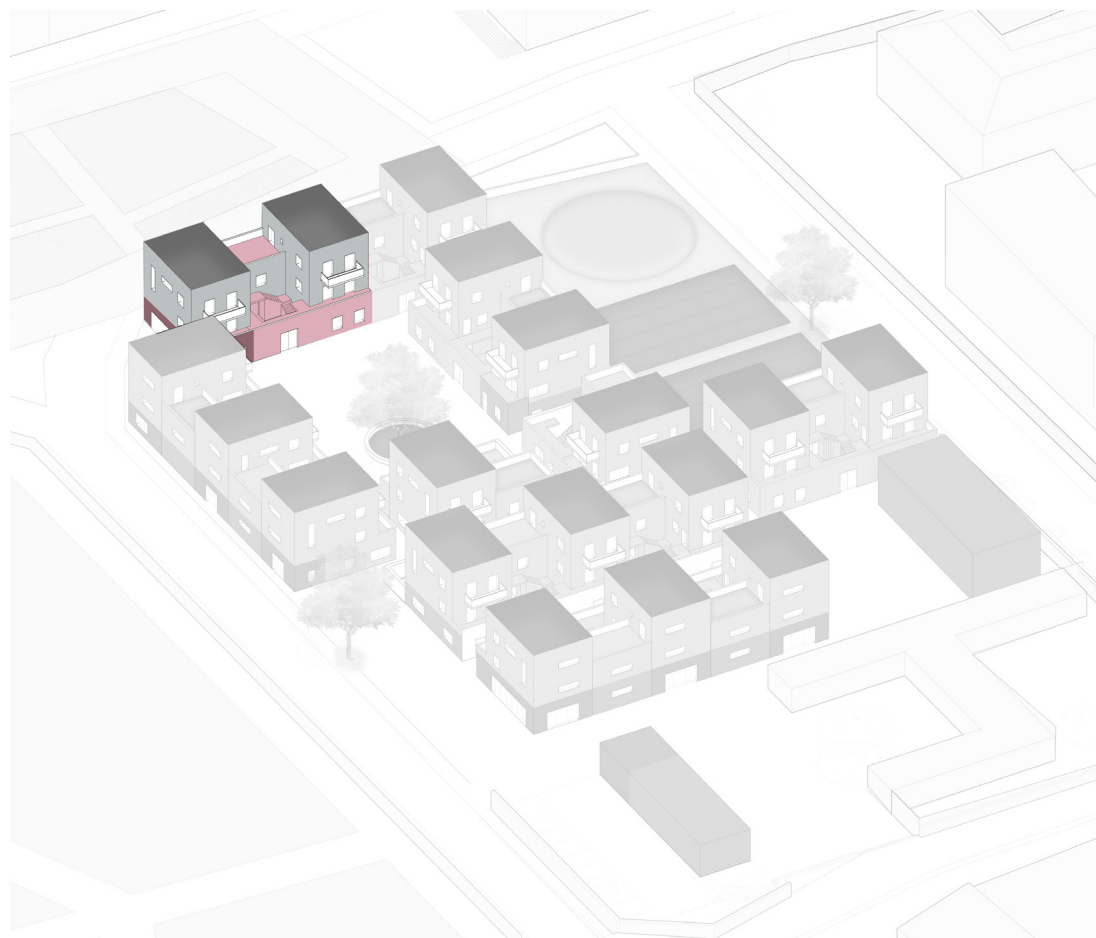


East Section

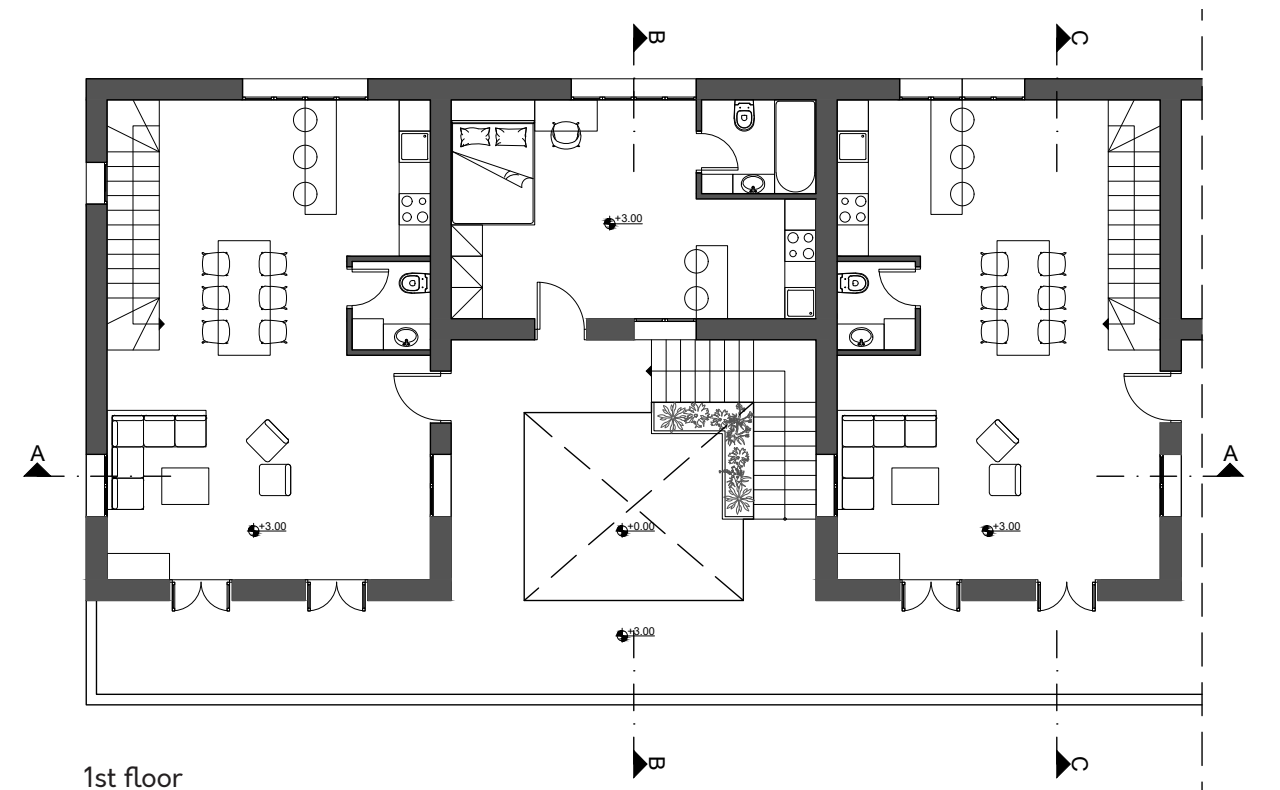


