Building a Community Rooftop Network:
Design Prototypes for Taipei

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Abstract

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Abstract

This thesis is an exploration of residential area rooftop space in Taipei, Taiwan. The rooftops now are mostly occupied by private owners or left vacant. There are possibilities to connect the rooftops for people live in the apartment buildings and potentially bring a new social, open space network in the neighborhood. My intention for the use of thesis is to be an outline of manual which people could adapt this thesis to their neighborhood occasion. My literature review covers three parts: first, the rooftop related literature such as the benefits of using rooftops and general challenges of rooftop; secondly, the design principle for residential area and lastly, the community process.

My design framework uses questionnaire and observation to layout a general way to document the rooftop space, to have a list of potential programming and to develop network design strategies. Next, I propose three prototypes according to different percetage of gardening use and the needs from the communities: 60% gardening use, 40% gardening use with needs from families and kids, and 20% gardening use with primarily leisure and social events. Finally, in terms of building a network, phasing is necessary: starting from node rooftop and connect to the ground and adjacent rooftops.

Table of Contents

List of Figure and table

Chapter One: Introduction

Taipei is my home town and I live on the top floor with a rooftop garden. Rooftop is where my family relaxes, excercises, gardens and barbecues. However, most of the rooftops are neglected leftover spaces in the city and create some problems such as illegal extra structure on the roof, less aesthetic quality and urban heat island. Thus, I want to create a design framework for future rooftop network development to mitigate these problems and advance potential benefits.

Figure 1-1: Issues related to rooftop and community open space.

Intention

"Take a look, the papaya blossoms!" "Come up to see the sunset together!" "Can you smell the tuberosa? It smells just like perfume!" This is a day of my rooftop life. I lived on the top of our apartment with an extra sixth floor. My mother has a rooftop garden that will have flowers every season. We built flower beds together. I used to have two dogs live there, a cat, turtles and fishes. We played with the cat together. We often have family events on the rooftop. Sometimes people will ask us if they can use the rooftop for barbecue. Rooftop, for me, is a place for gathering, for imagining, for relaxing, for producing, for sharing and for enjoying.

There is also a need for more community open space in the high density city, and the rooftop is a great way to increase the community space. However, looking around, only a few people are regularly using the rooftop space. Most of the rooftops are either privatized or vacant. Re-utilizing rooftop space is a great way to increase community space in the city as well as to increase the amenity of the community. So, how do people use them? Why do those spaces stay underutilized? What are the possibilities for those spaces?

Rooftops serve as the canopy of a city. Through many media, we know there are several benefits from building a green roof. It could absorb energy from the sun, collect water from the sky, increase biodiversity and create social space for people. Although we cannot bring nature back to its origin, we can use environmentally, systematically design to mitigate the problems. Re-utilizing the rooftop to decrease the concrete surface in the city and to improve the environment quality are the primary goals.

Thinking about how to reuse rooftop space is my original intention. From my experience, the individual building rooftop is a pretty small space. By connecting individual rooftops with each other, the space could be better utilized and potentially solve the exist fire escape issue. This is also a solution to solve the illegal extra structure issue by creating a negotiate avenue to enhance the structure safety check and visual quality of the city as a whole. Further, rooftop network is also a great chance to build a larger sense of community. Thus, I see the rooftop as a networking tool, providing people a space to gather, just like my family does.

Photos at left are taken from higher buildings. The top one is the rooftop of old apartment that already has a form of rooftop network which gave me faith that the idea of rooftop network is possible. The middle photo shows newer high apartments that has built rooftop garden as required by the city in recent years. Both of them are a cheerful sign for me to take this rooftop journey on and explore the parallel world. The bottom image is from an artist work and shows the characteristic of mix types of rooftops in Taipei.

Figure 1-2: Spontaneous built rooftop garden by residents that has potential to become spatial and functional connected rooftop network.

Source: Hai, Chen. "Rooftop Garden." 2013. JPEG file.

Figure 1-3: Rooftop garden on the new high rising apartments required by new regulation.

Source: Hai, Chen. "Rooftop Garden." 2013. JPEG file.

Figure 1-4: Art work shows the diversity and characteristic of rooftop in Taipei.

Source: http://www.redhouse.org.tw/Goods/Goods.aspx?id=5318&sub-id=5913

Research Questions

My main research question: How can rooftops be designed to increase community interaction and supports a livable environment?

My sub research questions are:

1. What are the factors that support or are barriers to rooftop uses?
2. How do people want to use the rooftop space?
3. What are the differences between building a community space on the ground than on a rooftop?
4. How can a rooftop system be designed to invite people to use it and serve multiple purposes?

Factors of designing and using residential building rooftop in New Taipei City context

The residential area in Taipei is the focus of thesis. Here is some background information to start the journey exploring different factors that might influence the future design and uses of the rooftop, including mixed use building form, typical apartment design, unlicensed one extra story and ownership of management of the buildings.

Figure 1-5: Mixed use commercial corridor

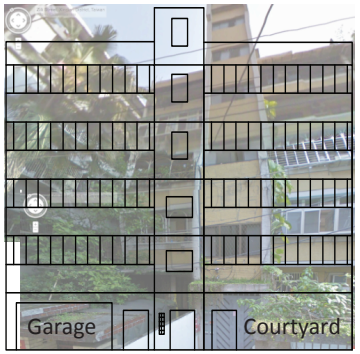


Figure 1-6: Typical apartment design built in 1980's

1. Mixed use

On a local commercial corridor, all buildings are mixed use: commercial on the ground floor with residential units or offices on the upper floors. In the residential alleys, buildings are mostly residential use but with some exceptions on some intersections. Those intersections often become an informal gathering space in the community, especially where venders or shops have staircases. People will sit on the staircase or chat with vendors for some time. (Figure 1-5)

For rooftop networks, buildings with or without commercial use could have different design strategies, however, this is not in the scope of this thesis. The cooperation between the shop and rooftop can have a larger range of programming potential. Also, for more public buildings, who the garden will be accessed by is the first thing to consider at the beginning of the whole project (Osmendson, 1999).

2. Typical apartment design

The physical form and the consist of resident are important factors for future rooftop use in terms of security issue, negotiating process and programing. A two-sided, five-storied apartment is the typical residential building

in Taipei city. There are ten or more family units living in one set of apartment. Front yards on the ground floor are usually used as garage or courtyard space. For rooftop networks, door-by-door visits are essential for developing the whole plan for the rooftop. It is not easy, especially with extra unlicensed stories or with renters.

Another type of residential building is called “tau tian shu” which means there is only one ownership throughout the building from bottom to the roof; the building is owned and used by one family and in the earlier established neighborhoods, the building is usually three to four stories. In this case, the negotiation process is easier than previous apartment types. (Figure 1-6)

3. Unlicensed one extra story

One of the most challenging issues of rooftop use is the unlicensed building of an extra story on the top of the original building structure. Based on “A study on the Illegal Light Gauge Steel Roof Construction in Taiwan” (Hong, 2009) and the observation within the chosen site, three types of extra stories are identified: remodel, cover and hybrid. (Figure1-7) “Remodel” means that the original building structure was changed by adding actual building material structure whereas “cover” means only adding a shelter structure. “Hybrid” means building an actual structure as well as an added shelter structure, mostly for blocking the heat from the sun. The combination of these three types on the roof creates an interesting topography and space, which is not frequent elsewhere. Many of the research as well as lay people tend to favor demolishing all the extra floors to protect the beauty of the city (楊昇樺, 2011). However, I propose to preserve the existing condition and to create a diverse use network on the rooftop.

4. Ownership and management

Ownership of the residential apartments is an important factor , especially for deciding the design process of the rooftop network. Ownership for residential apartment buildings are mostly one unit owned by one individual family and one apartment building has ten or more units.

The management types for different units of apartments include gated communities, communities with guards and individual management. The management mode greatly influences the process of designing a rooftop network. For example, gated communities have more efficiency for advertisement and with their existing committees, discussion is easily conducted.

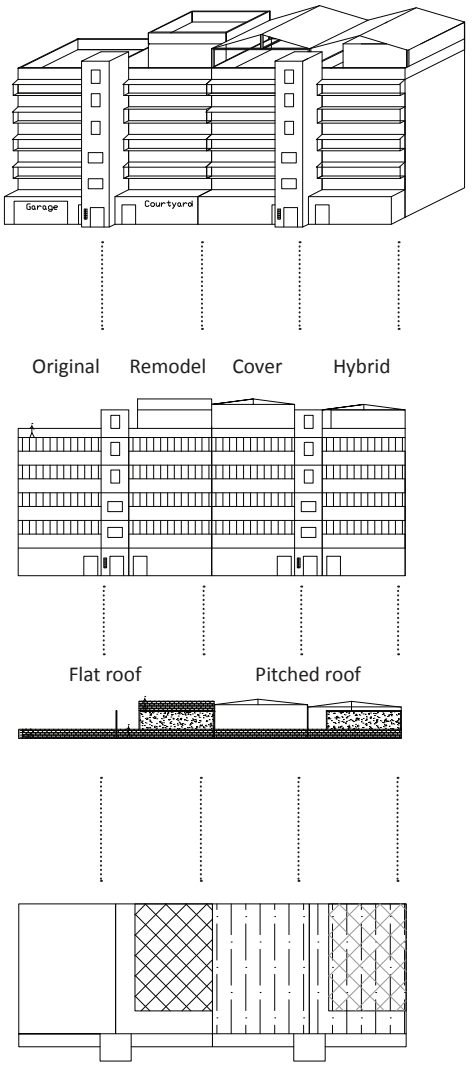


Figure 1-7: Diagram of different perspectives of rooftop structure

Problem Statement

High density rooftop spaces almost create another parallel world on the top of the ground life; however, this world has been forgotten by most of the people, city planners and city decision makers. According to the “Study of the ownership for apartment rooftops,” rooftops now are considered as communal spaces, neither exclusive nor public. However, this leads to inefficient use of rooftop space. They are either being abandoned or contested among residents. Rooftop space needs clearly, well-defined public space and norms. On the top of that, the extra story issue needs to be resolved by creative alternative regulation such as in some degree providing efforts on maintaining the rooftop’s public use. For further rooftop development on a larger scale and for policy making, more research is needed on the social aspects, and not just existing structural and environmental research.

Critical Stance

The role of rooftops in the city are confined as an extra space of building. They are seldom being considered at the begining of the urban planning and building design. However, I see that rooftops are not extra spaces for the city but a part of city network. They should be considered as a part of daily life that poeple will often use. Recently, there is a growing interest in rooftop garden due to lacking open space on the ground and the environmental issues. Several regulations aim to increase the rooftop garden by asking new buildings to have rooftop garden in certain percetage of the rooftop area. However, most of the buildings and residential social network are existing. The potential of rooftop spaces are overlooked both for open space in general as well as for social interaction. There are only a few resources for those people who want to build a rooftop garden on the existing buildings.

Anticipant Outcome

This thesis aims to provide another avenue for future work on rooftops on a neighborhood scale in Taipei, Taiwan. Anticipated outcomes include having more understanding of existing conditions of rooftop use as well as how people think of it. What are the future needs and how can I design a network system for further work with community? The toolkit-like product can be adapted to business brochures or used as a community advocacy tool.

Chapter Two: Literature Review and Design Consideration

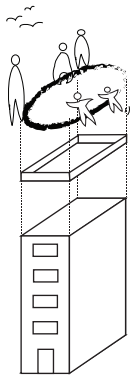


Figure 2-1: Literature review framework

Designing a rooftop network is a series of steps, including gathering people, envisioning future uses, designing and implementing the landscape, and maintaining and enjoying the rooftop. The purpose of this literature review is to create a framework for a future rooftop network. There are three main parts that should be considered when designing a rooftop network using rooftops in a residential area and building with community as a whole. First, why is it worth investing in a rooftop? How are rooftops different from community spaces on the ground? What are the environmentally friendly designs that are suitable for rooftops? Second, what are the design principles within a residential context? How does a rooftop communal space interact with private space? Third, how can community processes assist in building the rooftop network?

Figure 2-2: Three parts of literature review

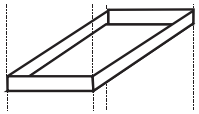


Figure 2-3: Literature about rooftop

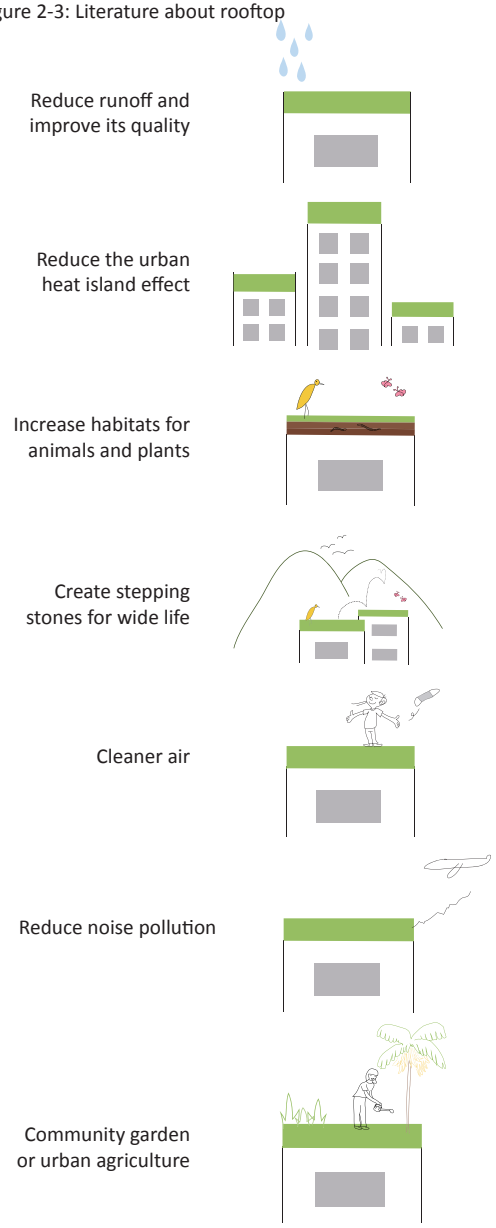


Figure 2-4: Benefits of using rooftops

Part One: Rooftop

1. Defining rooftops

Rooftop in this thesis means the very top of the building. It is not the top floor residential unit. It is not the garden area for top floor residents. The network design is focused on a residential context, not commercial uses or offices. Unlike residential buildings, commercial and office buildings have different needs and proposals. Such buildings are higher and newer. The needs will be more towards pressure release. Maybe a coffee shop, shelter and some planting boxes are adequate responses. The main stream of green rooftop use includes green roof, container garden, hydroponic garden. Moreover, other than formal categories, this thesis also focus on the spontaneous daily use and social aspects of the rooftop.

2. Green roof

There are two basic types of green roof: extensive and intensive. The main difference between the two is the thickness of substrate and intended use. Substrate of extensive roof is less than 6 inches. The purpose is more of environmental and visual concern and is mainly not for human uses. Differing from extensive roof garden, intensive green roof is for human recreational use. The substrate of the intensive garden is more than 6 inches and has different structures for different needs (Dunnett, 2008).

3. Benefits of using rooftops

When using rooftops as a green space, the greens bring the city benefits in ecological, social, spatial, visual, and economic aspects. Rooftop greens can reduce runoff and improve its quality, reduce the urban heat island effect and increase habitats for animals and plants. On a larger scale, green rooftops can connect existing habitats and support edge habitats. They serve as stepping stones for birds, insects and plants from nearby parks, street trees and even farther habitats. They also increase the buffer zone between the city and the surrounding area, providing temporary stops for migratory birds, for example. They create a bridge between habitat fragments in the city (Toronto City Planning, 2010).

Roof greens can increase the absorption of carbon and release of oxygen, provide shade and shelter, and decrease heat absorption. They also affect urban micro-climate by changing sun exposure level, light reflection, temperature, wind level and its direction. Along with environmental improvements, roof greens also increase the livability and amenities in the city. Vegetation on the rooftop can reduce noise pollution, urban dust and have

cleaner air. Greening rooftops with landscape design can increase people's desire to live and work in the city and beautifies the city (Weiber, 2009).

As a community space, rooftops provide another option for recreation and meeting people (Weiber, 2009). The lack of open space in the city is a serious issue and using rooftops is a great solution. Moreover, rooftops are also a great opportunity for urban agriculture, which provides closer social opportunities. The lack of open space in the city makes people start to think about growing vegetables on the roof. Similar to the benefits of community garden or urban agriculture in general, rooftop agriculture reconnects city people to the earth (Earth Pledge, 2005). Experiencing nature in everyday places such as backyards has restorative power that is similar to nature itself (Krinke, 2005). Once the network of rooftops has been created, rooftops can bring people closer to each other within this living space realm as well as create greater visual continuity throughout the neighborhood (Weiber, 2009).

In economic terms, rooftops can save money by reducing energy consumption, stormwater issues and air pollution. (Clark, 2008) They can gain money be increasing property values and create open space without taking additional land. They can protect roof surface membrane and increase its lifespan (Weiber, 2009).

4. Quantification of benefits in Taipei context

As discussed, green roof can bring many economic and environmental benefit. In Taipei context, here we will show the benefit on rain harvesting rate, energy consumption and urban agriculture. The rain harvesting could be calculate by green roof area and substrate depth and, if you have water tanks for rain harvesting, the total volume of tanks. The water that restored by growing medium is roughly 5% of the its total volume (Berryman, 2010). The formula will be: (green roof area x depth of substrate depth x 5%) + (volume of water tank x number of tank).

The energy consumption has two parts. The first part is the saving from reducing air conditioner use and the second part is electricity that generated by the solar panels. According to the reserch Hsiliu Foundation, green roofs could maintain the rooftop temperature at 32 degree Celsius in hot summer day. The cooling effect of four square meters of turf green roof equals to one air conditioner running for 12 hours. Take 650W air conditioner as example. Using air condition for twelve hours everyday for a month, the total electricity spend is 152 units which equals to 676 NT dollars (USD$23). (老子理財) For the solar panel installation, the average sun exposure

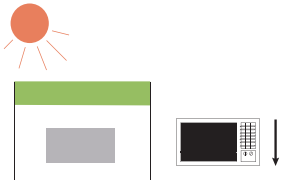


Figure 2-4 (continue)

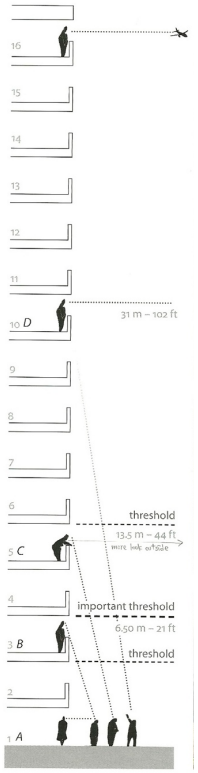


Figure 2-5: Views from different level of the building
Source: Cities for People (Gehl, 2010)

for Taipei city is 2.46 hours. Using 4kW solar power facility as example, it could generate 3591 units of electricity per year. If you sold it back to Taiwan Power Company, you can earn 37,046 NT Dollars (USD$1,134). However, in order to reach this amount of solar power facility, a huge space needs to be taken. It is not matching the goals for rooftop networking. Thus, the solar panel on the rooftop in this thesis will be only use as a educational facility.

The urban agriculture benefit is hard to calculate because lackng of data in the Taipei context. However, there are couple successful rooftop urban agriculture example in Taiwan that shows how gardenning on the rooftop could bring a fair amount of produce. Taking Dapong community as an example, they are a gated community with twenty high rised apartments with over 1,300 families live in the community. There are over three hundred people attend the gardening program and have profits from saling vegetables to neighbors. The produce amount even can provide parts of vegetable source for the elder people meal program.

5. Differences from ground space

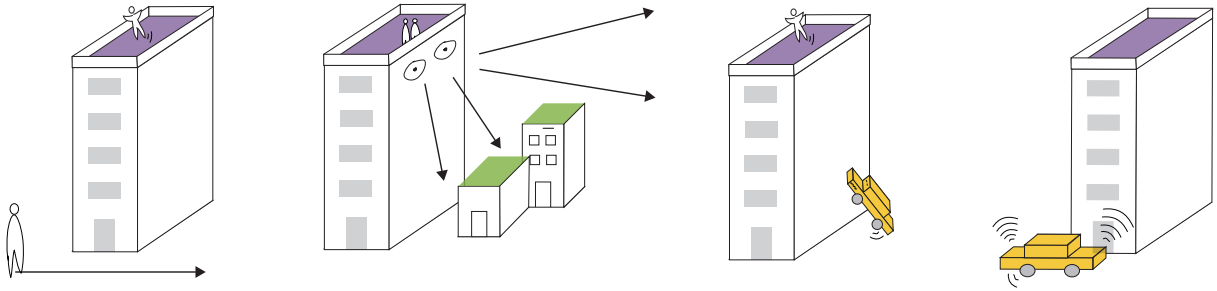
Off-ground and different ownership are two main special characteristics of rooftops. The height makes rooftops a destination rather than a passing space. People travel directly between ground level and the destination floor without noticing other floors, including the rooftop. Therefore, the programming is critical to reactivate the space. Rooftops also have better views from their higher position in the city. More and more residential high-rise buildings have rooftop gardens which serve as different social spaces. We can also easily find rooftops used in popular songs, TV shows and movies.

Rooftops are the closest community space from home for apartment dwellers and are a semi-public community space which has limited access to the public, whereas the ground land merely has limited access to the public. Thus, rooftops serve fewer users so that it is easier to program for specific and personalized demands. Moreover, rooftops have higher self-determined developing possibilities by residents with highly interactive and spontaneous design processes. On the flip side to this flexibility, ground rules are essential for long-tern development of rooftops. People need to share the space wisely.

Not only are they physically less accessible, but rooftops are also less easier seen from the ground. They have a higher privacy level. However, if there are higher buildings around, partial cover structures are needed. On the other hand, security is important not only because fewer people can see but also because they are close to where people live. Further, in contrast to a ground lot which has higher potential to be taken for other

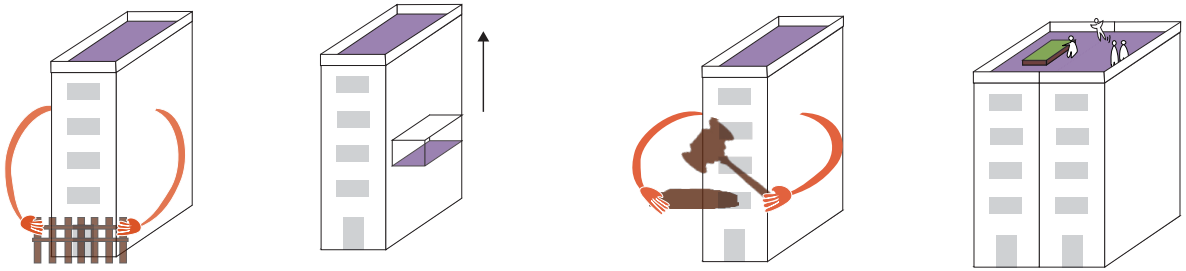
uses or becoming a new building, the rooftop already has a relatively stable developing foundation for further programs (M. Nowak, 2004). Future availability of using rooftop spaces can provide a sense of security and increases the willingness of the community to get involved in the project (Francis, 1984).

1. off-ground, higher location



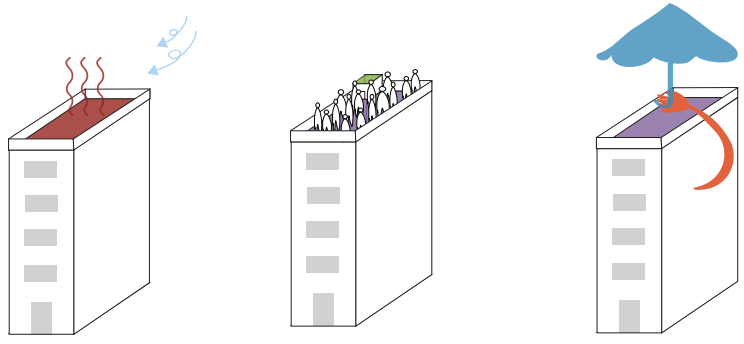
Destination | View to open space and to the street | Car free | Less noise

2. less accessibility



limited users | near home | easier to manage | social activities

3. building related considerations



extreme climate condition | weight load | water leak

Figure 2-6: Special characteristic of rooftop space

6. General challenges of rooftops and special consideration for rooftops

The general challenges of rooftops are extreme climate conditions. Just like every open space, conditions that are too hot, too windy or too cold will prevent people from using the rooftop space. There are several design strategies that could be used to protect people from this harsh climate; these will be introduced in the Chapter Three. Moreover, not only will the actual climate condition affect the use of rooftop, the perception of a harsh environment of rooftops including uncomfortable air temperature, humidity, wind speed and radiation fluxes is also one of the main reasons people do not use rooftops (Nikolgoulow and Steemers, 2003).

Many people are not aware of the existence of rooftop gardens due to the lack of advertising. Even if they know the existence of the rooftop, some of them still do not want to go there because the programs do not meet people's need and the rooftop's overall lack of attractiveness (Taib, 2012; Burgess et al., 1988). The highest rank of needs includes escaping or "taking a break", taking the children out, getting some exercise, enjoying the company of others, using facilities provided and smoking (Belinda, 2005). As noted earlier, defining users and having a participatory design process can help with this mismatching function.

From a cost perspective, building a rooftop garden needs an extra budget. Depending on the needs of the design, some of the green roofs will increase the cost dramatically due to structural considerations. After implementation, higher maintenance cost is the next main concern. Lack of promotion and incentives from the government and social communities among the public and private sectors are other barriers that keep people from building rooftop gardens (Xiaoling Zhang, 2012).

Furthermore, rooftops have special site design concerns and construction requirements. Other than brand new buildings, most of the existing buildings are old and do not have rooftop plans. Professionals need to make sure the house is structurally safe by checking the waterproofing, insulation, drainage systems, loading capacities, and lightweight fill of the building. (Weiber, 2009).

In conclusion, rooftops are different from the communal open spaces on the ground in various ways including off-ground higher location, less accessibility and building related considerations. Rooftops also after multiple social and environmental benefits such as reducing urban heat island effect, enhancing livability and saving energy. Altering the negative perceptions against rooftop gardens is an important first step. The next section of this chapter will move from the rooftop itself to some principles that would frame the rooftop network project.

7. Challenges of rooftops in New Taipei City context

As mentioned in chapter one, unlicensed extra stories is a serious issue in Taiwan. Moreoever, the unclear ownership of the rooftop is also a challenge to utilizing the rooftop space efficiently. According to the “Study of the ownership for apartment rooftops” (簡資修, 1995), rooftops are now legally considered communal space, not exclusive or public. However, constituting the space as communal is still not an efficient way to maintain the rooftop, mainly because it becomes hard to organize different activities, delegate responsibilities, and upkeep the maintenance of the space. The consequence of the communal system is that rooftops are often considered as no one’s place, instead of everyone’s shared space. They are usually either being neglected completely or induce fights between tenants over use of the space and other issues.

For unlicensed structures, if the structure has been reported by neighbors, it is automatically deconstructed. When the unlicensed structures are reported to local government, the builders are required to demolish it or pay the government to do so. According to research on the processing pattern and the improvement strategy of unlicensed buildings on flat roof apartments in Taipei County, from a civil viewpoint (楊昇樺, 2011), on average, only 19% of the reported unlicensed rooftop structures were being demolished every year. The waiting list for demolition is growing rapidly. This fact shows that there are financial issues, human power issues and social political issues associated with the process of demolition. Furthermore, because there is no strong force to ask top residents to fulfill their obligation and no efficient monetary system to control the new structures, there are more and more unlicensed structures being built. Figure 2-7 shows that the decision making process on whether an extra structure needs to be demolished is really simple and straight forward. This process doesn’t consider enough information and other possibilities for this widely spread phenomenon in the city.

8. Framework of rooftop space development in New Taipei City: policies and organizations

If people want to apply for a subsidy for a roof renovation project in New Taipei City, there are a couple of avenues that they can take. First, they can apply to the regular urban renewal regulation through either the New Taipei City Urban Renewal Rebuilding or the Maintenance Subsidy Standard and New Taipei City Urban Renewal FAR Bonus Standard. They have categories for rooftop greenery, facade beautification and balcony greenery. However, both standards are not a lay people friendly process and require a lot of paper work. The applicants would need a lot of help from a professional company or organization.

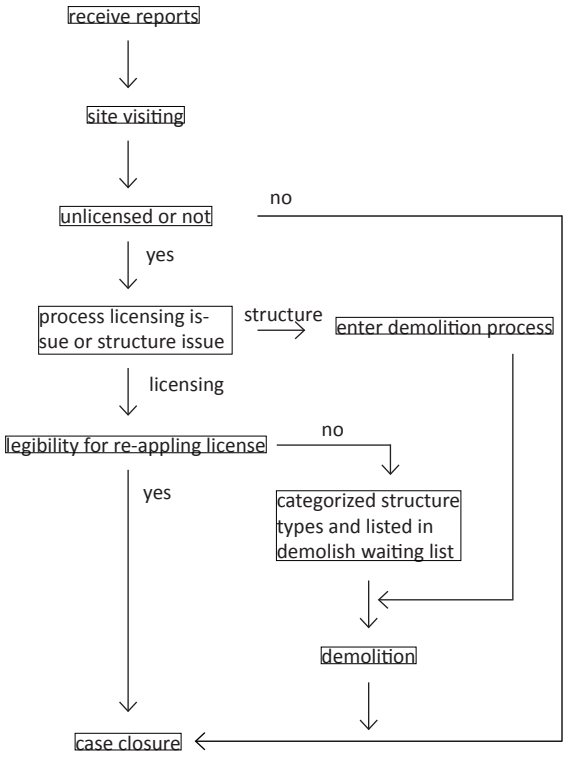


Figure 2-7: Unlicensed strucutres report and demolition process
Source: 楊昇樺, 2011

The second category is green roof specific programs: green roof pilot project program (at city level since 2011) and rooftop community urban organic farming promotion project proposal (at country level since 2012). The green roof pilot project program provided a qualified teacher, chose exemplary neighborhoods and schools, and had a design competition for selecting subsidy projects. It also held a conference to discuss and promote this project. There are eight projects, including four communities, one factory and two schools, that have been selected out of forty entries. This shows the huge demand for green roof development (http://www.greenroof.org.tw/about.php, http://civictree.blogspot.com/2011_09_09_archive.html). The rooftop community's urban organic farming promotion project proposal is a cooperation between the Department of Environmental Protection and the Department of Agriculture. It aims to create an urban sky farm land, an organic agricultural city and enhance city farmer recognition. The green roof demonstration projects are also highlights of the New Taipei City Department of Environmental Protection policy in 2013.

There are a couple of new organizations that work on the sustainability of city and green roofs. The first green roof organization, called the Taiwan Green Roof and Green Wall Association, was founded in 2011. It aims to conduct policy studies for green roofs, to be a mediator between green roof companies and people, and also to create design and construction standards. The New Taipei City Low Carbon Life Promotion Center is a new project initiated by the Department of Environmental Protection. It has a low carbon community planner training program and it is connected with a community college program. Through this project, over one hundred planners have been paired with different neighborhoods and over four hundred projects have been completed. There have been important projects and resources that has been planned by the city in this five year period. The only issue, however, is that the project has not done enough outreach. In order for this project to be successful, more promotion is needed.

In conclusion, there are many good opportunities for people who want to develop their rooftop space into a usable place. However, many of the projects are in the newer residential areas. There is a need to review and rethink rooftop space on the old row house apartment developments and enhance community networks in older established neighborhoods.

Part Two: Residential Area Design

The second part of my literature review is to understand the issues that we might face when designing a place that is close to a residential area. From Cooper Marcus and Sarkissian's *Housing as if People Mattered* and Alexander et al's *A Pattern Language*, I listed eight basic design frameworks for making a better gathering space on the rooftop. Each theme can be further explored, extended, and adjusted in individual design cases. Also, the principles in these two books have their own pre-condition- *Housing as if People Mattered* is designed for multifamily housing with middle density and a large portion of *A Pattern Language* is used for architecture design and interior design. In this thesis context, I've used only the main principles from each book as important guidelines for building rooftops.

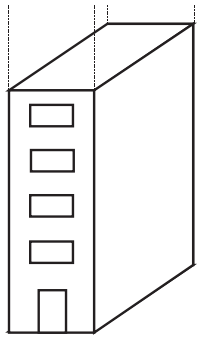
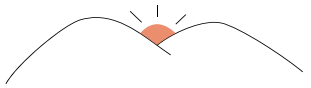


Figure 2-8: Literature about residential area design

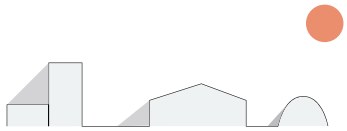
1. Using the advantages of rooftops

Rooftops have two distinguishing advantages from ground open spaces. The first one is the height differences. In high density areas, the traffic is busy and usually the small neighborhood park is surrounded by street parking and has high levels of noise and air pollution. Other than avoiding those disadvantages, kids can play on the rooftop without worrying about cars. The height of rooftop also can allow people to have a greater view.



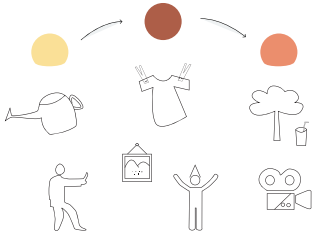
P1- Advantage-view

Secondly, rooftops have relatively simpler ownership and closer relationship between users. Also, the similarity of the users is high. "A degree of homogeneity is necessary before residents will develop a feeling of community" (Cooper Marcus and Sarkissian, 1986). As discussed in the previous section, decisions for how to use the rooftop can be easier than parks. Limited and rigid access rules are needed.



P1- Advantages-spacial arrangement

Rooftops represent the basic needs of human beings. That human beings need "shelter" and "safety" are repeated themes in different books as well as in my questionnaire results (which will be discussed in Chapter Three.) In different cultures, rooftops represents different meanings. In Tibet, for example, rooftops are a place for avoiding floods, for increasing efficiency of using the space, for religious illustration, for serving as a sacred place and also for having views (Chen, 2012). Moreover, the quality of the landscape surrounding the houses contributes highly to resident satisfaction. Improving rooftops from a vacant condition to useful open space could enhance the quality of life.



P2- Different uses in a day, daily uses and events

Figure 2-9: Principle illustrations

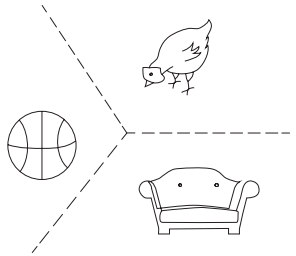
2. Get know your neighbors: programming; networking; communal space

Rooftop space should be designed for both day time and night time daily life and events in order to increase

its use rate. Matching programming with demographics information with real needs is important. Further, gardening should be included in every rooftop design. It is an essential element from different points of view. From many community garden experiences around the world, gardening is a great medium for gathering people. Also, from an ecological and food security perspective in the city, gardening (greening) has many benefits.

Networking as part of programming to create a communal life. The strategies will be holding community workshops, having outdoor classrooms, dining rooms and kitchens depending on different users' preference. Different non-profit organizations could play an important role in providing different workshops such as carpentry or painting. Having shared gardening tools, greenhouses or some indivisible inputs is another way to enhance the interaction between residents as well as to better use the small space.

Since a rooftop is such a small space, certain activities, such as basketball and drying clothes, need to be well contained in separate areas. The programming can use spatial as well as "timing" separation to break through spatial constraints. Movable furniture can serve as a connection element across different sections and create flexible use of space. In order to maximize the use of communal space, we need to connect rooftop space as much as possible with security considerations in mind.

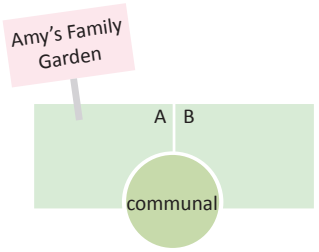


P2- Careful about conflicts between activities and creating buffer between conflict ones

3. Make things as you like- place making; place identity; sense of place; participation; individual control

Place identity is a well-established concept in built environment professions. "A sense of community and security is likely to be enhanced when access to the site by outsiders is discouraged" (Cooper Marcus and Sarkissian, 1986). A well-defined space will be used more than unclear ones. The management plan and regulation of access are important.

Naming is an interesting part in the literature review. If you have a dog, you may want to name it to enhance the relationship with it. Naming a place has the same effect. "The front entrance is more likely than any other part of the house to be personalized" (Cooper Marcus and Sarkissian, 1986). "The front entrances" can be at the ground floor as well as at the rooftop entrance. Special personal decorations at the ground floor entrance can illustrate the connection with rooftop use and also can serve an advertising purpose. Rooftop entrance will serve a similar function as the front door, where people say hello to each other and start a conversation. A meeting setting is needed.



P3- Well defined spaces

Figure 2-9: Principle illustrations (cont.)