North Section

ZOOM IN TYPOLOGY OF SPACES IN CLUSTER

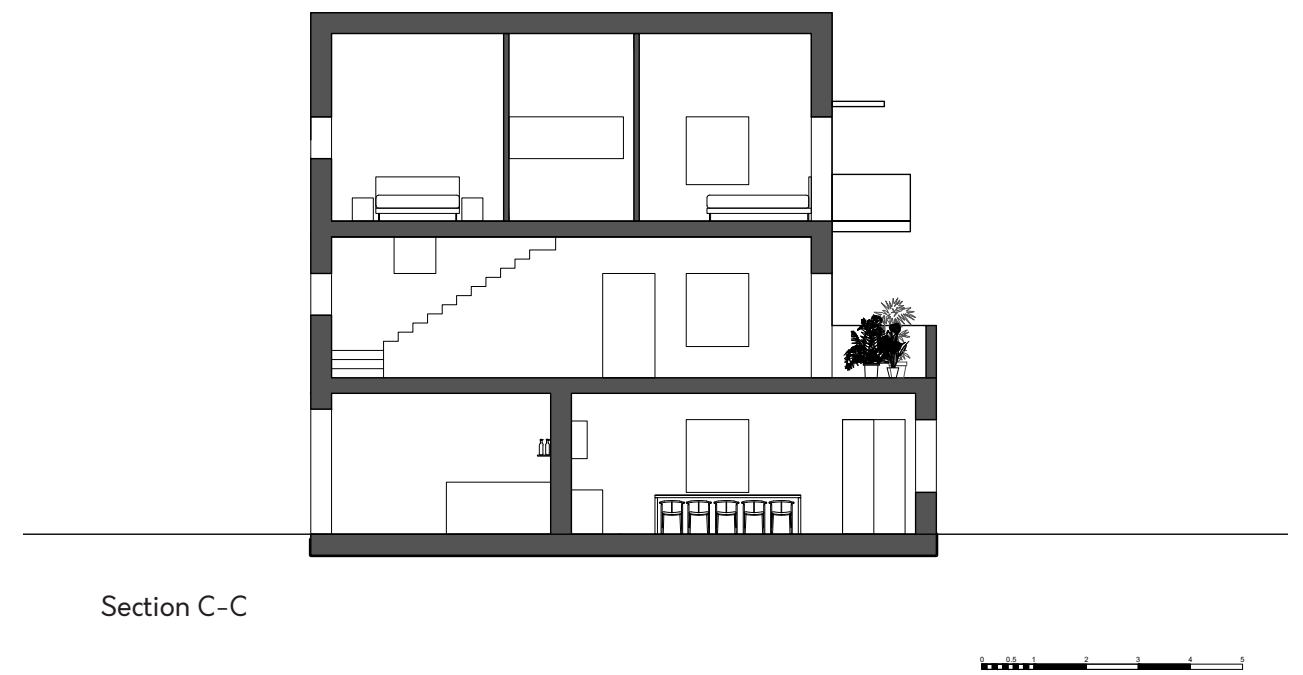