A room for personalization or control is a way to get people together. The space should be designed as a framework for further development by residents. Participation before and after the design implementation are both crucial. “Personal modification of the environment not only allows people to give their homes meaning but also facilitates changes that enable occupants to stay...It also encourages neighbor cooperation in the swapping of ideas, tools, and skills in do-it-yourself home improvements” (Cooper Marcus and Sarkissian, 1986).

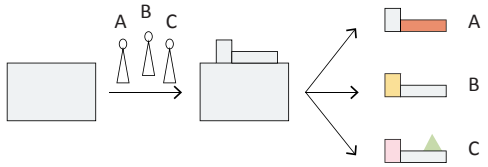
4. Make the place safer and comfortable for everyone- private/ public transition and security: publicness; privacy; visibility; security; scales of the spaces

Well-defined space can guide people on how to use the space and reduce the confusion and discomfort. Because of the fact that the rooftop is very close to where people live, the publicness of the space needs to be carefully designed. Using different scales of space and screens between different spaces can create a clear hierarchy within the space. For instance, at the middle public space and along the path, seating can increase the social function, whereas the inside corner of the rooftop behind the garden, a planting screen and a smaller opening might be appropriate for those who want to be alone watching the sunset.

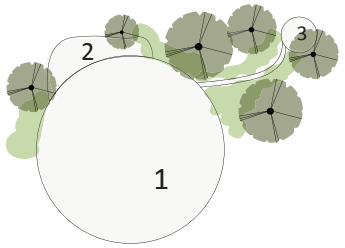
In the cases where an extra private story exists, the transitional filter and visual/physical screen is essential to create a clear boundary between the private home and the communal space. Planting is a good medium for creating a visual/physical boundary. If possible, leave space for personalized decoration outside of the fences. This is one way to soften the boundary visually but strengthen it functionally. Personalizing via details is also a great way to strengthen the separation between public use and private property.

Rooftops are a relatively safe place compared to open space on the ground because of restricted rules about who can come and when they can come to the rooftop. However, visibility is still important, especially for the safety of kids playing. Near the parapet there should also either be an extra fence on the top of the structure or there should be at least 5 feet clearance to prevent kids from falling over.

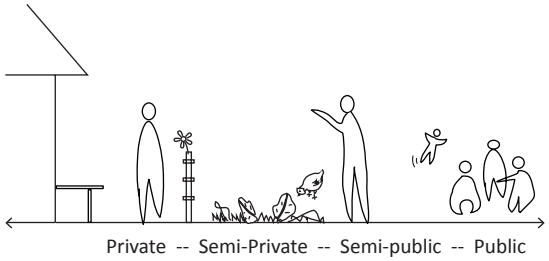
Lack of fire escapes is a huge problem in Taipei’s older residential area. The arrangement of the buildings do not have enough width for the fire trucks to pass through. There are rarely fire escape facilities on the rooftops. Considering both of these problems could be a good strategy to convince both the government and lay people to work together towards functioning rooftop improvement.



P3- Group effort to design and build communal space, and still allow individual control and personal additions

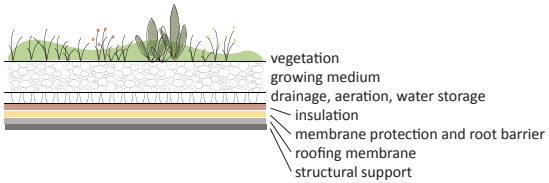


P3- Clear hierarchy of spaces with different scale and intimacy level

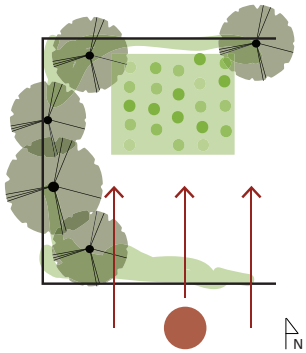


P4- Publicness: transitional filter and clear boundary between the private home and the communal space

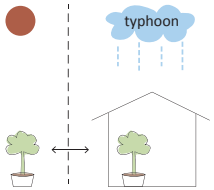
Figure 2-9: Principle illustrations (cont.)



P5- Recommended layers for green roof



P6- Arrange garden at south for sun exposure but oriented to east for less glare for people



P6- Movable plants is recommended for plot garden

Figure 2-9: Principle illustrations (cont.)

5. Consider building structural limitations: weight loading; water leak

Rooftop design needs to follow the city building codes and safety restrictions, especially for weight loading. The loads delivered to a roof structure have two categories: dead loads and live loads. The dead loads come from the rooftop structure itself and permanent elements on the rooftop, which include waterproofing, insulation and permanent utilities. The live load includes human occupants, furniture, and temporary maintenance equipments. The location of supporting columns and beams can carry a greater load than space between them. An engineer is needed for calculating the allowable load at a given location on the roof (Osmundson, 1999).

Water leak is another serious issue, especially in old buildings. Under a rooftop garden, waterproofing and insulation membranes can prevent mechanical damage from gardening tools and the penetration of plant roots. Also we need to make sure that the existing roof membranes can last long enough without demolishing the whole rooftop garden for repairing (Osmundson, 1999). The general recommended layers from bottom to top are waterproofing, root barrier, insulation, aeration and drainage mat, filter fabric, growing medium and plants (Werthmann, 2007).

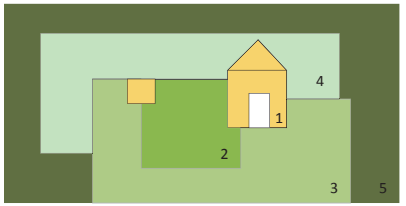
6. Respond to environment context: microclimate; 5 zones

As mentioned in chapter two, the extreme climate condition needs extra care to attract people to come to the rooftop. We need to consider four things: sunshine, chill shade, strong wind, and rain. The orientation of the garden can minimize the glare of sunshine. In most situations, gardens oriented to the east are better to get enough sun to warm up the space but not have glare at the second half of the day. Using umbrellas and trees or using less reflective materials can prevent having too much sun exposure (Osmundson, 1999).

Taipei has many typhoons during the summer rainy season. The rainfall is huge and the wind is strong enough to blow off a potted middle size shrub. The plants need to either use a structure firmly attached to the rooftop ground or be movable and thus be moved as needed. Flood-tolerance and wind-resistant plants are recommended. Windbreaks or wind screens can be used in very high-rise buildings. Last note, all of these strategies depend on different regions.

The purpose of permaculture zoning principle is to save time and energy by arranging different purposes to zones according to how frequently you visit them. The zones are numbered from the inside out. Zone zero is

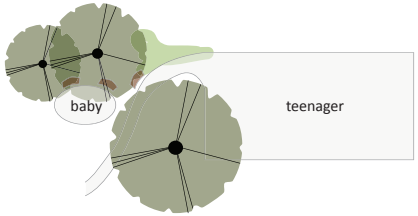
the house and the further from the house, the larger the number will be. For example, the vegetable and herb garden should be in zone one where you will visit everyday whereas fruit trees will be in zone four because you only go there once every three months. This also applies to chicken coops and mushroom farms. In rooftop network context, every roof has a special micro-climate condition and existing structure arrangement. (Mollison, 1988) The five zone concept can be transferred from the distance from the home into more diverse, spread out pattern near each different apartment unit but still considered as a whole.



P6- Five zone concept example: 1. home, 2. herb garden by kitchen, chicken hoop between zone two and three, 3. vegetables, 4. fruit trees and mushroom farm, and 5. green roof or low maintain landscape.

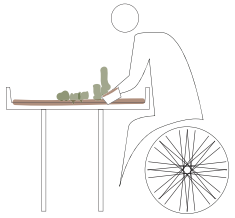
7. Think of your kids and grandparents: kids; teens; elderly; gardening

In Cooper Marcus and Sarkissian's *Housing as if People Mattered*, design for kids and teens occupies around one-fourth of the book, from two to five year old kids to teenagers. The discussion includes diverse preferences, conflicts between different age groups, and programs and safety. The flow of kids is an important one because of space limitation. Minimizing the conflict between different uses meanwhile having a smoothly connected loop throughout the site can provide a stroll path for the elderly as well as for running kids. Minimum design can increase the creativity. More spontaneous things will occur.



P7- Seperation between different age group and be careful for the flow of kids

For the elderly, allowing them to sit by where kids play can increase the interaction between different generations. Some programs can be designed as a bridge across ages. It is good to provide high-raised gardening beds for elders that they can also use as a working plate for potting out, seeding, etc. Therapeutic garden elements can add to the garden design and create a functional and beautiful place.



P7- High-rised gardening bed for elders

8. Don't give up anyone!: process; management; organizing

The participation is a key to success the rooftop network, especially in multi-ownership situation. In Matanovic's *Multiple Victories: Pomegranate Center's Art of Creating Community-crafted Gathering Places*, giving everyone task to do could enhance the participatory satisfaction and make people more engaged. In terms of management and maintenance, in *Housing as if people matters*, having a clear distribution of responsibility is important and contract with outside organization if needed.

These eight design principles represent the social, spatial, structural, and ecological aspects of the project and consider different users' needs and the sustainability of the project. Each principle can extend the application in many ways with existing resources. The main principle (slogan) can be used in advertising. After under-

Figure 2-9: Principle illustrations (cont.)

standing the basic design principle framework of rooftop networks, the last section of this chapter will get into the community process framework.

The following table is a summary of the eight design principles with several sub-principles. Each sub-principles has a list of things that need to be considered followed by possible design responses and examples of design elements or community process. The last column indicates the sources of this principles came from.

Table 2-1: Residential design principle for rooftop

Main principles	sub	lists	possible design responses	examples of design elements, process	sources
Rooftop!					
1. Use the advantages of rooftop	the height	- free from car - free from noise - view	- viewing point	- platform - balloon	h 3 children safe from cars h 48: street activities off the ground p 134: zen view
	ownership	- private own access	---	---	(Francis, 1984)
	psychology meaning	- enhance feeling of “shelter” “home”	- visual coherence - having themes through out the building cluster	- pattern and plants design on rooftop	h 11: landscape quality p 117: sheltering roof
Social - create a good communal space					
2. Get know your neighbors - enhance social interaction	programming	- different time: daily/ events	- flexible space - enhance the connection with staircase - be aware of conflicts between activities	- open plaza - open daily routing space - movable furniture	h 130: meeting neighbors h 131: friendly encounters h 138: outdoor drying h 196: on-site picnic h 230: conflicting uses
	networking	- communal life	- social events - educational events: community workshops, classroom	- tool shed and tool loan rules - kitchen and dining space - gardening space	h 139: workshops h 141: community garden p 175: greenhouse p 177: vegetable garden
		- communal space	- maximizing connected space - good connection	- passage between different spaces and rooftops	p 106: positive outdoor space p 115: court yard which live

“h”: from *Housing as if People Matters* (Cooper Marcus and Sarkissian, 1986)

“p”: from *Pattern Language* (Alexander et al., 1977)

Table 2-1: Residential design principle for rooftop (continue)

Main principles	sub	lists	possible design responses	examples of design elements, process	sources
3. Make things as you like - place making	place identity	- well defined space	- symbol - group effort - access limitation	- use name tag for each family or group - collective build project	h 5: community identity h 21: subunit identity h 24: name sign
	sense of place	- participation before implementation - individual control - personal additions	- provide environmental cues at entry - provide at least flower bed when space is limited - remain modify right to residents	- use materials that have access by residents - regular or spontaneous meetings	h 32: personal additions h 34: entry personalization h 62: display garden h 84: unrestricted setting (esp. for kids) h 99: children as planners h 179: landscape installation and modification h 180: personalized landscape
Spatial					
4. Make the place safer and comfortable for everyone - careful about private/ public transition and security	publicness	- scale of the space - hierarchy of the space - group territory - front/back	- provide different scales of places for different intimacy level and group size - when space size allowed, create at least one small space which has natural back protection and opening to larger space	- pocket space, quiet place - main plaza space - fences - planters with/without seating in different height	h 4: space hierarchy h 56: “front” and “back” customs h 72: group territory h 77: street linkage p 75: the family p 114: hierarchy of open space p 127: intimacy gradient p 176: garden seat p 193: half-open wall
	privacy	- transitional filter - common space boundary	- provide visual buffer, clear boundaries and transitioning between private property and communal space - gradually change of publicness by plants - if possible, offset private home line inward to create personalized space outside the fence to increase private boundary	- privacy planting - privacy screen - fences	h 29: territorial expression h 30: added privacy h 39: transitional filters h 57: privacy screening h 58: overlooking h 77: common space boundary h 176: privacy planting p 118: roof garden p 140: private terrace on the street p 174: “keep off” planting p 176: garden seat p 192: windows overlooking life

Table 2-1: Residential design principle for rooftop (continue)

Main principles	sub	lists	possible design responses	examples of design elements, process	sources
	security	- visibility - lighting - fire escape	- do not put things too high to create hiding spot for crime - provide fire escape ladder	- lighting - sound instrument which will make sound surprisingly	h 36: visible entry h 202: visible lobbies h 209: fire escapes
Structural					
5. Consider building structures	- building limitations	- weight loading - water leaking	- prevent penetration of the plant roots - ask structure engineer - well design drainage system	- waterproofing and insulation layers - planting box, pots	(Osmundson, 1999) (Werthmann, 2007)
Ecological					
6. Respond to environment context	microclimate	- provide shelter space - use different plants to enhance biodiversity	- arrange garden at south for sun exposure but oriented to east for less glare for people - shelter in different types - consider shade from adjacent tall buildings - use existing cover for more diverse uses on the rooftop	- plant big tree with larger canopy after structure check - colorful umbrellas - have shelter structure - windscreen	h 173: microclimate p 105: south facing outdoors p 118: roof garden p 161: sunny place (Osmundson, 1999)
	five zone design	- arrange things according to the existing condition - design zoning with care	- use covered space to grow mushroom or ferns - each space has their small zones but still create a collective farm	- deliver paths - working cooking party	(Mollison, 1988)

Table 2-1: Residential design principle for rooftop (continue)

Main principles	sub	lists	possible design responses	examples of design elements, process	sources
Design for different groups					
7.Think of your kids, grandparents and other people	kids and teens	- create interesting space - use advantage of different heights - safe play	- provide variety of play equipment - ensure space is large enough to minimize conflicts between different age range - design with children running path in mind	- outdoor staircase - playground equipment - minimum design where the space is not enough - wild design of plants	h 73: interesting landscaped places h 74: comfortable space dimensions p 73: adventure playground p 83: leftover space p 110: flow of play p 133: staircase as a stage
	elderly	- stimulate five senses - therapeutic garden	- put kids play area by elderly seating area - provide opportunity for elderly teach their experience on gardening, cooking, etc	- high rised planting bed - seating area with shade - adult sport equipment	p 94: supervising adults p 168: connection to the earth
Sustainability of the project					
8. We need you!	process	- participation mechanism - glue program	- design games and design dialogue	--- (next section)	Eva Brandt- formatting design dialogues
	management and organizing	- ground rules - management plan - connection with NGO	- contract with outside firms if needed - give everyone task to do from kids to elderly - diverse organizing alternatives	--- (next section)	h 135: sharing work h 181: landscape maintenance

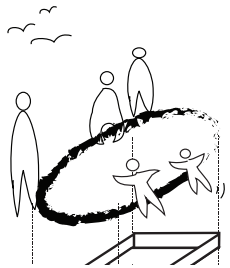


Figure 2-10: Literature about community process

Part Three: Community Process

Because rooftop gardens are very close to where people live and are semi-public spaces with access restrictions, the tied spatial relationship between rooftops and residents makes participatory design necessary. Moreover, rooftops are not a public space so that residents will need to design and build by themselves or must consult with firms or rooftop related organizations. However, a participatory design process is still needed. Some suggested processes for community organizations from *Community Open Spaces* (Francis, 1984), *Neighbor Power* (Diers, 2004) and from the experiences of the Pomegranate Center (*Multiple Victories: Pomegranate Center's Art of Creating Community-Crafted Gathering Places*, Maranovic, 2007)are presented as follows.

1. Door-to-door promotion (motivation)

Rooftops have been a battle field over a couple decades and the consequence is that no one wants to touch the rooftop issue. Outreach is the first step to get people together and start to discuss about the future of the rooftop, and understand the importance and benefits of building a rooftop garden. Promoting the program with funding or a way to seek funding such as government subsidy programs is ideal.

2. Over two families want to initiate the project

On the other hand, providing a way to make people find outside support for the rooftop is important too. There are already several organizations that have funding matching programs or competitions in order to help individual community members practice their ideas. Project initiation needs at least two families from the building to form an inside group in order to communicate with outsiders. The core leader group plays an important role for making a long term project.

3. Workshop for quick installation and rooftop map- warm up and visioning, catalyst project

If people are willing to go up to the rooftop, they will notice that there are many vacant rooftops. Workshops for rooftop mapping could give them a reason and motivation to join the rooftop network. Workshops for quick installation could be a sign, a flag or a balloon which symbolizes the start of the project. Small achievement at the beginning is crucial for keeping the ball rolling.

4. Groups: 1. resident group, 2. technical assistance/ coalition, 3. city program, policies and research

After the initial project workshop, the dynamic of participation groups are clearer. The resident group is the core of the team. Technical assistance and organizations support the core group and also make connection with

other communities. Connecting to neighborhood networks and city networks, recording research data such as benefits of extensive green roofing, and supporting the core group as a third party are the role of organization.

5. Ground rules

The purpose of the ground rule is to create a comfort zone for discussion and a framework for the decision making process. For example, Pomegranate Center's ground rules include: "listen and try to understand others' assumptions and views, listen willingly to new information and allow it to change your mind." (Maranovic, 2007) These rules are a reminder and a tool allowing people go back to discuss the original problem or issue rather than continuing to argue with other people.

6. Identify: goals, needs, concerns, resources

Before creating a rooftop garden, setting clear goals-- short term, middle term and long term-- will guide people moving forward. Matching resources with goals, needs and concerns, residents can reach out to outside resources with this list and do the networking by themselves.

7. Design-build workshop process

This is the main step of the whole process in terms of creating a usable space. This step is also the process that needs outsiders' help the most. Design-build workshops are a way to create a stronger sense of community and to have larger place attachment. We need to be aware of the "evolutionary nature" of the community design process.

8. Management plan

Knowing everyone's specialty and interests is the key to arrange people for different tasks. Everyone has different skills and time. The membership and time bank regulation could create a successful collective farm. A management plan should clearly define who will do what and in what time and frequency.

9. Programs and events: making connections and building relationships

The programs that can gather people together such as a harvest party, maintenance party, barbecue, poker game, pot-luck need to be hold in a regular base.

The purpose of this project is to build better relationships with neighbors, to improve health and well being

of people in the city, to be more confident and skillful by learning from each other, and to have a supportive network, not only for urban agriculture but also for human relationships in the city.

Residential Area Rooftop Design Case Study

After looking at rooftops, residential area design, and the community process, the following two rooftop network case studies could enhance the understanding of building a rooftop network in Taiwan. The first case is located in New Taipei City, named Zuo He community. It's a seven storied, common old style building in a "U" shape. (Figure 2-11) The community leader noticed that some of the elderly keep gardening in vacant lots nearby, but their gardens kept being destroyed by new developments. Thus, he wanted to create a space on the rooftop for people who wanted to garden. The rooftop community garden project began with a 20 square meter gardening space. A couple years later, they received project funding from the government and expanded the garden to 300 square meters. The rapid growth shows how people benefit from the rooftop community garden and how gardens represent an important demand from the community.

Figure 2-11: Case study one rooftop network design plan
Source: 我愛綠屋頂(I Love Green Roof）

This is a gardening/agriculture oriented rooftop. Over 80% of the space is used for agriculture. For the design, staircases are used for space guidance and each staircase has a set of different types of gardening planters. Furthermore, each set of garden spaces has a center gathering space. The community members built the modular container garden by themselves and combined it with many other environment friendly facilities such as a DIY wind power generator, a bike rack, and a soil test device. This process makes this community garden grow with rapid pace and also allows it to develop a solid ground rule for funding, management, and other regulations for the garden.

Figure 2-12: Urban agriculture use
Source: 我愛綠屋頂(I Love Green Roof）

For the gardening style, this community used a movable, modular container garden. The community leader said: "This type of planter is easier to be accepted by people who are very worr[ied] about the weight load and water leaking issues. Most importantly, it is easy to move when a typhoon comes or when some people want to use a larger space for drying clothes or throwing a party." This is a very good strategy for doing community gardening on old buildings.

The second rooftop garden case is in a gated community with newer and higher buildings. (Figure 2-13) It is also located in New Taipei City and named Lin Jiang Xian community. The community leader is the government's low-carbon community planner. He led the community members to apply for funding from the government and also designed the rooftop garden. He designed a gardening place with a lawn that looked out over the river. Just as in the previous cae study, the decentralized garden patches were all located near staircases and every

residential unit had its own gardening space.

This case illustrates some of the principles in the previous section of this chapter, such as principle one, two, four, and six. For principle one, the lawn area is facing the riverside with viewing platforms. Also, there is a strong visual coherence throughout the different residential units on account of curvy planting design, and using similar plants and material. For principle two, to maximize the connected space, the network between the residential units is very well done with continuous planting and installing benches people to meet and spend time at the intersection. The study did not mention a structural social program but some informal social activities such as exchanging information and forming a gardening plan likely occured.

For principle four, the garden space maintains both publicness, and privacy and security. There is clear hierarchy of space with different functions, each co-related with staircase entrance openings. The gardening area is smaller and closer to the staircase entrance opening, forming a less public and more private space than the lawn area. This is also following principle six, the five zone principle, where the most frequented space is closest to the staircase. Since the gardening space needs lots of daily care, it is built closest to the staircase. From figure 2-13 we can see clear boundaries separating different function zones—the gardening and the lawn area are clearly spearated. Short walls and plants, with limited pathways, are used as boundaries between spaces. The planting choices also reflect the publicness of the space. For security, there is adequate lighting so that people could use the rooftop space at night safely.

These two cases illustrate well the design of a rooftop network. However, there are some principles have been overlooked, such as having a shelter area, and consideration for different needs and programs. For example, the summer is very hot in Taipei so a shelter area is worth considering as a necessity. Even a picnic table with an umbrella helps people survive in the hot sun and therefore could encourage them to stay on the rooftop for longer time. The study does not list other programs or needs for the community, but it is worth mentioning for future consideration.

Both of the cases have the same design strategy that is critical for creating a rooftop network: functionally decentralized zoning. This is important for the publicness principle and the five zone rule. For the process and

funding, interestingly, these two cases both refer to the people who live there, and not from the outside. The tenants designed the space and applied for funding from the government for private use. This shows how roof-top improvement is an important public interest. Furthermore, the projects used a top-down reward system to encourage the willingness for people to start designing and building the rooftop garden. It is a process that starts from top-down and then becomes a bottom-up discussion process. As we can see, the relationship between residents and the government still needs couple of enthusiastic community leaders for support.

Finally, it's worth to note that the building type of these two case studies are not exactly the same. Both of these two rooftop networks consist of more than two apartment units. However, they are still within one building structure. In this thesis, the rooftop network usually refers to networks across more than one building. They are close to each other. Some of the building structures have many apartment units but still connect to adjacent buildings by connecting programing, visual continuous or informal trade for agriculture inputs and outputs.

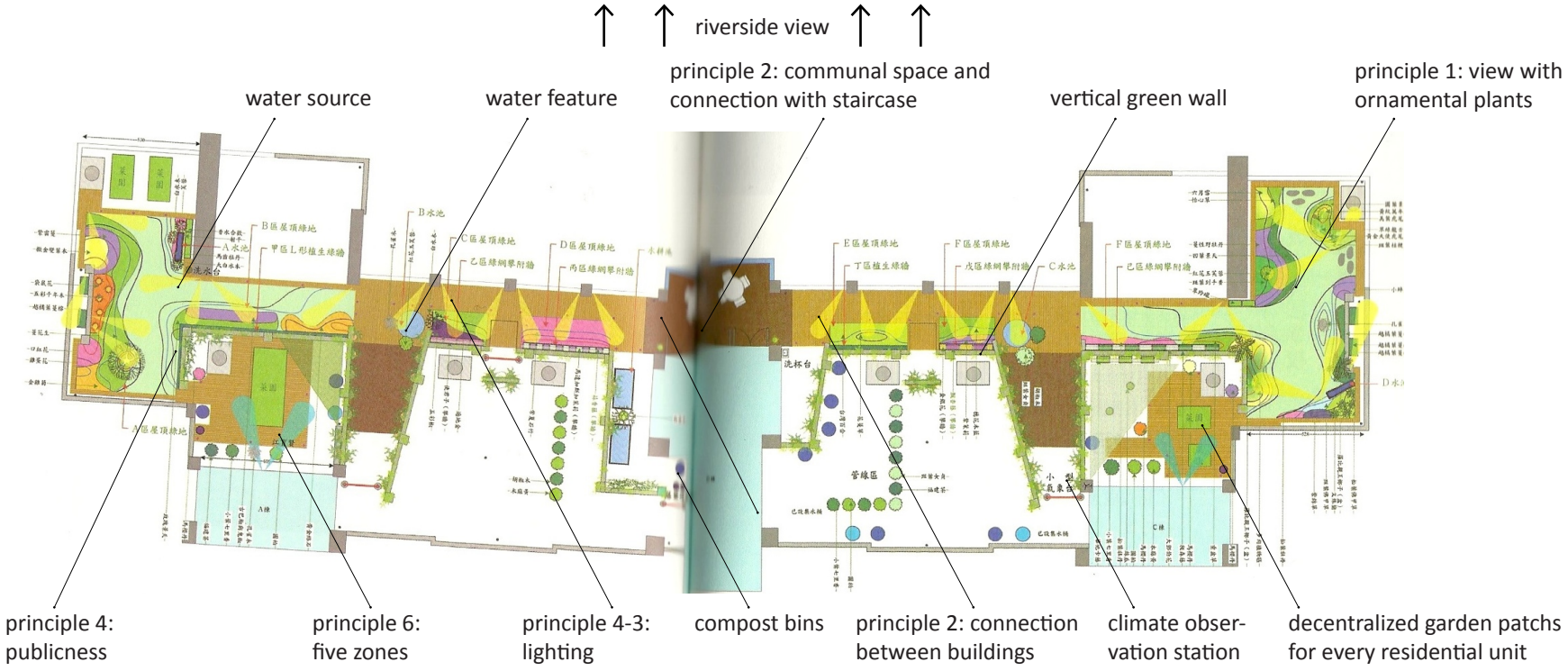


Figure 2-13: Case study two plan

Source: 我愛綠屋頂(I Love Green Roof）

Chapter Three: Design Study and Framework

The process of defining a design framework for rooftop networks are: 1. literature review, 2. questionnaire, 3. design assumptions and goals, 4. developing rooftop map tool, 5. identify rooftop spatial typology, 6. explore programming possibilities and 7. four strategies for designing rooftop networks. From the previous chapter's literature review, three parts of concern- rooftop design, residential design and community process- as a basic design frame work has been discussed. In this chapter, I start off with the questionnaire for understanding how people think about rooftops and find out the trends and potentials for new rooftop uses. Then I describe the design goals, followed by the rooftop map tool as a start point of observing and documenting rooftop space. The fourth and fifth parts explore programing possibilities from the questionnaire with different types of space on the rooftop. Lastly, I provide five strategies for building a rooftop network.

Questionnaire

The purpose of the questionnaire is to have further understanding on the following six topics: 1. the perception of rooftops, 2. use pattern and its factors, 3. barriers to using rooftops, 4. existing activities and future demands, 5. gardening conditions, and 6. how people think about connecting rooftops as a whole community space system and what are their concerns. I delivered the questionnaire to on-line social networking websites such as a Facebook rooftop group page, aimed to have respondents from Taipei area. There are forty respondents: 27 female and 13 male; three quarter of them are age 19-30 and others vary; 7 people's house are rented; 12 people have the whole apartment building. In the result charts, the four basic colors indicate the four groups of people: 1. darker green: top floor residents who do use the rooftop space; 2. lighter green: non-top floor residents who do use the rooftop space; 3. darker red: top floor residents who do not use the rooftop space; and 4. lighter red: non-top floor residents who do not use the rooftop space. Three quarters of forty respondents have been using the rooftop space. Eleven of them are top floor residents and nineteen of them are not. In fourteen of top floor residents, only three of them never use the rooftop space. (Figure 3-2)

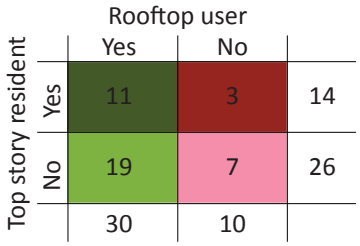


Figure 3-2: Relation of rooftop user and top story resident

1. The perception of rooftop

In the beginning of my questionnaire, I asked "what's the first thing you think of when you hear 'rooftop' ? " The answer shows that most of the people have a negative impression of rooftops. They think the rooftop is in general hot, dirty, messy and vacant. There is nothing up there besides some facilities like a water tank. Many problems need to be taken care of such as water leakage and the extra story issue. However, the original "rooftop" meaning is still in people's minds from ancient times. They used words such as "shelter", "safe" and "relax and being away" to describe the rooftop. Another frequent answer is about personal experience as well as about the pop culture such as lyrics to songs. Moreover, some people approach this question by activities that could happen on a rooftop, from personal daily errands such as drying clothes to public events such as parties. Many people mentioned the view and the experience of either being alone or out there with other people. (Appendix one.) The general issues that people first think of are water leaks, the extra story, and nobody there. (Figure 3-3)

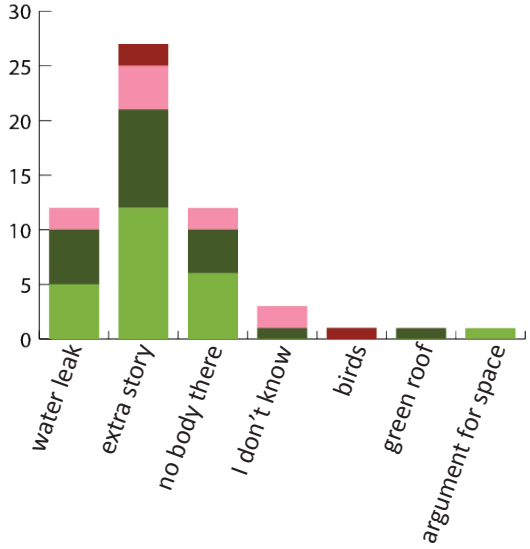


Figure 3-3: Issues of rooftop use in people's mind

2. The existing use pattern

There are 30 people who have experience using the rooftop: 6 people use it everyday, 5 people use it once per week, and the rest of them use it once per month or once per year for some events. The frequency of using the rooftop space of top floor residents use is higher then non-top floor residents. (Figure 3-4) The most popular times are morning, evening (dinner) and night. Top floor residents and those who frequently use the rooftop use the rooftop in the evening the most. (Figure 3-5)

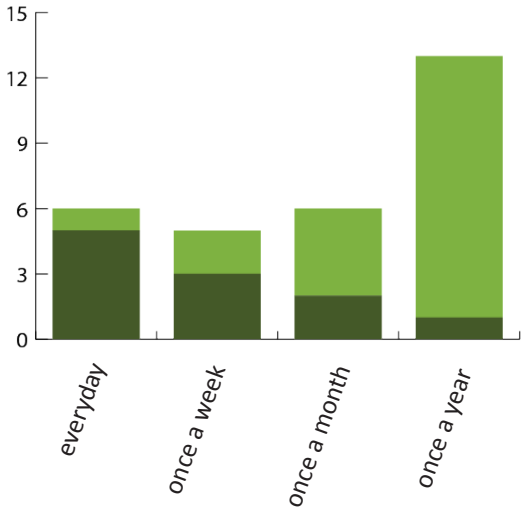


Figure 3-4: Frequency of using rooftop

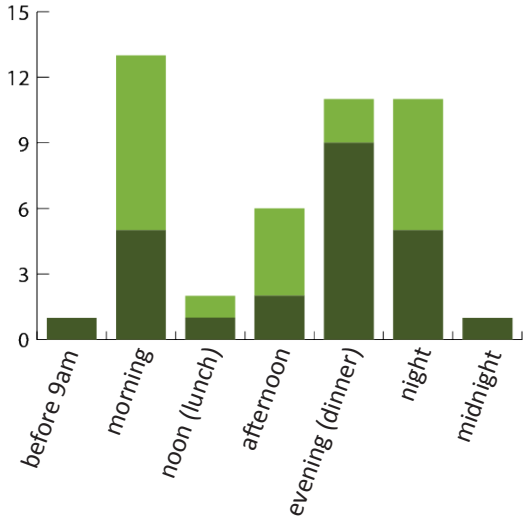


Figure 3-5: Time of rooftop use

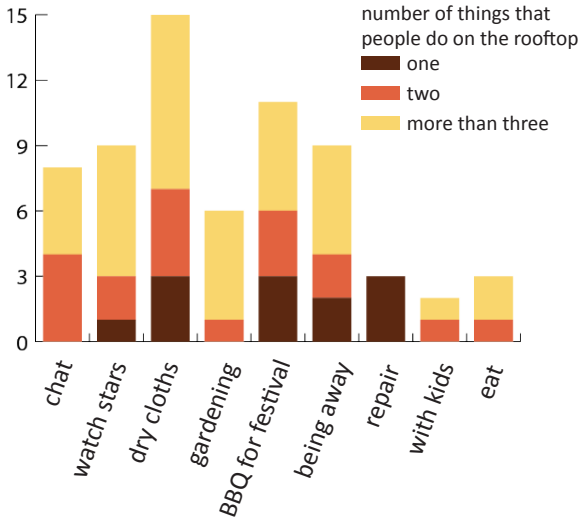


Figure 3-6: Activities people do on the rooftop

From figure 3-6, the activities that happened on the rooftop are 1. drying clothes; 2. having a BBQ for the moon festival; 3. having alone time and looking at the stars; 4. chatting; 5. gardening; 6. repairing and eating; and 7. spending time with kids. The different colors indicate the number of things that people do on the rooftop. Such as, people who go rooftop for drying clothes usually do other things on the rooftop whereas people who go to the rooftop to do repairs will not to other kinds of activities on the rooftop. The people who go to the rooftop for drying clothes act as a good indicator for the condition of rooftop use: ten of them chat with people, four of them do gardening, and five of them go to the rooftop everyday (total of fifteen people using the rooftop for drying clothes).

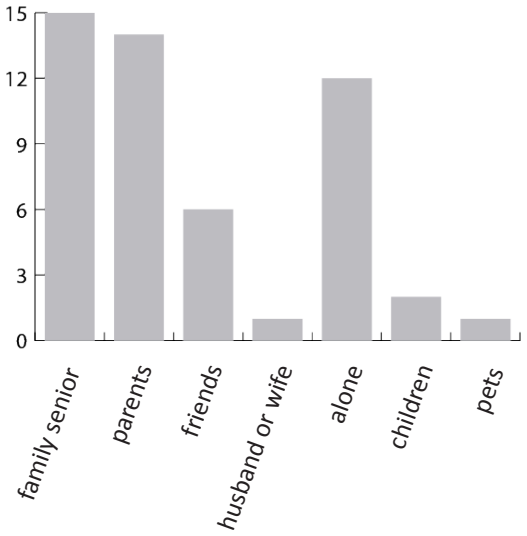


Figure 3-7: Whom do people use rooftop with

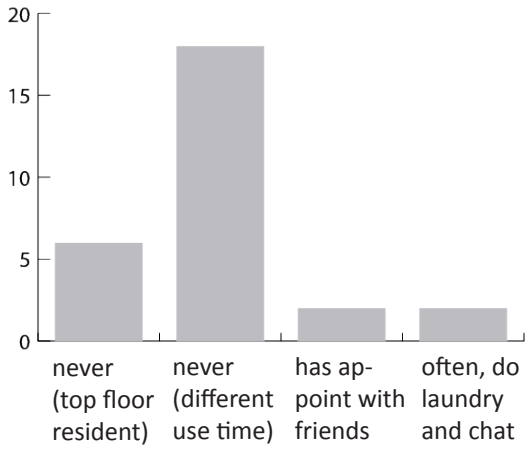


Figure 3-8: How often people meet other people using rooftop

People use the rooftop space both as a group and by themselves. As a group, people often go to the rooftopwith family, especially seniors. In contrast, people going to the rooftop with friends is suprisingly low. (Figure 3-7) In the question “how often people meet other users?” most of the people do not meet other users mainly because their using times are different from each other. Again, people who dry clothes on the rooftop have met other users, because they are more frequently using the rooftop and use it for long periods of time. (Figure 3-8)