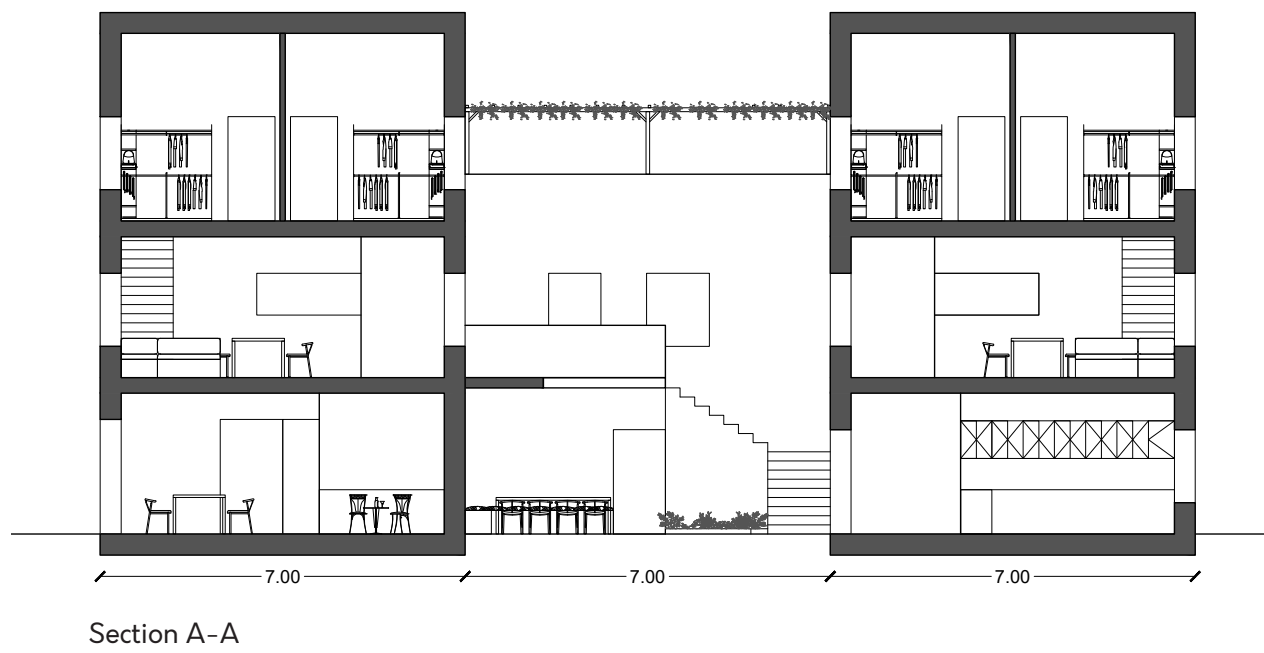
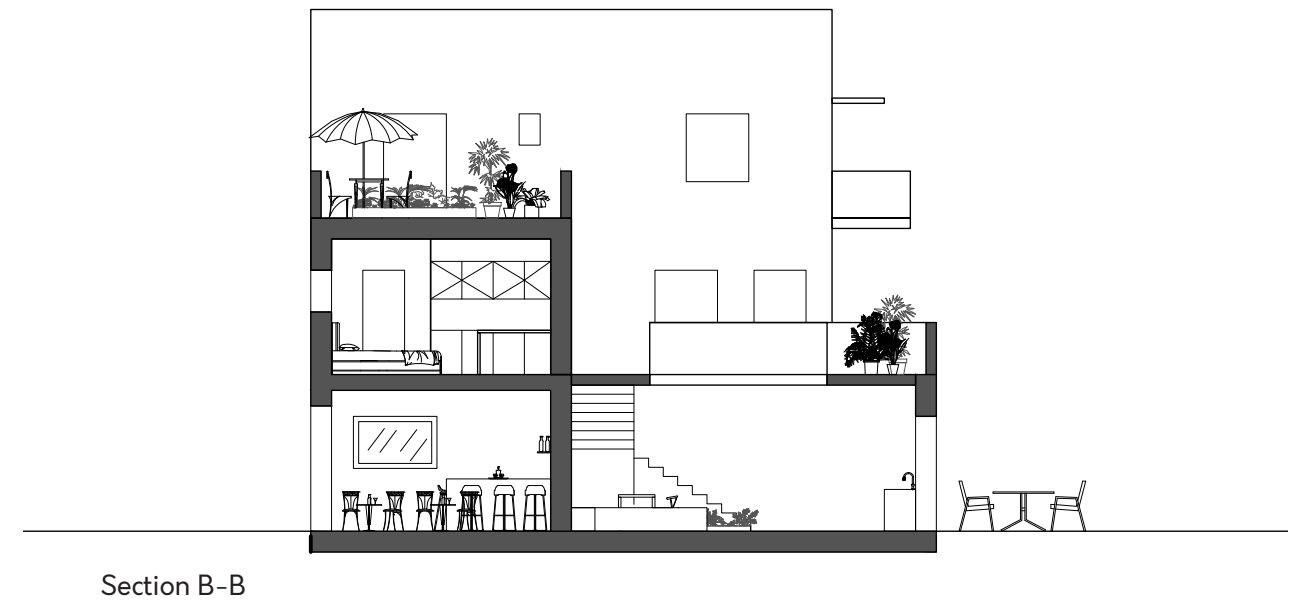
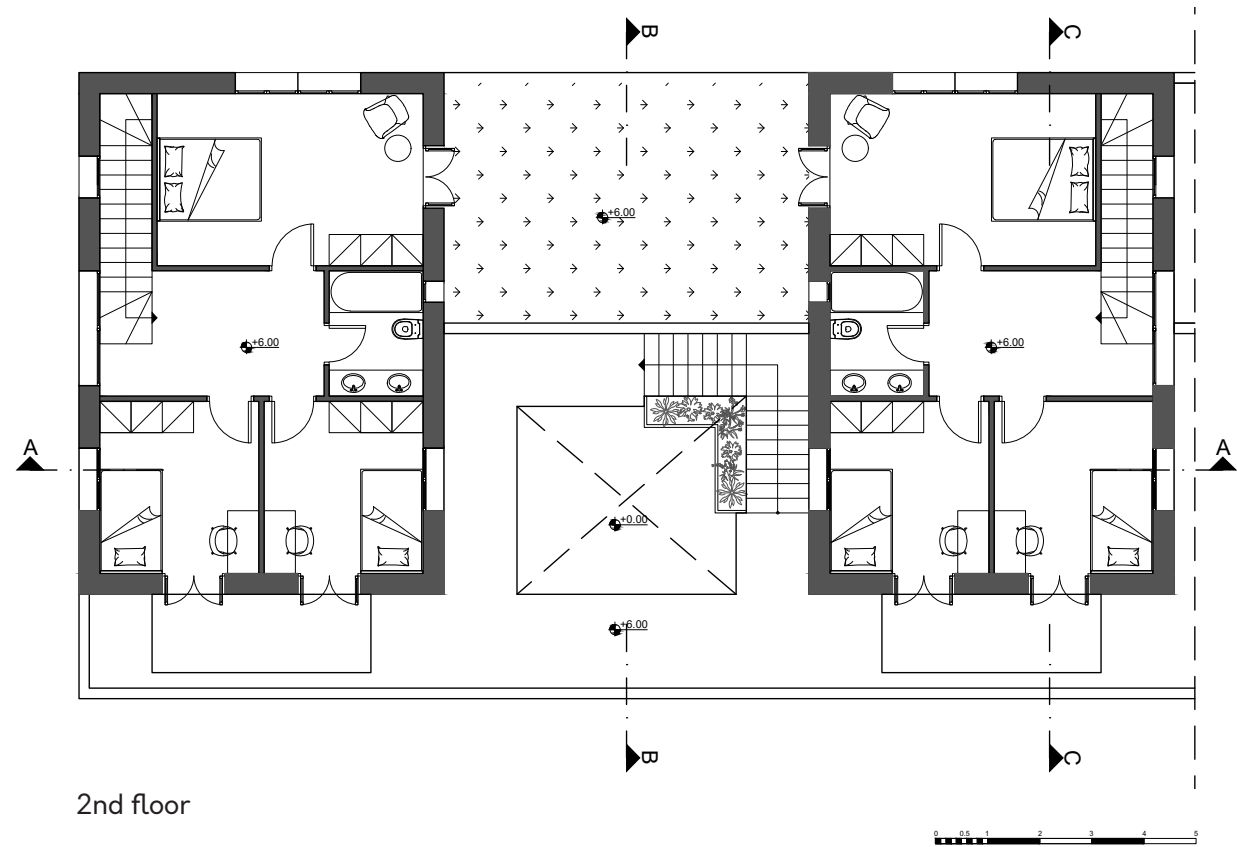