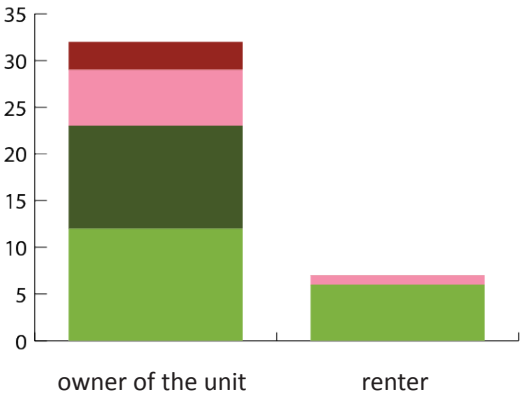


Figure 3-9: Relation between rental and rooftop use

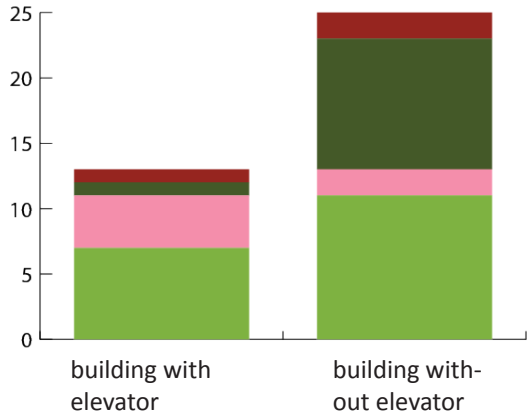


Figure 3-10: Relation between elevator and rooftop use

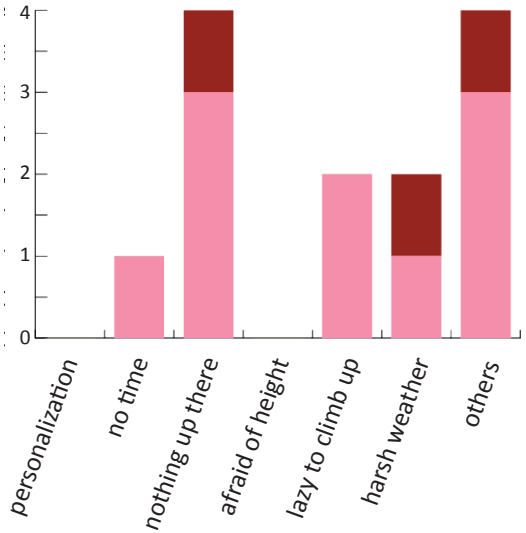


Figure 3-11: Reasons people do not use the rooftop

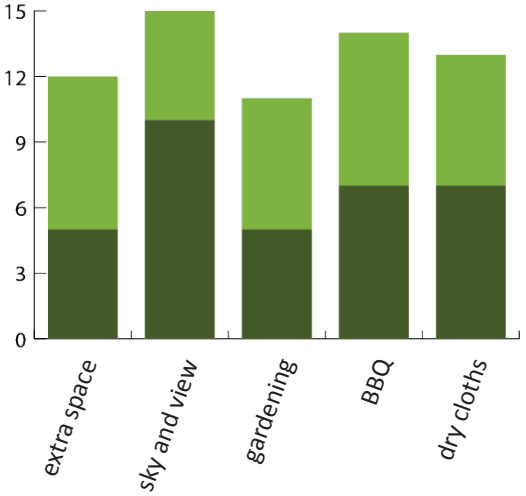


Figure 3-12: Reasons people use the rooftop

In conclusion, the factors that affect the use pattern the most are whether the person is a top floor resident or not and whether the person has children and is a senior. Whether they own the property or not is not a major factor for determining if a person is a rooftop user or not (figure 3-9). One the other hand, most of the "tau tian shu" family uses the rooftop because they own the whole building and have more flexibility and opportunity to use the rooftop. The interesting points about use pattern are: 1. the elevator doesn't matter as much as I thought it does (figure 3-10); 2. people who want to use the rooftop, as long as the condition allowed, will use it no matter what official use the rooftop has; and 3. almost every top floor resident uses the rooftop space and surprisingly, lots of non-top floor residents use the rooftop as well, but in relatively lower frequency. Of course there are 2-3 people who never use the rooftop and admitted that they are too lazy to climb up the staircase.

3. The barrier of using rooftops

The barriers to using the rooftop are similar to the findings in the literature review. The top five barriers include: lack of awareness, lack of promotion and management, lack of motivation, structural concerns and extreme climate conditions. Here, I want to address the factors from a Taipei context. In figure 3-11, 4 out of 10 people reported that the reason people do not use the rooftop is because nothing is up there. The other reasons are that they are waiting for the water leak to be repaired and that it is unclear whether the rooftop is even accessible. In the written open-ended answers, people often mentioned "I don't know if I can go up to the rooftop." The confusion of ownership is one of the main barriers to rooftop use in the type of apartment where every individual owns one unit and theoretically shares the right to use the rooftop. People also mentioned "It is used by the top floor resident," but sometimes that is not the case. The privatized rooftop perception makes people hesitant to use rooftop space and actually sometimes give opportunities and higher motivation for top floor resident to dominate the rooftop space.

4. Future demand for rooftop

The most popular existing activities are drying clothes, BBQs, relaxing and having some time alone. It is interesting that 9 out of 30 people who have used their rooftop said that they like to have day dreams alone on the rooftop and for some of them, day dreaming is the only activity they do on the rooftop. Drying clothes and

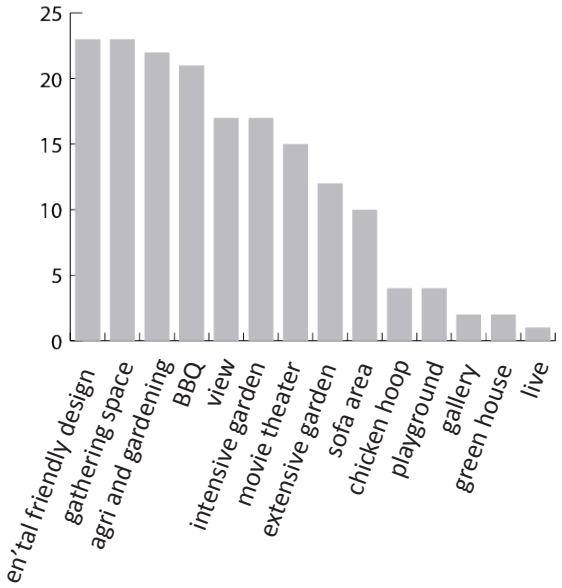


Figure 3-13: Future demand from people who already use the rootop

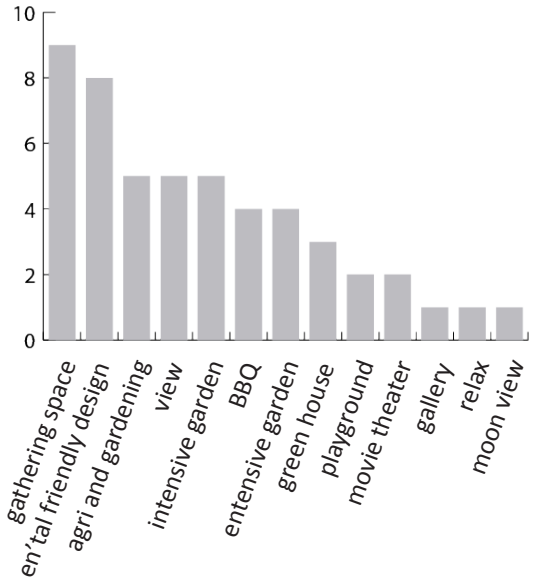


Figure 3-14: Future demand from people who do not use the rooftop

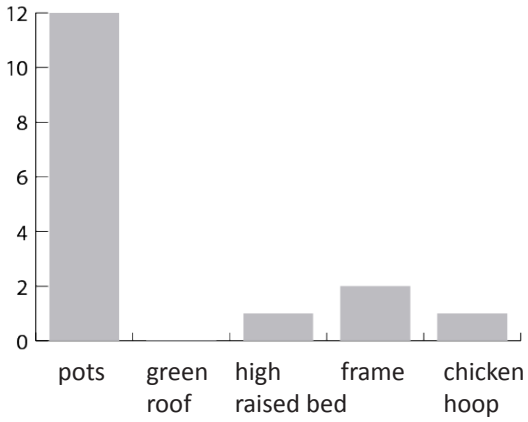


Figure 3-15: Gardening methods

comforters is another major demand, especially drying comforters because it's hard to do so at home. BBQ stands out mainly because they are related to a traditional event that everyone will go to, watch the full moon, and have moon cake together with their family. The ranking of the future needs are: 1. environmental friendly design, 2. gathering space, 3. urban agriculture, 4. intensive green roof, 5. BBQ, 6. view, 7. movie theater, 8. extensive green roof, 9. sofa space, 10. chicken coop, 11. playground, 12. greenhouse, and 13. gallery. It is interesting to keep in mind that pets are the other users; this group include dogs, cats and rabbits. Furthermore, the answer also shows that people who don't use the rooftop have less ambitions and imagination for future rooftop opportunities. That shows that the ice breaker for promoting and showing people the "new" role of the rooftop is important.

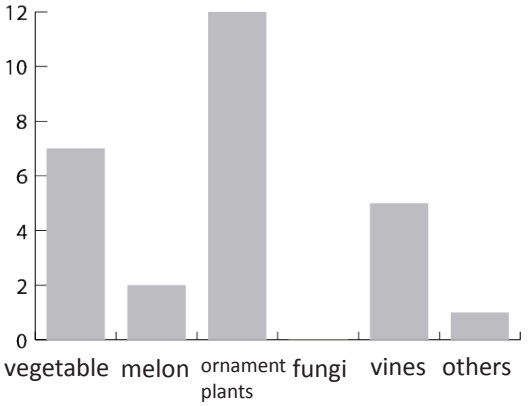


Figure 3-16: Types of plants

5. Gardening on the rooftop

The section for people who garden on the rooftop had 12 respondents. The form of the garden is mainly a container garden. One of them has a chicken coop and two of them have structures for vegetables. (figure 3-15) Everyone has non-edible plants and seven of them also have a vegetable garden. (figure 3-15) There is no rela-

tionship between age and gardening and some of the people begin to learn how to grow things on the rooftop itself. The frequency of using the rooftop is higher than for people who do not garden. In the questionnaire, there is a section where you can write a story about the rooftop. (Appendix 1) Seven people filled out that section and six of them wrote about gardening on the rooftop. They have more place attachment to the rooftop as well as a sense of community. Two of them often chat and garden with neighbors on the rooftop.

6. Consideration for connecting rooftops

The last topic is to understand how people think about connecting rooftops as a whole community open space system and what their concerns are. The positive response rate (21 out of 38 people who answer this question) is higher than I thought it would be and surprisingly people who live in “tau tian shu” are more likely to disagree with this idea. (figure 3-16) Also, surprisingly, whether people live on the top floor and already using the rooftop space is not an obvious factor. The only obvious factors are gardening. Eight out of eleven rooftop gardeners like the idea of connecting rooftop spaces and everyone says it is because they want a larger space. (figure 3-17) People who have a rooftop manager are willing to connect rooftops as well. The reasons for these positive responses are: seeking a larger space, meeting more people, networking with each other and beatifying

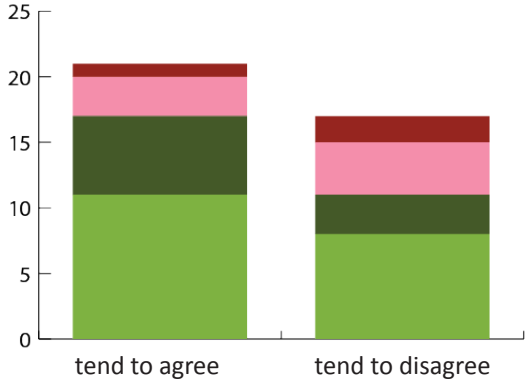


Figure 3-17: Opinion on connecting rooftop space

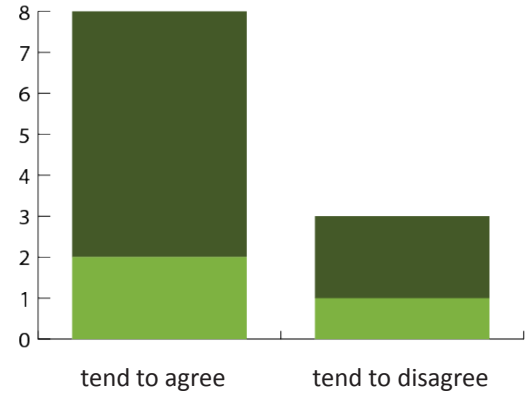


Figure 3-18: Opinion on connecting rooftop space by gardening population

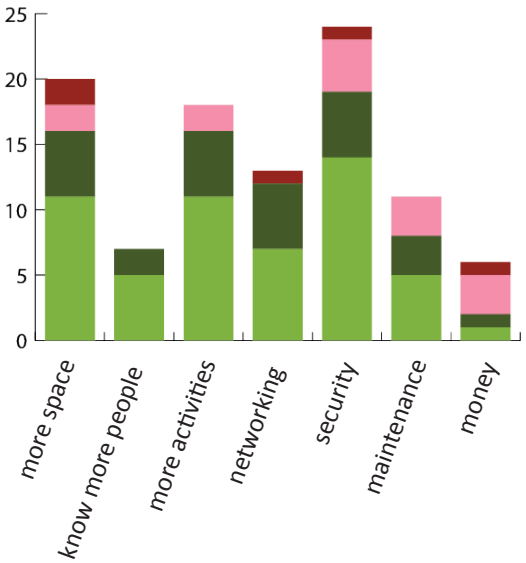


Figure 3-19: Concerns of connecting rooftop space

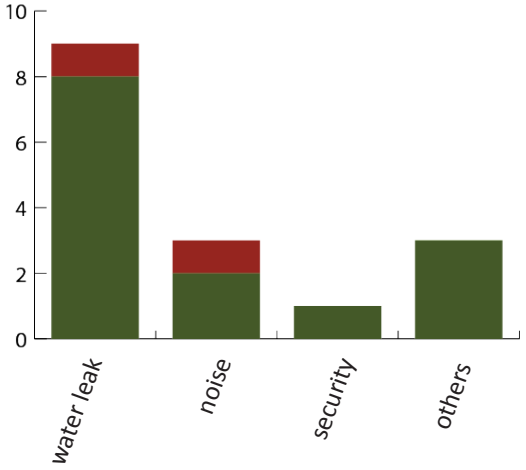


Figure 3-20: Concerns of connecting rooftop space from top floor residents

the space. The reasons for negative responses are: security, management issues, maintenance issues, cost issues and theft. (figure 3-18) Thus, management and funding are the most important considerations for creating rooftop networks. Top floor residents have more practical concerns towards rooftop networks which includes water leakages, noise and security. Other reasons are the potential damage to the building's structural safety by tree roots and consequences of insects brought to the rooftop by gardening soil. (figure 3-19)

To sum up, there are a couple of lessons for designing rooftop networks. Using the rooftop for drying clothes is in highest demands. Second, a good combination of daily activities and opporunities for staying longer on the rooftop need to be considered. Also, senior activities are of great importance. People do not meet other users on the rooftop because they use it at different times. Therefore, in order for people to meet, diverse programming is necessary. Also, the ice breaker programs and the enhancement of the quality of experience on the way to the rooftop, such as a staircase space, are good ways to change the existing bad impressions of rooftops. The design solution for improving the physical condition, programming, the structural check and management plan are the body of reutilizing rooftops. The strategy is to strongly promote an environmentally friendly design, a space for urban agriculture, and a space for public gathering, and a space that offers opportunities for privacy. Extending the "shelter" idea can increase the sense of ownership and extending the "sharing" idea can build a sense of community.

Design Assumption

Three assumptions need to be made in order to make the design framework work. These three assumptions are also the issues that need to be solved other than physical design solution but by changing the policies and regulations as well as by outreach and advocacy.

1. Assume that the illegal one more story will become legal once it opens to all residents.

2. Assume that people can build structures on the roof once it has structural check.

3. Assume that community people are willing to reuse the rooftop.

Basic Design Considerations

Rooftop spaces are the most-close-to-living-space public spaces. There are couple underlining design considerations for publicness, fire escape and management.

1. The rooftop space should be open to the all the people who lives in the apartment.

2. Considering fire escape, the design needs to have a clear path leads to fire escape facilities and restrict management in order to ensure the safety of the building.

3. In order to ensure point one and two, the door to the rooftop space needs to be unlocked all the time.

4. Permission from architects or structural engineers is pre-required to ensure the building structure is safe.

Design Goals

Goals for making a rooftop map are looking from a broader view of the neighborhood as a whole. Making connection, re-utilizing vacant lots and enhancing community life are three major goals to connect rooftops and design them as a whole system. Connect existing resources such as shops, restaurants, active community members, and surprising points in order to create a diverse network. Identify, organize and reutilize the resources as well as the vacant space is important. The last goal is about keeping people in the community and having a sense of community.

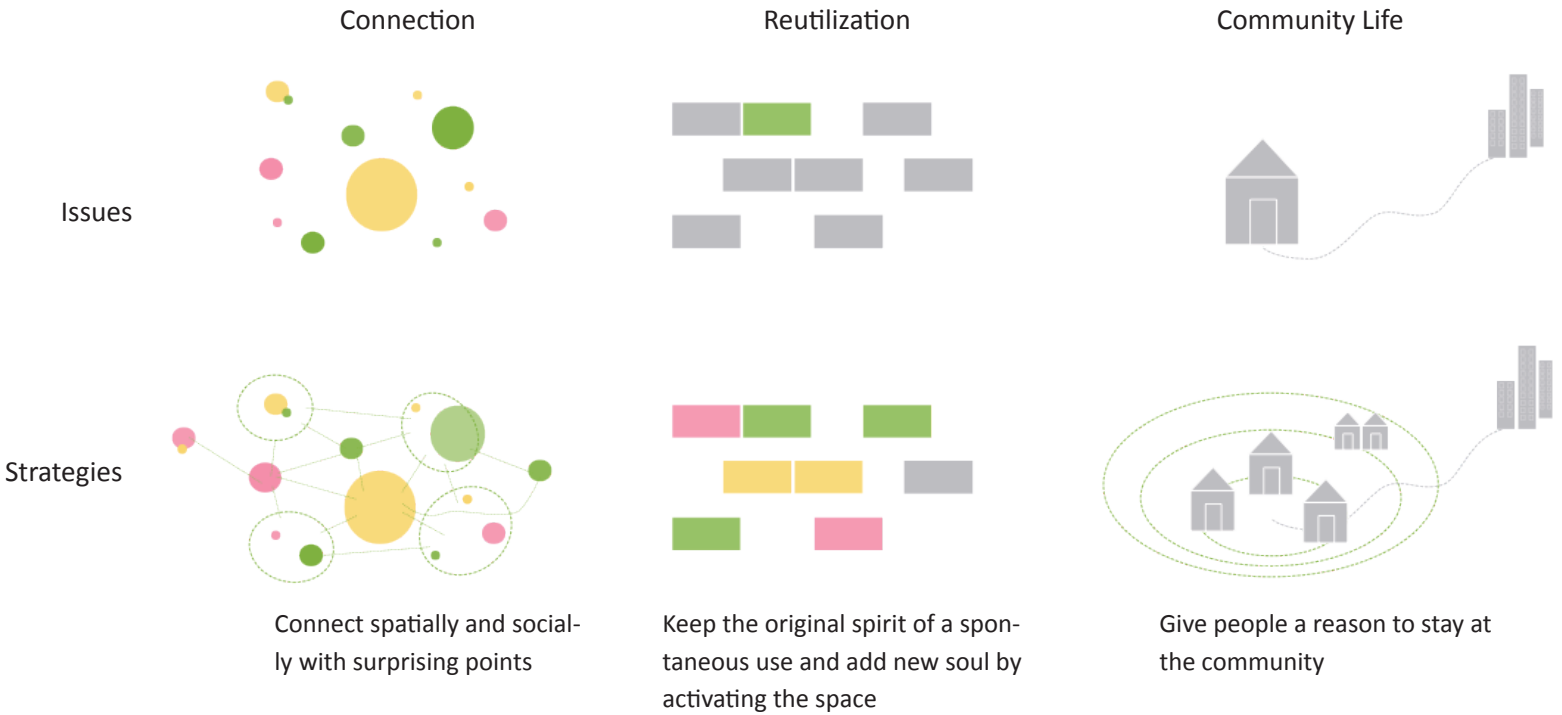


Figure 3-21: Design goals diagram

Rooftop Map in Neighborhood Scale

A rooftop map is a good starting exercise for the community. It is also a good tool for understanding the rooftop and for gathering basic rooftop information for future planning and design. There are two scales of the rooftop map: the neighborhood scale and the building cluster scale. The former one is to identify nodes and connections of the whole neighborhood and the latter one is to identify the different typologies, uses and conditions of existing rooftops.

The first step for creating a neighborhood scale rooftop map is to have a neighborhood comprehensive plan on available rooftop space. The comprehensive plan needs to first identify flat rooftops in the neighborhood. The flat rooftops are potential nodes on the rooftop level. The second step is to identify the nodes on the ground and some empty rooftops that have the most potential to develop into a node. The ground nodes can include places where people already use it as a gathering space or a vacant lot that can be turned into a node or an intersection of two lanes or a grocery store place. The third step is to overlap two maps with potential nodes both on the rooftop and at ground level.

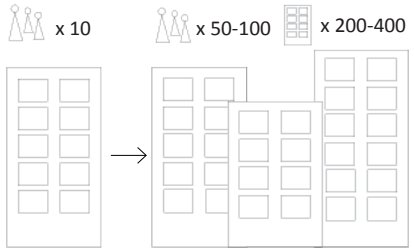


Figure 3-22: First step of defining rooftop cluster: calculating number of people and buildings

The fourth step of creating a neighborhood scale rooftop map is to calculate the population for each building in order to define building clusters. According to the building arrangement and the consideration of safety and security, each building cluster should have 10-20 buildings, which comes to about 50-100 families or 200-400 people total. If it's a high-rise business building, one or two buildings consist of a building cluster. A building cluster is a basic unit for rooftop networking. In this size of a neighborhood, people can get to know each other easier and have a manageable programming and exchange system, and a smooth material flow and human group flow. The connection between different building clusters can be considered in the future.

The criteria for a rooftop node are 1. a relatively large space, 2. a less privatized space, 3. has a view or other advantages that come with the location, 4. relatively located at the middle of the building cluster, 5. the potential connection with the ground nodes and 6. the degree of willingness from the residents. Next, it is imperative to identify the potential connection between the nodes on the ground and on the rooftop, which can help visualize the material flow and human activity flow.

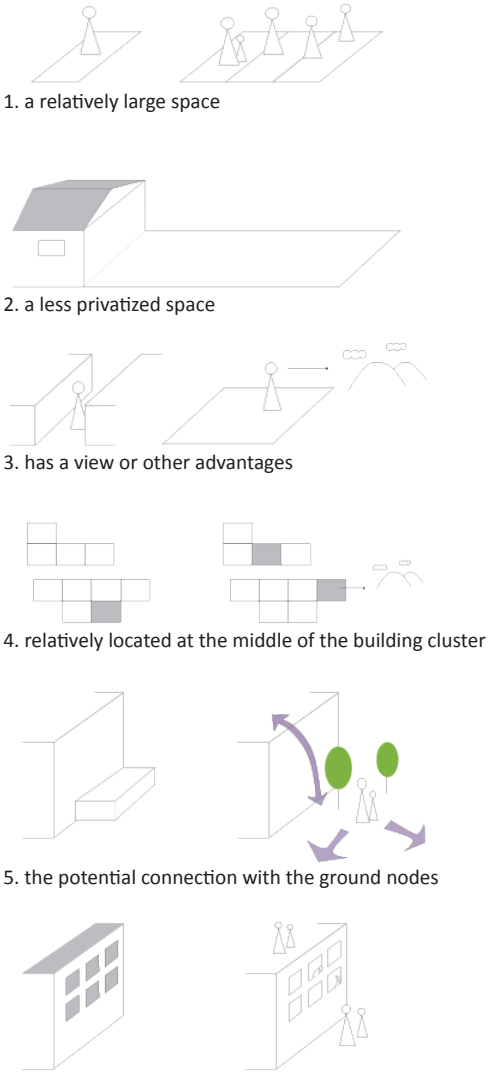


Figure 3-23: Second step of defining rooftop cluster: criteria for a rooftop node

Rooftop Map in Building Cluster Scale

Spatial Analysis

When somebody is interested in making rooftop network, they could follow the rooftop map in neighborhood scale and then look into the more detail about the actual rooftop space condition. In building cluster scale, people need to identify 1. whether the rooftop is pitched or flat, 2. if there is any covered structure, 3. where is the extra structure, 4. height difference, and 5. existing greenery and uses. This map is important to categorize rooftop spaces and developing future programming. The existing greenery can be seen from the Google earth if the rooftop is not accessible at the research time and it is showing the interests of using the rooftop in that particular building.

As well as the rooftop map tool, these diagrams can help people easily understand the spatial characteristic of rooftop spaces. In the first row, depending on how many extra stories there are on the top of the building, there are three possibilities for rooftop space: canyon-like narrow space between two extra buildings, an extra story on one side with a open space, and a larger space with no extra story building. The second row shows whether the building is free standing or in a row. If it is in a row, the column shows whether the space is located on the side or the middle of the row. The final row shows some facilities that need to be taking into account, such as a personal screen/fence, a staircase and a water tank.

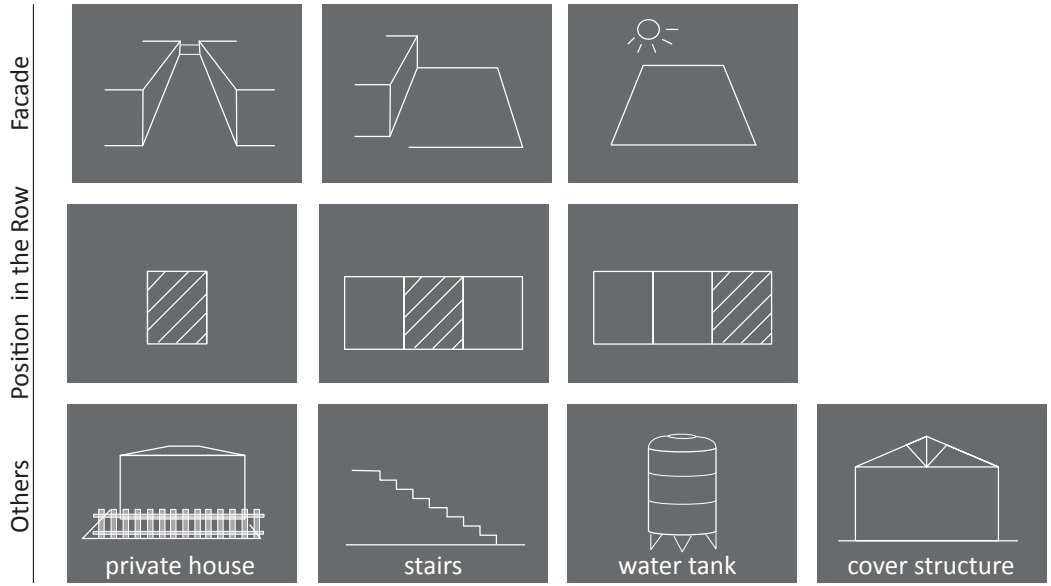


Figure 3-24: Spatial analysis diagram

Programming

Based on the case study, the questionnaire, the literature review and my own experience, a few activities are identified and each of activities has their own required equipment or space type.

Figure 3-25: Programming diagram

Programming Analysis

Different programs have different needs and conflicts between each other. Figure 3-x shows how these programs could be arranged by considering the relationship with other activities and private residential use. Referring back to the five zone rule discussed earlier, things that people need to use or take care of everyday need to be located close to where people live, such as gardening patches and flower beds. Due to the ease of moving things around, cooking facilities could be located near the home. Different activities could have conflicts, such as negotiating if the the ball court should be put far away from the small kids playground or the quiet area. If they need to be placed together, a buffer zone is preferred, or people could negotiate over when each space is used to reduce the conflict. Also, since the rooftop is a small space, multi-functional usage of space is needed. For example, the ball court could be used as gallery or movie theater as needed.

Figure 3-26: Spatial relationship between programmings and residential use

Five Design Strategies and Considerations for Rooftop Networking

The existing rooftop spaces have formed in a way to prevent freely use by residents' wishes. In order to build a better rooftop network, there are five design strategies have been developed. The main idea is to understand each rooftop space's characteristic, spatial identity and strength and assign good plan for each of the rooftop space.

Strategy One: Using the Advantages of Each Rooftop

The first strategy is to address the importance of the view and also to emphasize that using the advantages of each roof as much as possible such as rooftops with a cover can serve different purpose from the ones that do not have a cover structure.

Figure 3-27: Strategy one- before

Figure 3-28: Strategy one- after

Strategy Two: Maximizing Connection of Rooftop

Area of each rooftop originally should equals to two apartment unit because each apartment unit have two sides with one shared entrance. However, the extra personalized story makes the space divided into two parts and less connected. After analyzing the advantages of each rooftop, in order to build a rooftop network, maximizing shared rooftop space is crucial to optimize the usable space. Thus, the second strategy is breaking the wall between two individual personalized spaces and creating larger and more usable space with special topology and micro-climates.

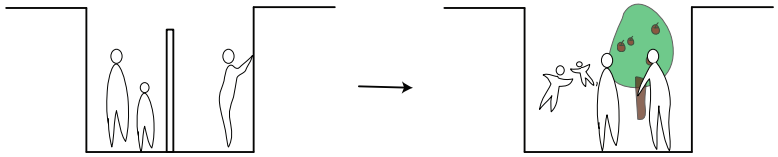


Figure 3-29: Maximizing connection diagram

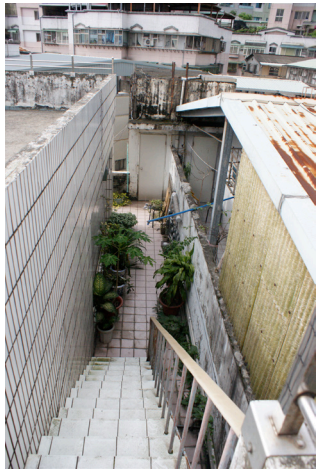


Figure 3-30: Strategy two- before

Figure 3-31: Strategy two- after

Strategy Three: Social Programming for Flat Roof

Larger complete vacant areas in this type of residential building is relatively rare. The flat roof should have programming for supporting social events, agricultural use and other daily uses. There are two types of flat roof: one is the top of the original building, another is on the extra story structure. The programming on the extra story structure flat roof needs to be carefully calculated for weight bearing than the other one. It should not have event that will have too many people on it. The agricultural soil and facilities need to be light weight.

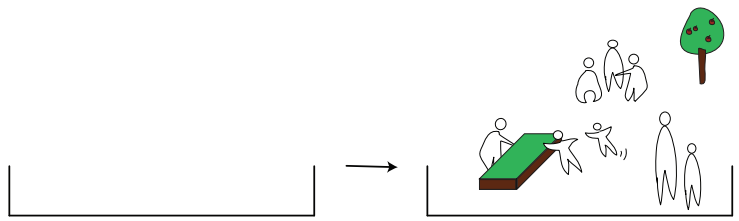


Figure 3-32: Social programming diagram

Figure 3-33: Strategy three- before

Figure 3-34: Strategy three- after

Strategy Four: Green roof on Pitched Roof

The pitched roof is important to be covered by green in order to improve livability in the house as well as reduce urban heat island effect. In the after picture, The green roof creates a visually pleasant view upon the rooftop landscape, softens the edge of buildings and has many environmental benefits. Furthermore, a monitoring system is important to record the benefits of greenroof and have more people willing to join the project.

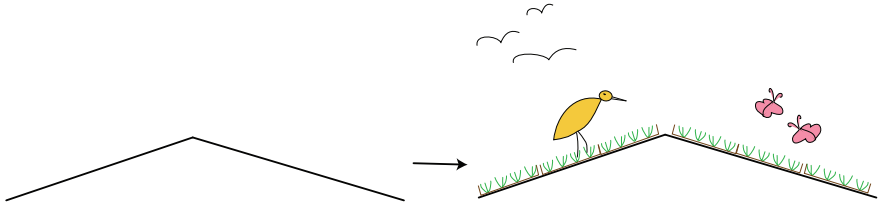


Figure 3-35: Pitched greenroof diagram

Figure 3-36: Strategy four- before

Figure 3-37: Strategy four- after

Strategy Five: Sky Passages on Rooftops

Except for adopting from the existing rooftops, we could also change the typology of the rooftops, such as turning the piteched roof into flat roof or changing the structure of pitched roof. For example, for the hybrid type rooftop (shelter structure with actual flat rooftop building underneath), we could demolish the shelter structure and extend the flat rooftop area for agriculture use. In between the buildings, we could create a longer sky passage to create easier path for people to exchange different functions within the network. However, the original function of metal sheet structure is to keep the heat and rain away from the actual structure. Thus, the double roofing idea is still important to keep in mind.

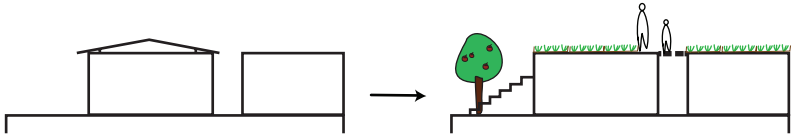


Figure 3-38: Sky passage diagram

Figure 3-39: Strategy five- before

Figure 3-40: Strategy five- after

In conclusion, different rooftop condition will have different opportunities and constraints. The purpose of these five strategies is to give a basic idea and expectation for people who want to renovate the rooftop space. It is a starting point for people to negotiate the programming in different rooftops.

The five basic strategies for different condition of rooftops

1. Using the advantages of each rooftop
2. Maximizing connection of rooftop
3. Social programming for flat roof
4. Green roof on pitched roof
5. Sky passage on rooftop

The key for successful rooftop network is to carefully arrange the programs accordingly to the condition of rooftops, in terms of the size, sun exposure, existing structure, orientation of the building, and so on. Considering the existing condition of rooftops, the flat rooftop and pitched rooftop have different strategies. Flat rooftop is for activities and the pitched rooftop is for green roof. If necessary, the pitched roof structure could be demolished or transform to another usable form. Ideally, the sky passage could be added wherever suitable.

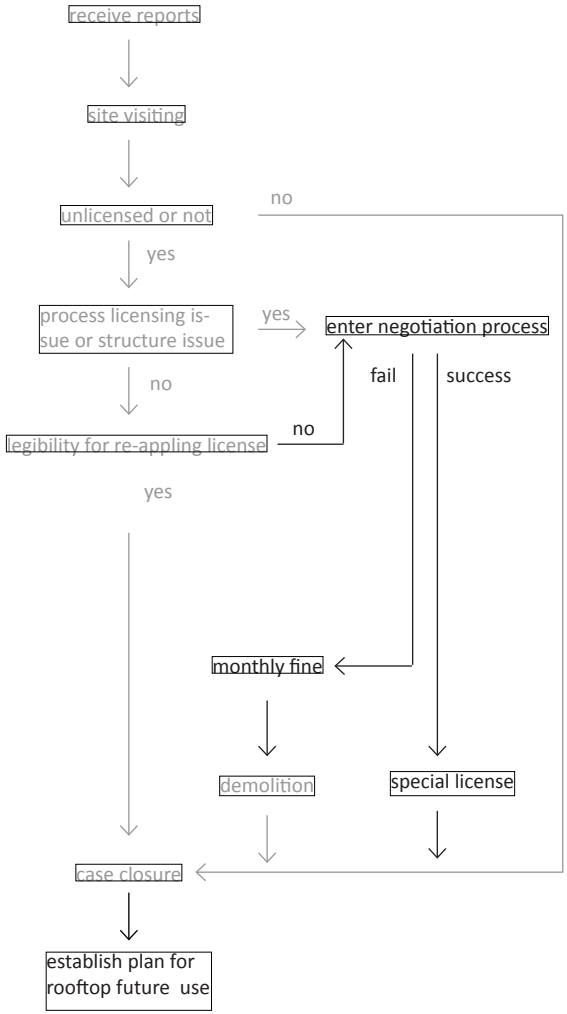


Figure 3-41: Proposed unlicensed structures report, negotiation and demolition process

Proposed Community Process and Policy Making

With all the design tools, how to get the process started is important as well. As discussed in Chapter two, there are already many programs at the government level for improving rooftop conditions both from an environmental aspect as well as from a social aspect. However, there is a lack of a comprehensive plan for both the whole city and especially for older row house apartment renovations. For older row house apartments, where there are issues of illegal extra stories and the vagueness of ownership, the most important step in the renovation process is redefining who is responsible for taking care of the rooftop space. First of all, on the neighborhood level, the local government should be collecting data using the neighborhood scale rooftop map and then making a comprehensive plan to efficiently add one more layer of open space in the city.

On the building cluster scale, there are two main scenarios for individual rooftop space: 1. vacant rooftop with some degree of spontaneous use, 2. rooftop occupied by extra story, which either has some outdoor space or is fully covered by the structure. For the first scenario, the rooftop plan could get into rooftop map in building cluster scale as the design framework showed. For the second scenario, the process of reporting illegal structures could be a way to force people to enact some changes toward a green, usable rooftop-scape. When the demolition process begins, the residents should negotiate to add a green roof on the top or give a majority of the outdoor space to public use and thereby take responsibility of managing it to a certain degree. If the negotiation process succeeds, the new special rooftop space license could be given to the whole apartment. While the special license in the application process or even after the special license is given, residents need to establish a plan for the rooftop's future use. If the negotiation process fails, the demolition will begin and then it still would be necessary to establish a plan for the new rooftop's future use. The difference between demolishing or not is a different degree of responsibility upon the top floor resident. Furthermore, in order to enforce this regulation, it should have a fine established before the demolition process on a monthly basis. If people cannot fulfill the negotiation process or demolish the structure, the monthly fine should be applied to the owner of the structure. The monthly fine could be used as special funding for future rooftop renovation projects. (Figure 3-41)

The plan of rooftop future use could use this design framework as a step by step guidance. The first step is spatial analysis and creating a rooftop map in order to have a comprehensive understanding of the relationship between the individual rooftop and its surrounding. The second step is to find out the future demand and plan the network using the rooftop map. The third step is to develop design strategies and management methods.