Ground floor

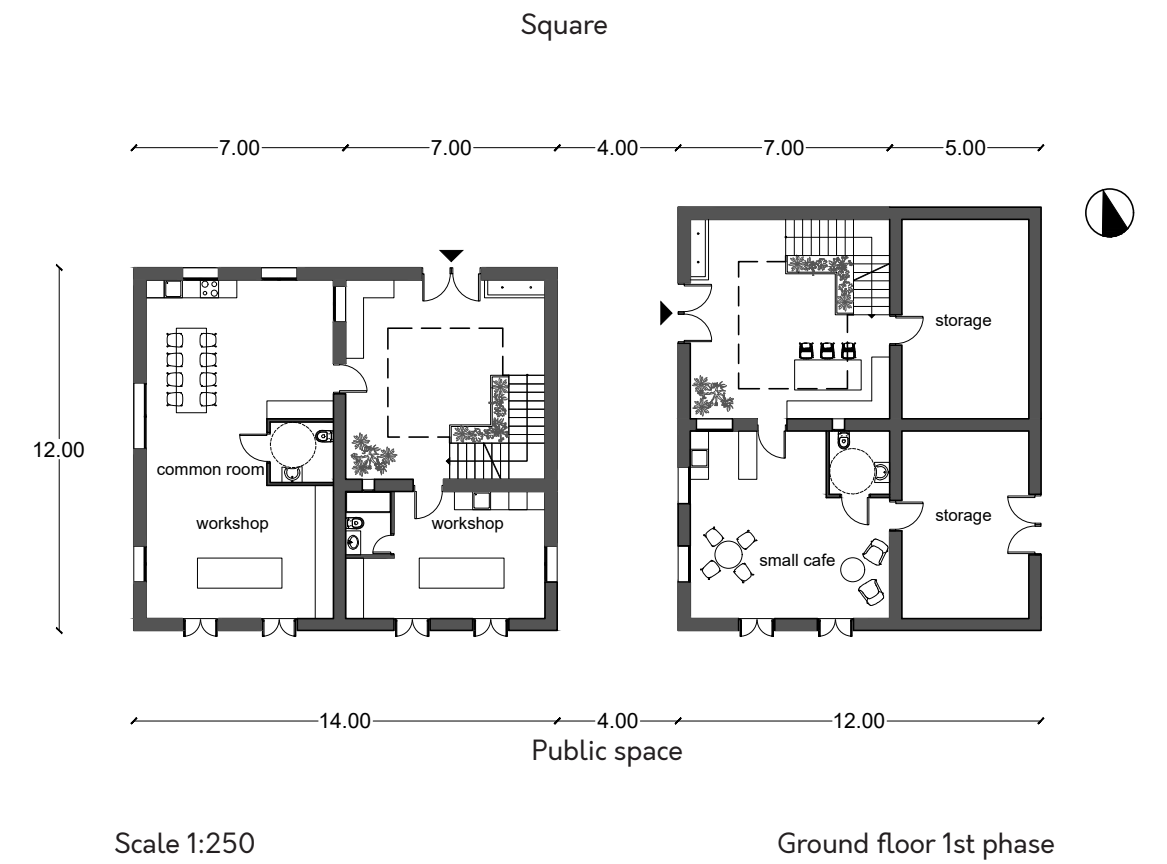
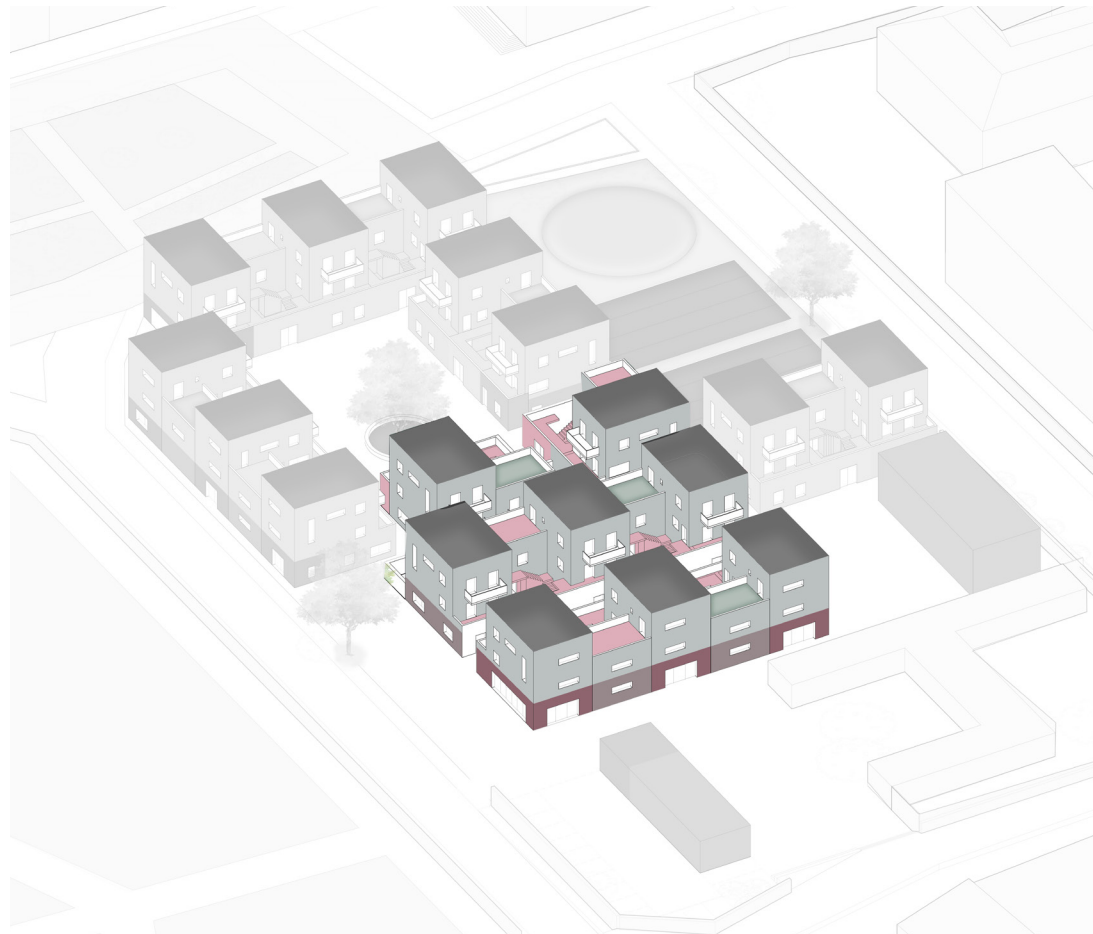