There are some site specific considerations. There are different advantages of each rooftops in different building clusters. The connection of rooftop and the combination of intensive and extensive rooftops will be site specific as well.

Lastly, outreach and education about the rooftop policy is a crucial step for making the process more efficient. The government should establish a rooftop program group in charge of rooftop policies, basic research and data collection. The low carbon community planners and community planners should be part of this system as a resource to assist the monetary policies, outreach, education and negotiation in the neighborhood.

In sum, for the ground work, it is very important to have a comprehensive plan of rooftop space. The creation of the neighborhood scale rooftop map is mostly the responsibility of the neighborhood organization's work unless some residents want to initiate the process. The building cluster scale rooftop map could be initiated by anybody that is not satisfied by current conditions of rooftop use. Figure 3-42 illustrates the process for two different scales of rooftop mapping. Further, the process of dealing with unlicensed structures need to be reformed to consider the public benefit as a whole. To create a win-win situation for both private and public sections is the purpose of negotiation process.

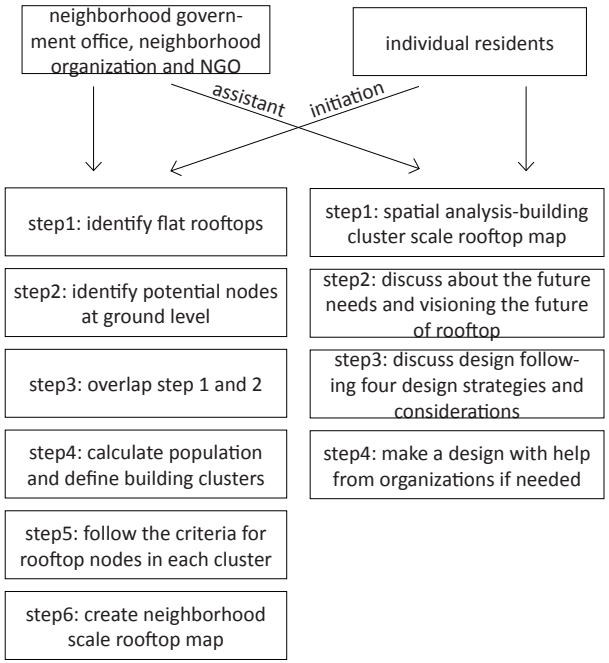


Figure 3-42: rooftop map process in two different scales

Chapter Four: Design Application

In Chapters Two and Three, the design framework was developed. In this chapter, I use a choosing site to demonstrate the implementation of the design framework. The implementation is in two different scales with a rooftop map tool. On the neighborhood scale--based on ownership, management type and the existing use of the rooftop--several building types and building clusters have been defined. The next scale of implementation is be choosing from one of the building types and building clusters.

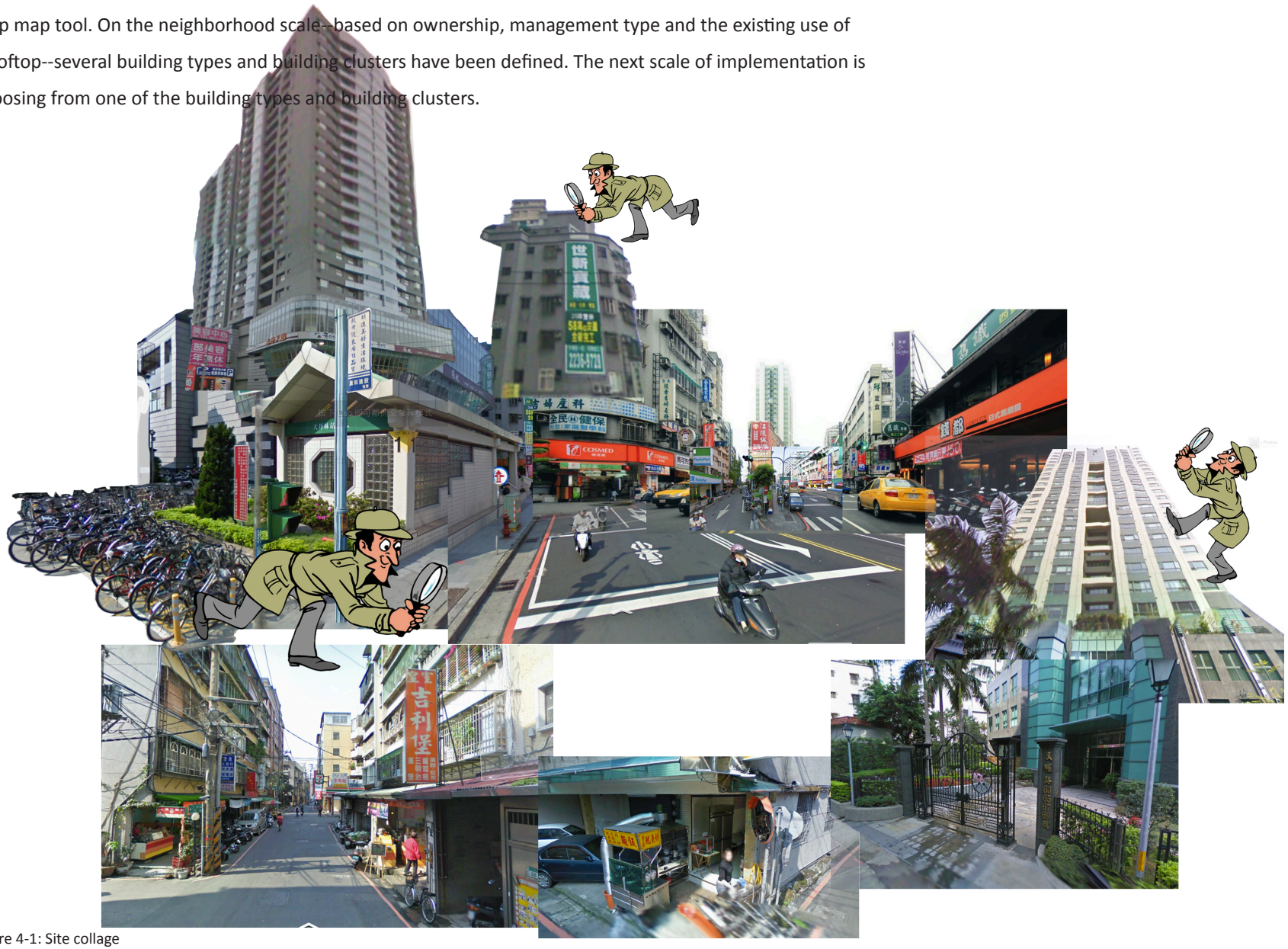


Figure 4-1: Site collage

Site selection

The design framework aims to practice in different neighborhoods. Thus, when choosing the site, a generic typology is needed. The criteria of choosing the site are as follows:

1. A neighborhood where has different community spaces and organizations which has more diverse program potentials, especially if they are close to schools or religious spaces.
2. A neighborhood where is lack of open space. In this case, there may be greater demand for creating a rooftop network.
3. A neighborhood where has different building types. One of the thesis goals is to create a framework for further research and design. To choose a place that has different typologies of buildings and therefore could have larger applications for other communities.
4. The degree of familiarity with the neighborhood is another important consideration. This is also one of the limits with this thesis, since I cannot go back to Taiwan and do site analysis. Thus, the degree of familiarity is critical for future research and design of the site. The higher the degree, the better.

With these criteria, the chosen neighborhood is Jiang Ling Neighborhood in Taipei, Taiwan, which I am very familiar with and has a good range of different uses of buildings including a mixed-use commercial corridor, a hospital, a supermarket, many new office buildings, a Metro station and apartment buildings. In addition, there are department stores, other hospitals, and many schools and neighborhood parks nearby. The park is not in the neighborhood and the serving area is large.

Context

Jiang Ling Neighborhood is located in the south of Taipei city. It covers 188 acres and the government defines its boundary with several mixed use commercial corridors surrounding it in a triangle shape. According to the Census, there are 23 sub-neighborhoods and about 6,000 people. This is a growing neighborhood with several brand new gated communities. There are several schools and hospitals nearby with two neighborhood parks outside of the neighborhood boundary. Other than these two neighborhood parks, there are no smaller parks within the residential area. There is an industrial zone to the north. To the west, there is a large agricultural and historical preservation area that will be developed soon. The residential apartment buildings in this neighborhood consist mainly of two-sided apartments.

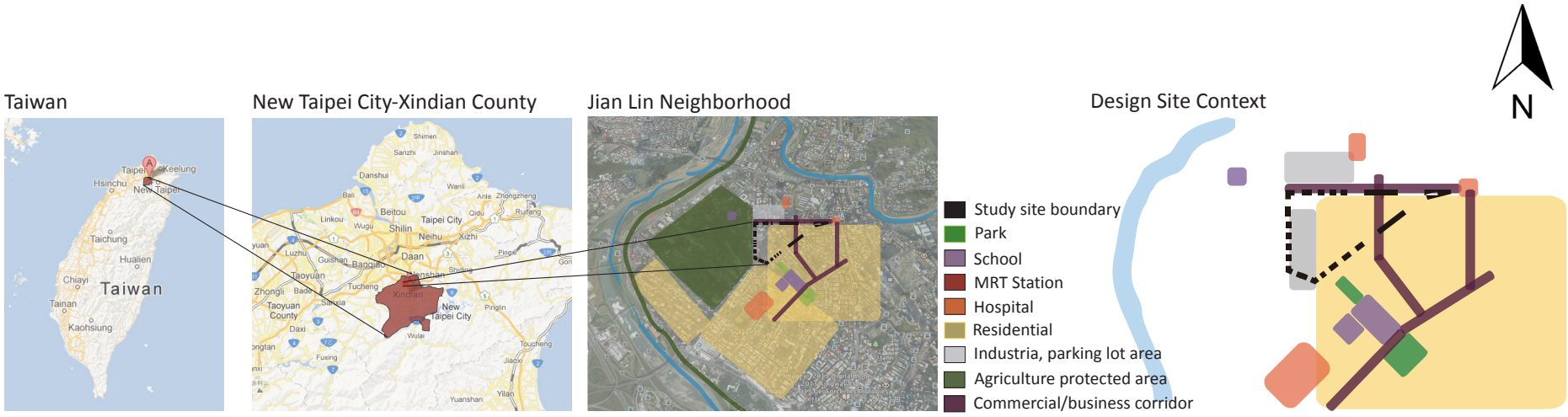


Figure 4-2: Site analysis

SCALE ONE: NEIGHBORRHOOD

Neighborhood Analysis

Rooftop design and process needs to consider the ownership of the building, the height of the building, the use of the building, and other factors. Here, buildings are categorized by ownership, management type and existing usage and also have an analysis of open space.

Figure 4-3: Open space mapping

Figure 4-4: Management of the building mapping

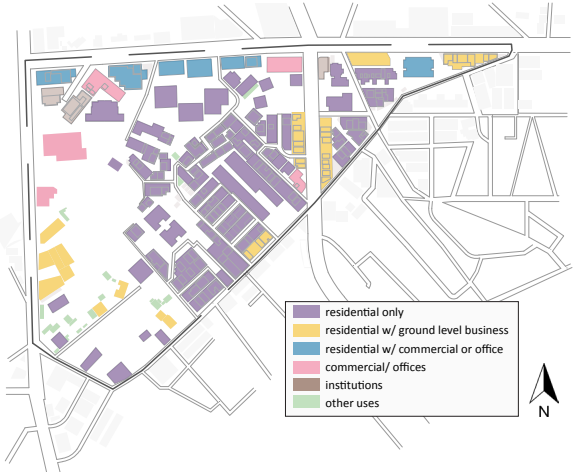


Figure 4-5: Existing usages of the building mapping

Open Space:

This neighborhood has many gated-communities (purple area) that should count as community open space but become fenced afterwards. The farmland and woodland are private space. At west side, there are mostly retail store and office building parking lots. The open space within this neighborhood is not sufficient.

Management of the Buildings:

Individual responsibility means every single unit in the building has one owner who do not have overall management power behind them. Buildings with guards have overall management. The purple area represents the gated communities that have their own management company. Single management is usually found in institutions, big box retails or restaurants.

Existing Usages of the Buildings:

Most of the buildings in this neighborhood are residential buildings. There is only one institution and a few offices along the commercial corridor. The other uses include covered garages, tool sheds and storage spaces.

Neighborhood Overall View and Building Height:

From the 3-d diagram, we can see the different heights of buildings and the different building densities within this neighborhood. One of the special characteristics of this neighborhood is that it has many new gated communities that were mostly built by the same developer. In the near future, the development of the western protected area will perhaps alter the use of the western part of the site and potentially may have a higher building and population density.

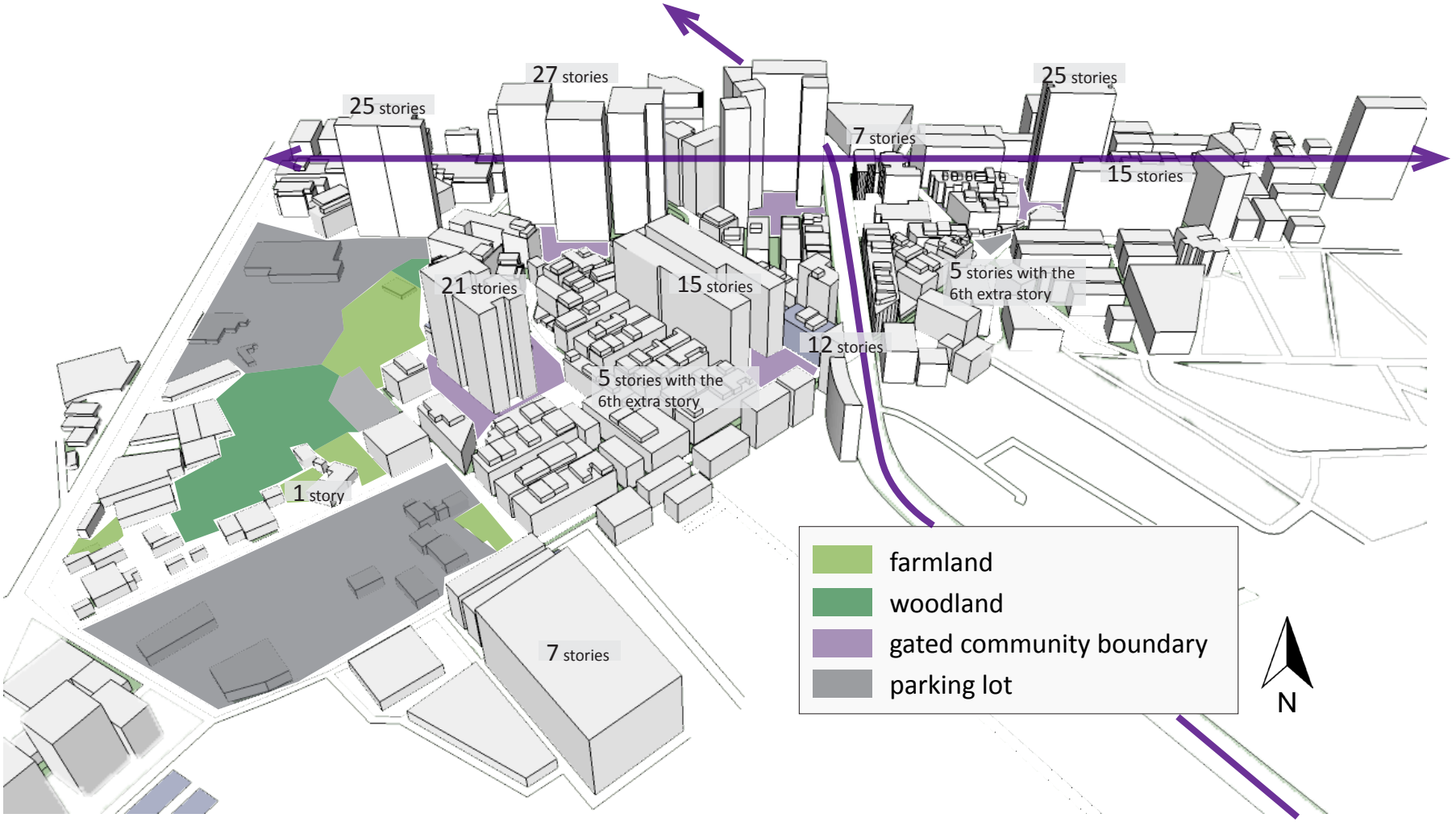


Figure 4-6: Bird's eye view of the neighborhood

Neighborhood Rooftop Map

The neighborhood rooftop map is used to identify flat rooftops, ground open space, building clusters and then connecting points between rooftops and the ground. The yellow dots are flat rooftops that use as rooftop nodes within one building cluster. The orange dots are ground level nodes. Looking at the neighborhood rooftop map, you can see that 24 building clusters have been identified with one to two nodes according to their building arrangement and location. Every building cluster has a node on the rooftop and a potential connecting point with the ground. The nodes on the rooftop are places that are either at the center of the building cluster or are flatter and larger area. The nodes on the ground refer to relatively active intersections or small vacant lots where already have semi-public uses such as gardening, vendor, pocket park, and motorcycle, bike parking. The potential connection between rooftop and ground is based on both visual connection and programming opportunities. Each cluster has 200-400 people. However, the commercial buildings are different from residential buildings that the population inside the building depends on the type of the office.