1st floor





ZOOM IN
CONNECTIONS IN CLUSTERS AFTER 1ST PHASE



Second phase

Square

Functions change and become private

Common backyard

12.00

3.00

12.00

Narrow street used as an extension of common space

7.00

7.00

7.00

7.00

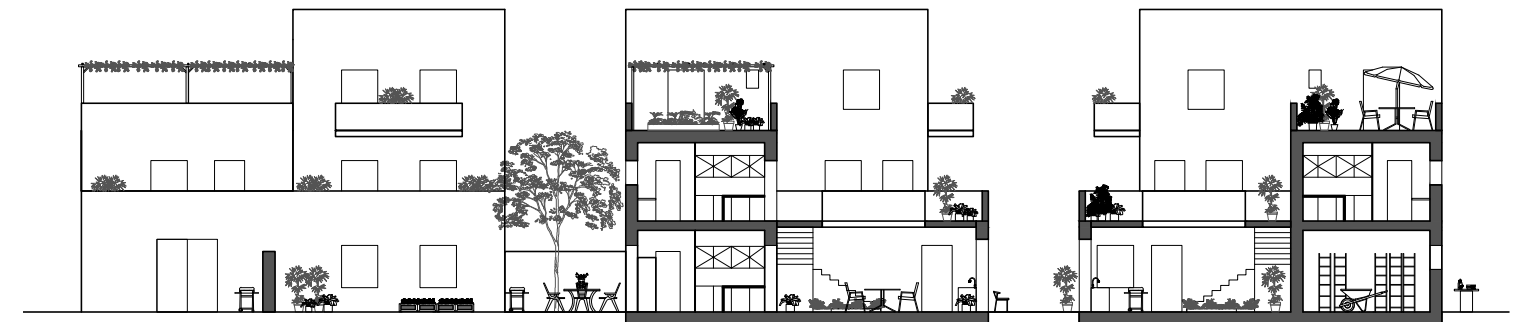
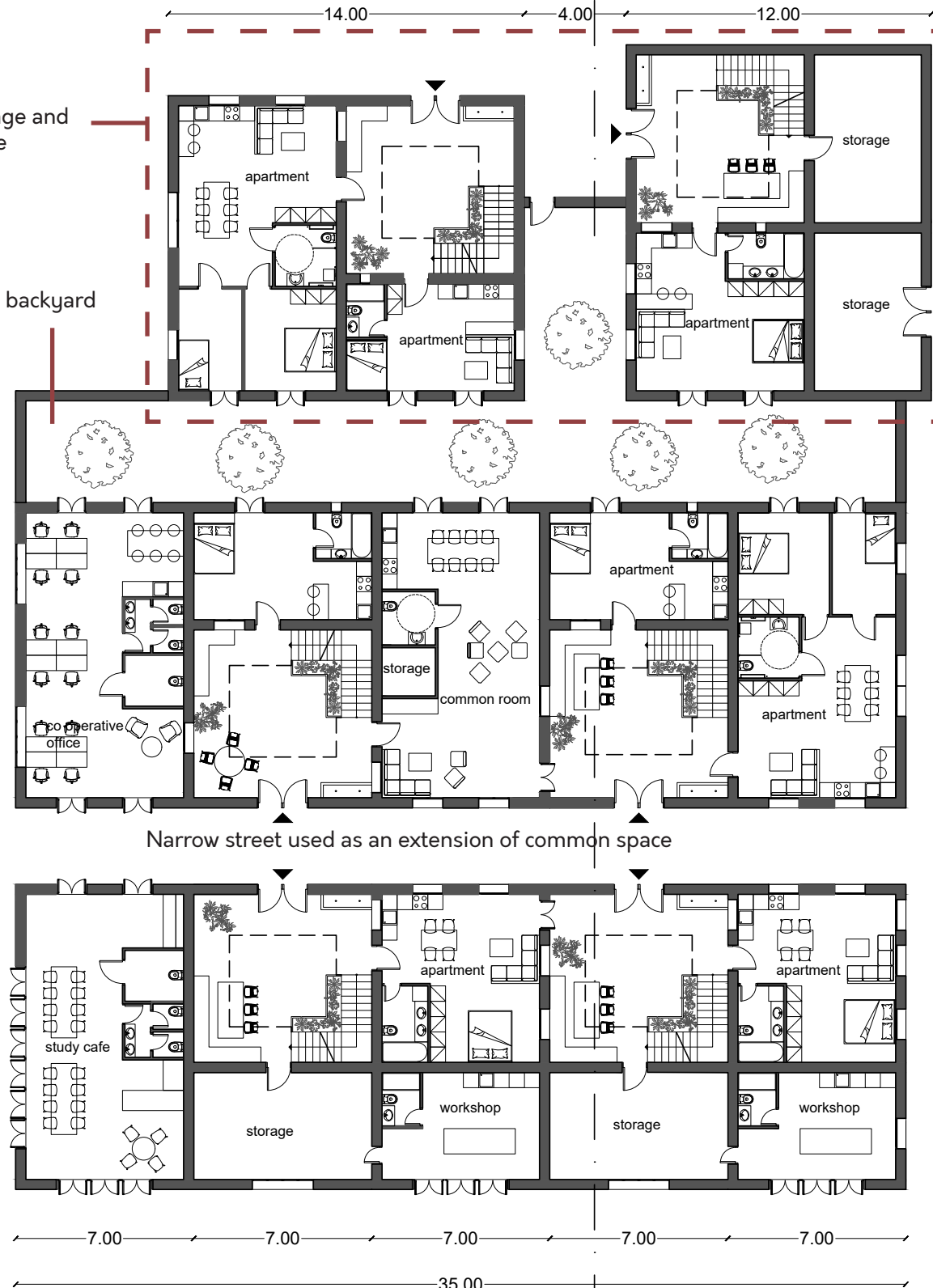
7.00

35.00

Public space

Scale 1:250

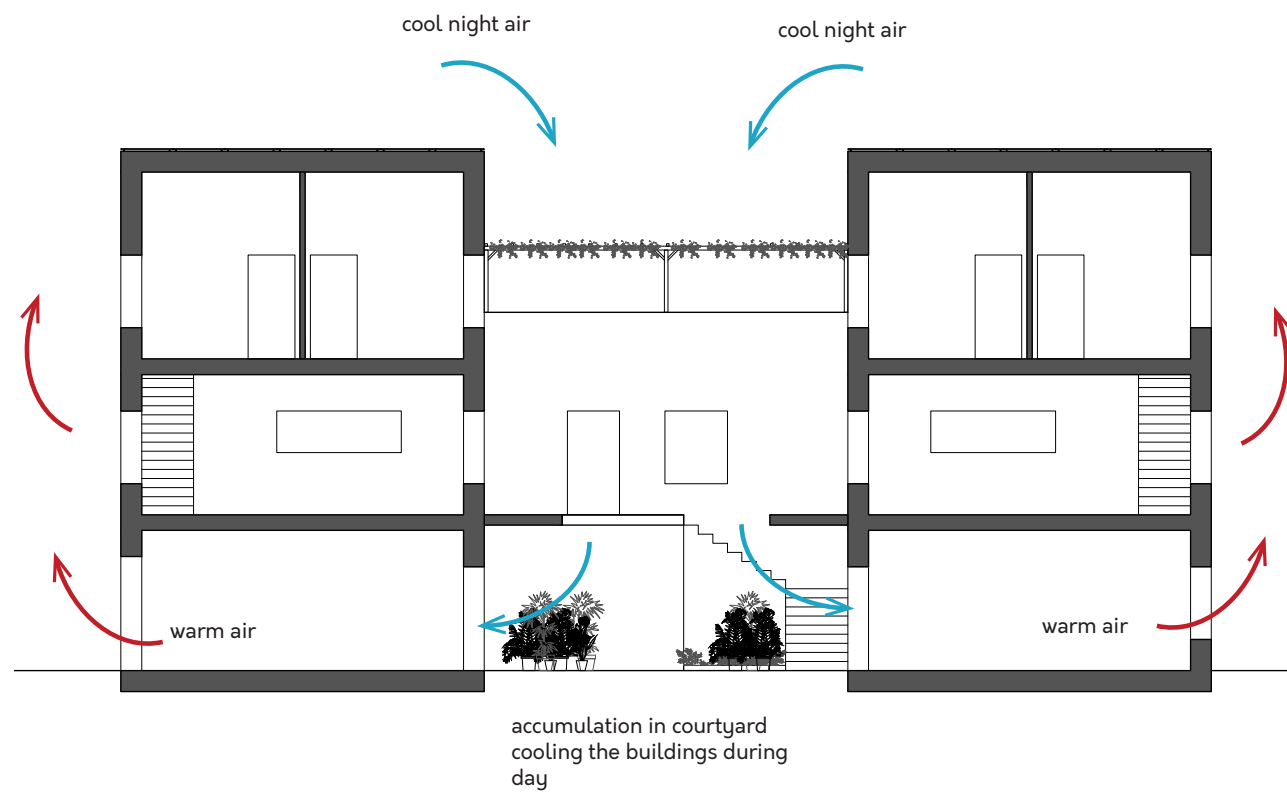
Ground floor



Scale 1:250

Section

4.4 PASSIVE STRATEGIES



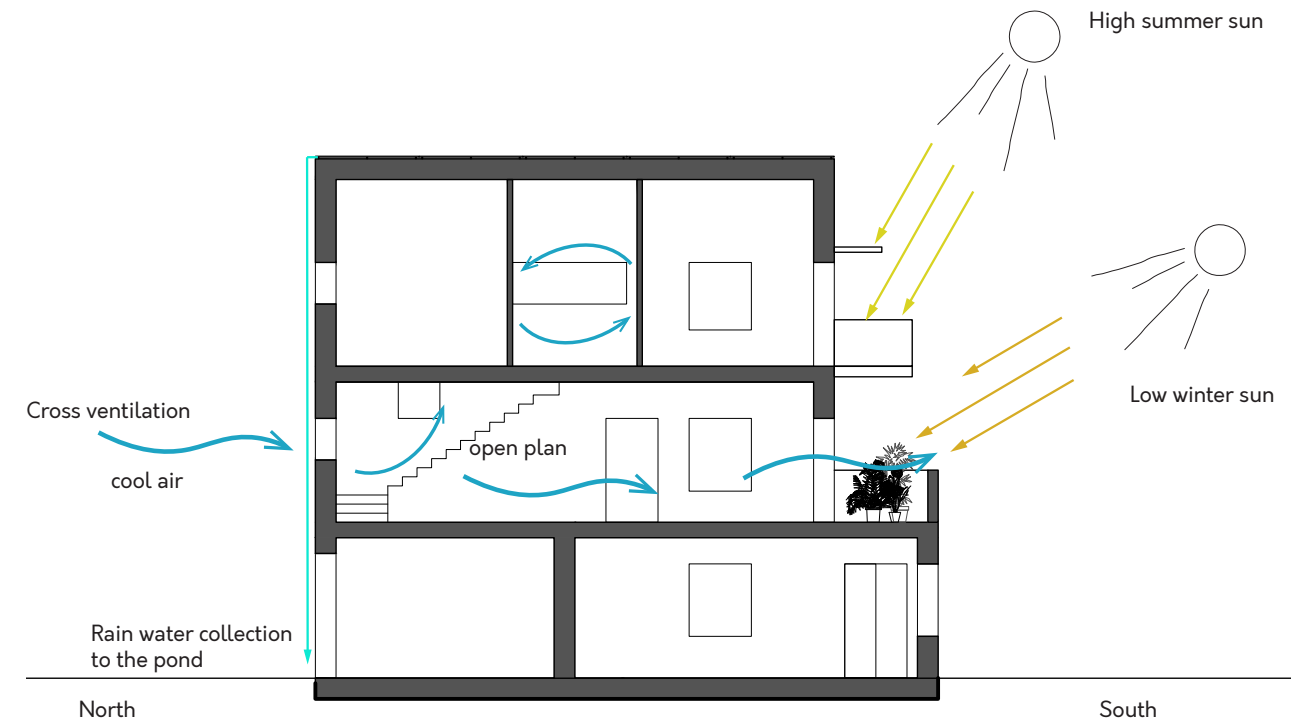
Cooling

During summer the cold night breeze enters the courtyard and then is released during the day, cooling the buildings. The use of plants and water in the courtyard helps with evaporative cooling.

PV's
Use of PV's for energy production (total production for the whole block 312.151 kwh/year approximately)
Also prevention of roof overheating and a good temperature preservation during summer.

Shading

Use of balconies and overhangs for shading in order to avoid overheating from the high summer sun.



Cross ventilation

Use of open plan and windows location in opposite directions to enhance cross ventilation

Water management

Rain water collected from roofs and directed to the pond- use for farming

Direct heat gain - high thermal mass

Use of big openings towards the south to allow low winter sun to enter. The sun fall upon flooring surfaces characterized by high thermal capacity. The heat is stored and released when the temperature drops.

4.5 ILLUSTRATIONS



In Between



Square



Courtyard



Backyard

REFLECTIONS

This thesis aims to turn to the past to find the values which made our ancestors live sustainable by default, and to re-introduce those values to change the way we form the urban environment today.

Through the design process, a lot of questions emerged. How do we create a “contemporary vernacular block” that integrates with its surroundings and avoid the creation of a “vernacular island”? Is vernacular architecture enough to make us live sustainable by default? How do we create interactions between different social groups and who is responsible for the management at the end? What levels of freedom give to the inhabitants to transform their own space? Some of the questions are answered and some are subject to further discussions.

In general, it is possible to design sustainable infrastructures which use guidelines from vernacular architecture, but the hard part is to integrate these infrastructures in the urban context. Each case should be examined in detail regarding the setting and the possible connections with the existing environment in different scales, to avoid the creation of separate cells in the city.

It is not possible to use vernacular principles without being aware of today’s world factors: technological development, virtual world, climate change, modern societies. This thesis does not suggest to go back in time but to use the past as a tool which can be combined with current knowledge to design better infrastructures and promote social cohesion.

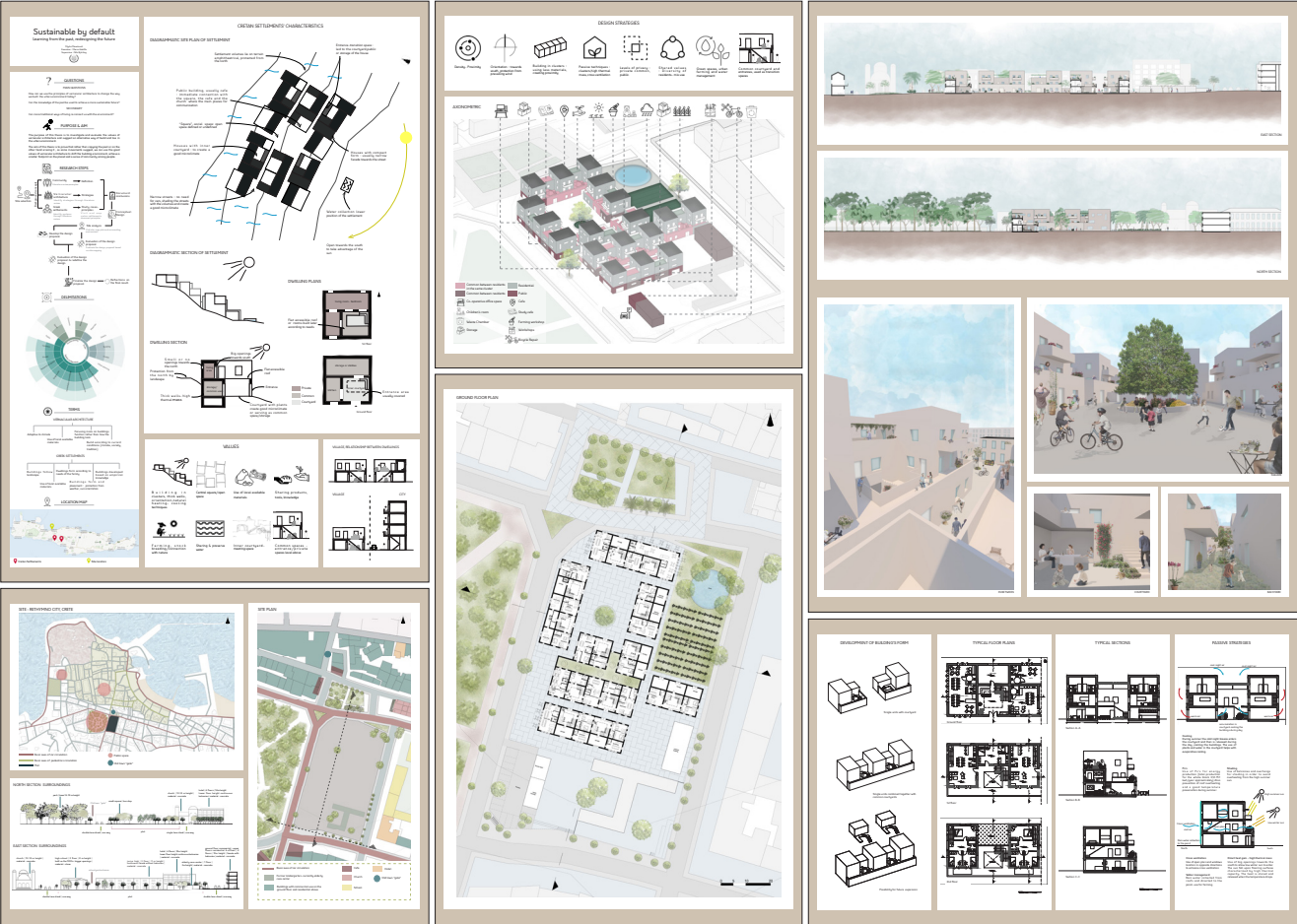
The values of vernacular architecture can show us a way to live a bit lighter on the planet, it can be the base to start being more conscious about our surroundings, but it is up to us to decide if we want to follow these guidelines and in what extent. Architecture can be used as a tool to mobilize us towards that direction.

Architecture can promote social exchange and connectivity but at the same time create further segregation between existing and new infrastructures. Regarding this case, it can define the openness of the community towards the city. There is a danger of formation of a static close “village” which is not open towards new individuals or further development. That is a part that needs further examination as well as how and who the decisions take place in the community.

Vernacular architecture can re-teach us how to inhabit a place, but we need to be open to this knowledge. This concept is not going to be accepted by everyone. Many people are satisfied by the anonymity that the urban environment provides and annoyed by the social control of small communities. On the other hand, many people are also lacking the sense of belonging and a network that they can rely upon and feel included. I believe that if this concept is further examined and applied local-based, it could cover, at some levels, the needs of both groups. As it is mentioned before that is a subject that needs further discussion.

The design proposal showcases that we can build sustainable infrastructures with a focus on inhabitants and the local context. We can use vernacular architecture as a guide which will help us to make healthier cities. There is a need to create spaces which encourage the transition between private, common and public and the in-between relationships. To understand the sequence of spaces, to rediscover the “natural way” to inhabit a place and not just to exist.

OPEN SEMINAR



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Figure 3. Biddulph, Mike (2000) Villages Don't Make a City, Journal of Urban Design, 5:1, 65-82, DOI: 10.1080/135748000112981

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Figure 28. Climate Consultant software, ©2008, 2014 Regents of the university of California, EPW climate file imported by http://climate.onebuilding.org/WMO_Region_6_Europe/GRC_Greece/index.html

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