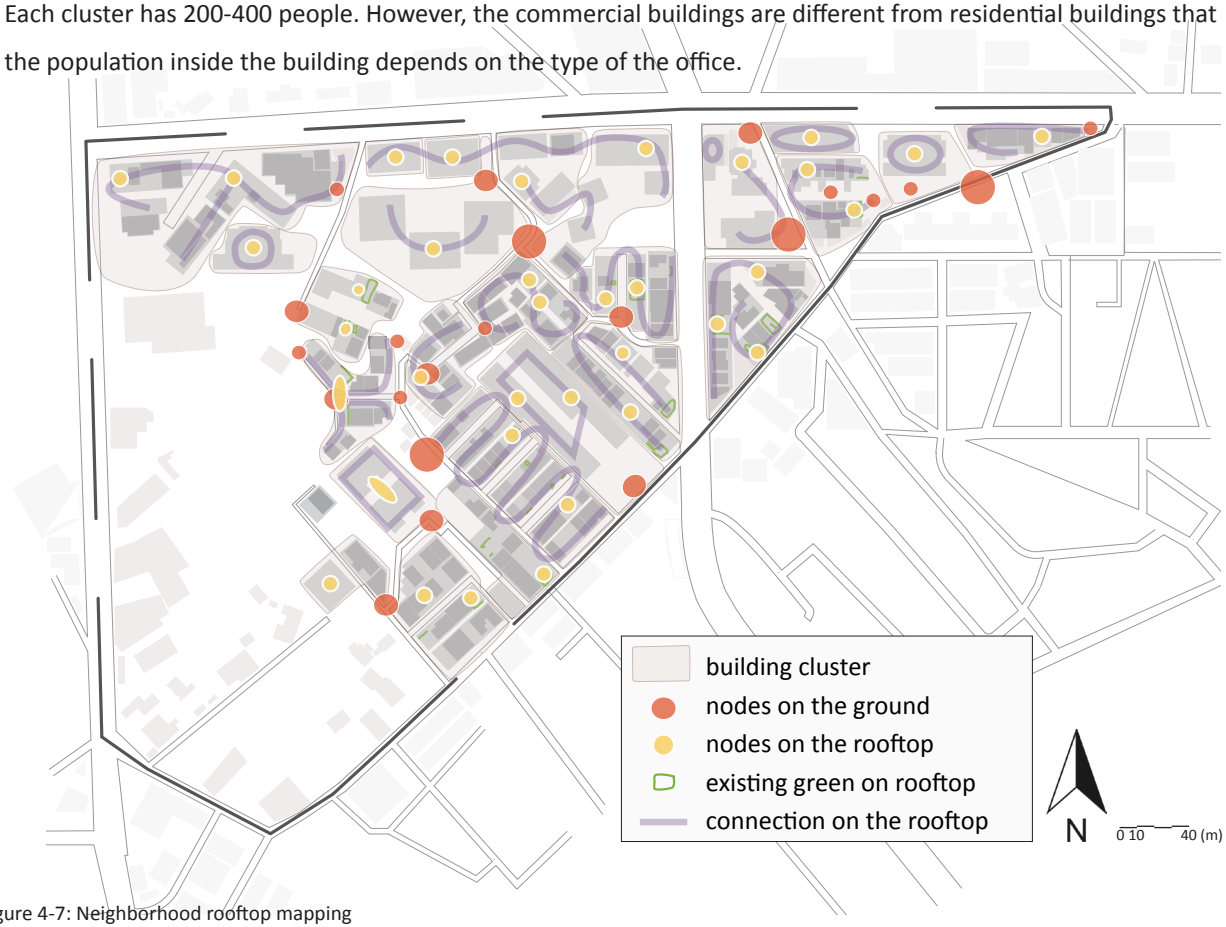


Figure 4-7: Neighborhood rooftop mapping

Categories of Building Cluster

In the analysis, five categories of building types are identified (1) commercial office high-rise buildings; (2) buildings for institutions; and three kinds of residential buildings: (3) gated communities; (4) open communities with a security guard; and (5) individual apartment units in a row or with an organic arrangement.

1. Commercial-office building

   Commercial-office buildings in this category are new tall building between 12 to 25 stories high and located on the main commercial corridor. They have management organizations and have business activities that involve outsiders. Most of the rooftops in this categories are flat roof which can provide a good social space or a place for people to relax.

2. Institutional building

   The institutional building here is a hospital with a nursing home for the elderly. The flat rooftop can be used as a therapeutic garden, providing the elderly, their families, and employers an outdoor space.

3. Residential building

   The most important differences that will affect developing a rooftop network is the management. Below are the management types found in each building:

   1. Gated community: Gated communities have a larger ground floor open space, they have higher buildings surrounded by walls that's about six or more feet. They also have a gated entrance with a guard. Rooftops have less potential for spontaneous use because of the management style. The community has a committee to decide public affairs.
   2. Open guard community: In contrast with gated communities, the buildings' height is around 5-12 stories, with several buildings in a row. They don't have a gate surrounding the community but they do have a security booth.
   3. Individual community: There is an irregular arrangement of older buildings that make up an organic building cluster. The buildings are usually 5-7 stories. No guard or collective body exists.

Rooftop networks for these five categories have different needs and different appropriate procedures. Commercial-office buildings, institutional buildings and gated communities already have a clear, developed management mechanism. In addition, they all have clearly rooftops that either un-used or well-organized which would make it easier to establish and implement new rooftop garden plans. Furthermore, commercial offices

and institutions have much more specific needs, such as releasing the pressures from working or ameliorating sickness, whereas for residential buildings, the diverse needs of complex human relationships require more time and effort to establish a rooftop network. For open guarded communities and individual communities, the major roadblock to creating a rooftop network is the extra stories. To solve this big issue, a reciprocal mechanism needs to be designed so that people can use the rooftop as a community space more.

Characteristics:
Owner: Individual
Management: individual
Use: Residential only
Building height: 5-12 stories
(over 7 w/ elevator)
Building age: over 20 yrs.

Space
- Irregular arrangement of buildings
- With other residual space on the ground
- Conjunction with gated communities

Social
- Totally individual

Characteristics:
Owner: Individual
Management: individual
Use: commercial/ office
Building height: 12 stories
Building age: under 15 yrs.

Space
- on the main road
- usually individual building

Social
- Individual
- Different needs required
- Outsider/ workers

Characteristics:
Owner: single owner
Management: single management
Use: with day-care center, varies
Building height: usually over 20
Building age: 18 yrs., varies

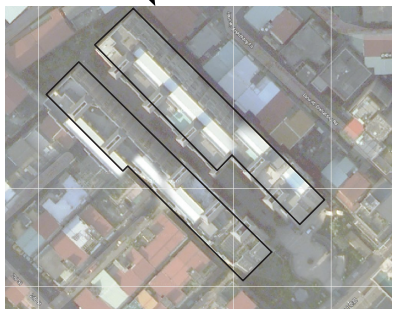
Space
- Irregular arrangement of buildings
- sometimes w/ open space around

Social
- Totally individual
- Different needs required

Characteristics:
Owner: Individual
Management: with guard
Use: Residential only
Building height: 5-12 stories
(over 7 w/ elevator)
Building age: over 20 yrs.

Space
- Buildings in a row with similar characteristic
- Not gated but have a guard
- A block of the community

Social
-Management fee is required
- Easier to distribute information



Characteristics:
Owner: Individual
Management: Gated
Use: Residential only
Building height: usually over 20
Building age: 18 yrs., varies

Space
- Buildings in a row with similar characteristic
- Having court yard on the ground

Social
- Management fee is required
- Usually have management company cooperate with residential committee members
- Easier to distribute information

Figure 4-8: Building cluster categories

Circulation

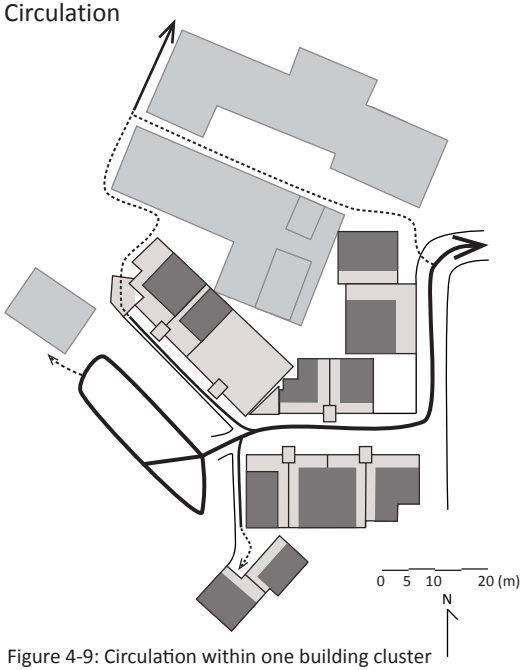


Figure 4-9: Circulation within one building cluster

Ground open space

Figure 4-10: Ground open space analysis

SCALE TWO: BUILDING CLUSTER

Building Cluster Assumption

For future rooftop network designs, the following will focus on the fifth category -- individual building clusters -- because the organic arrangement and the complex condition on the rooftop are intriguing challenges to me. The general background assumptions about these building clusters are:

1. The demographics are mostly middle class families with one or two children, as well as a few retirees.
2. The buildings were constructed over 25 years ago. They are all five stories and most of them have an extra story on top.
3. Every resident has his or her own residential unit.

Site Analysis

The circulation graphic shows that this is a cul-de-sac, where only one car can pass at a time. There is a parking lot at the end of the road. The ground open space shows the existing uses on the ground. The purple dots show places where a few people will gather together on their motorcycles or chat while waiting for the trash collector. The pink dots show places where elementary and junior high school kids will gather for ball games, flying kites or just for running or biking around. There are bamboo fields on the west side of the site and there are a few agriculture patches within the site. The brown area is the back of buildings that have no use.

The population of this site is around 280 people. (Estimated formula: 14 buildings x 5 families x 4 people = 280 people) The rooftop area is around 1425 square meters. The break down of the areas are: a. 270 square meters for complete square of flat rooftop, b. 810 square meters for pitched roof, c. 430 square meters for incomplete flat rooftop area (paths) and d. 720 square meters for the flat rooftop under the shelter structure. The pitched roof area (b) could be double with path area (c). The metal sheet shelter structure area is a little bit less than the sum of the last two feagures. It is roughly 780 square meters.

Considering the environmental factor for solar panals and rain harvesting, here are some data of Taipei region. The average rainfall of Taipei is 197 millimeter per month. From May to September is rain season. The total rainfall is 1417 mm. In the rest of the year, the rainfal is 946.8 mm. (http://content.edu.tw/senior/earth/yl_ld/content/rain/4/41.htm)

Original Section and Usage of Rooftops

The original section shows the relationship between buildings, as well as different households. Figure 4-11 shows the sections with building layout whereas figure 4-12 shows the sections for two major sections within this building cluster. In the sections, we could see different existing usage of rooftops and balconies. Some households have more interests in gardening and some don't. Most of the rooftops are belongs to hybrid type. Only one is original and one is remodel. There is no cover type in this building cluster. As the result, there are mostly pitched rooftop in this cluster.

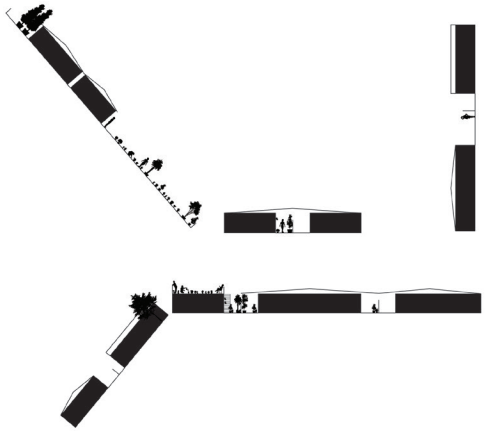


Figure 4-11 Original sections with building layout.

In figure 4-12, small gaps between two buildings show the possibility of connecting buildings with paths. The gaps' distance range from one to two meters (numbers in red). Two sides of the gap are sometimes at the same height but sometimes don't. It is more difficult to connect two buildings with different height and needs to have slope or staircase structure. Also, because these paths will be built in very high elevation away from the ground, the safety issue is the most important concern. Nevertheless, the small distance between the buildings and the new technology we have today make the rooftop network possible.

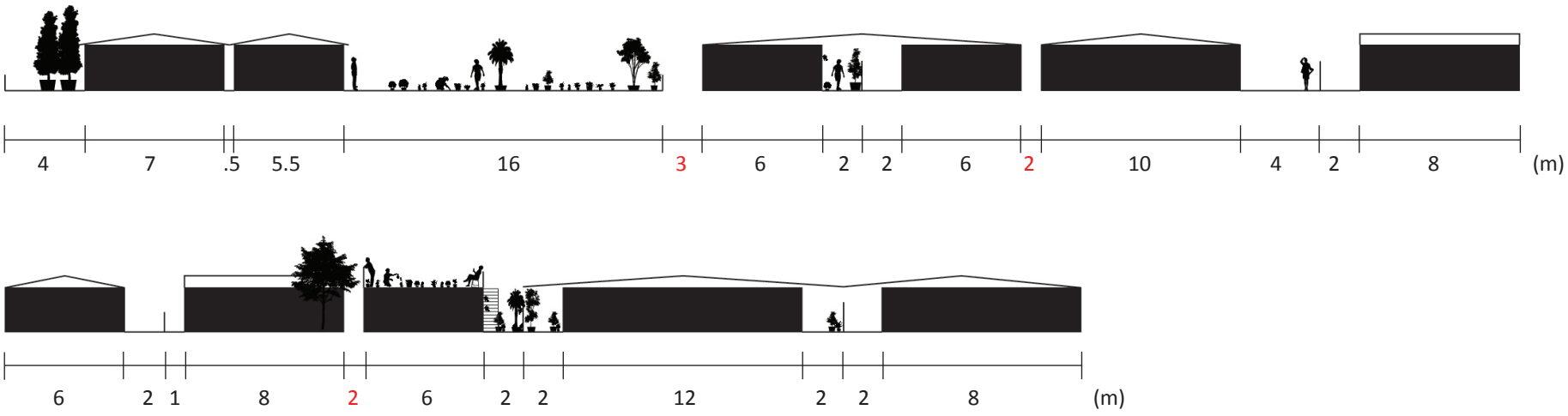


Figure 4-12 Original sections for two large sections.

Cluster Rooftop Map

Based on the method of rooftop mapping for a building cluster scale, two maps are drawn. One is the existing condition and the other is the general proposed design for public accessible area. In the existing rooftop map, the lighter color surface is the top of the original building and the darker areas are the extra buildings, showing that there are height differentials between buildings. The extra building with the oblique line is a pitched roof and the grids represent the pitched roof covers. In the proposed rooftop map, the main change is to define private and public access space. The orange line represents the boundary between private open spaces and shared open spaces. Also, fire escapes have been located. The official public access area and the flat extra floor with staircase is the lightest colored area. In later discussion, some of the pitched roofs will be removed in order to increase the flat rooftop area for different uses.

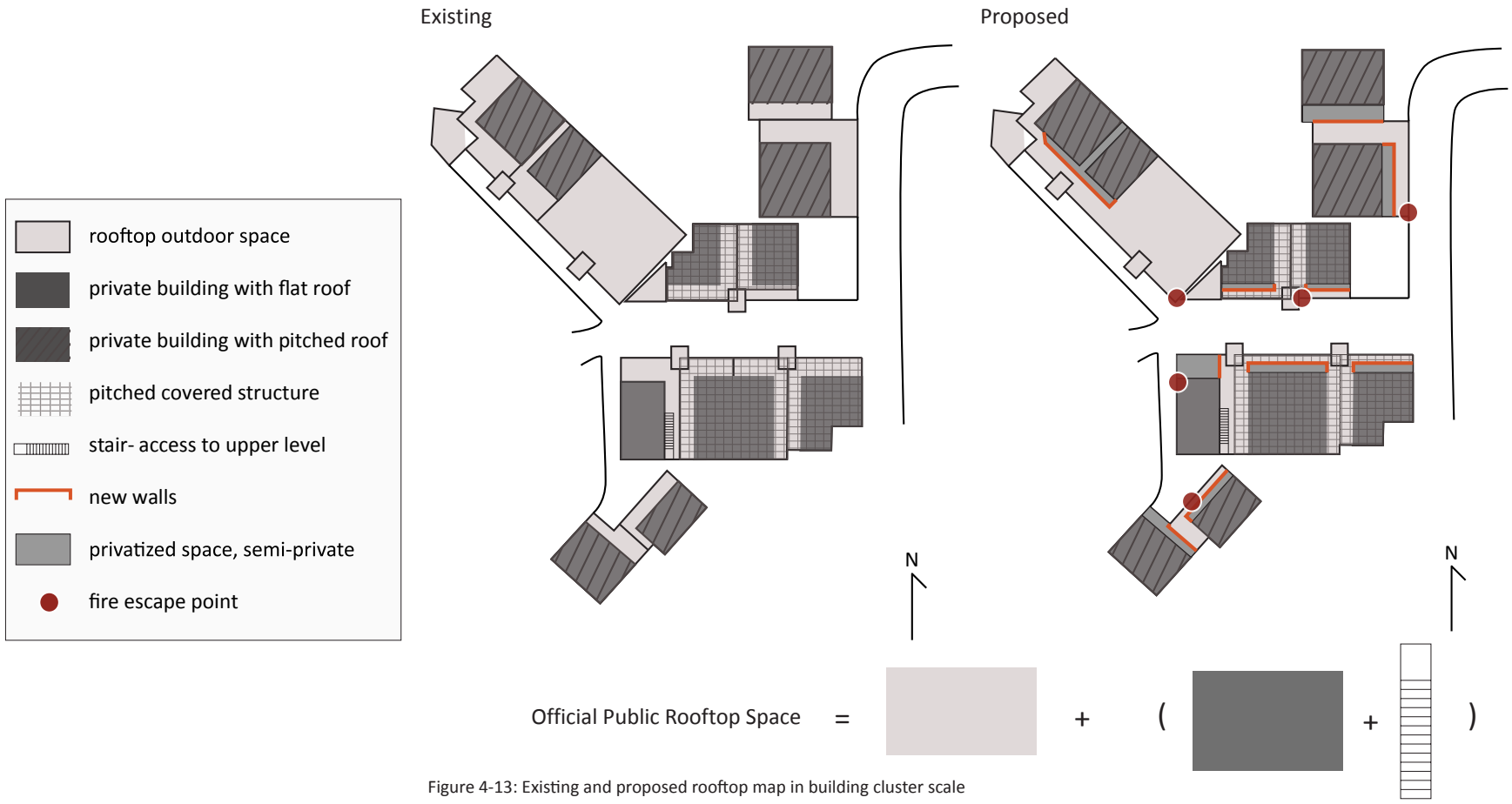


Figure 4-13: Existing and proposed rooftop map in building cluster scale

Ground-Roof Relation

This 3-d diagram shows the topology and characteristics of current ground use and how they can continue, extend and connect to rooftops. The social space nodes are located at the middle of the cluster with two larger spaces on the rooftop as well as near the agriculture land on the ground. The bamboo-woodland field can be connected to the rooftop as well. As the real estate in this area goes higher and higher, the future of the parking lot is uncertain. It is important to let the future builders know the value of this ecological connection as well as the visual connection.-

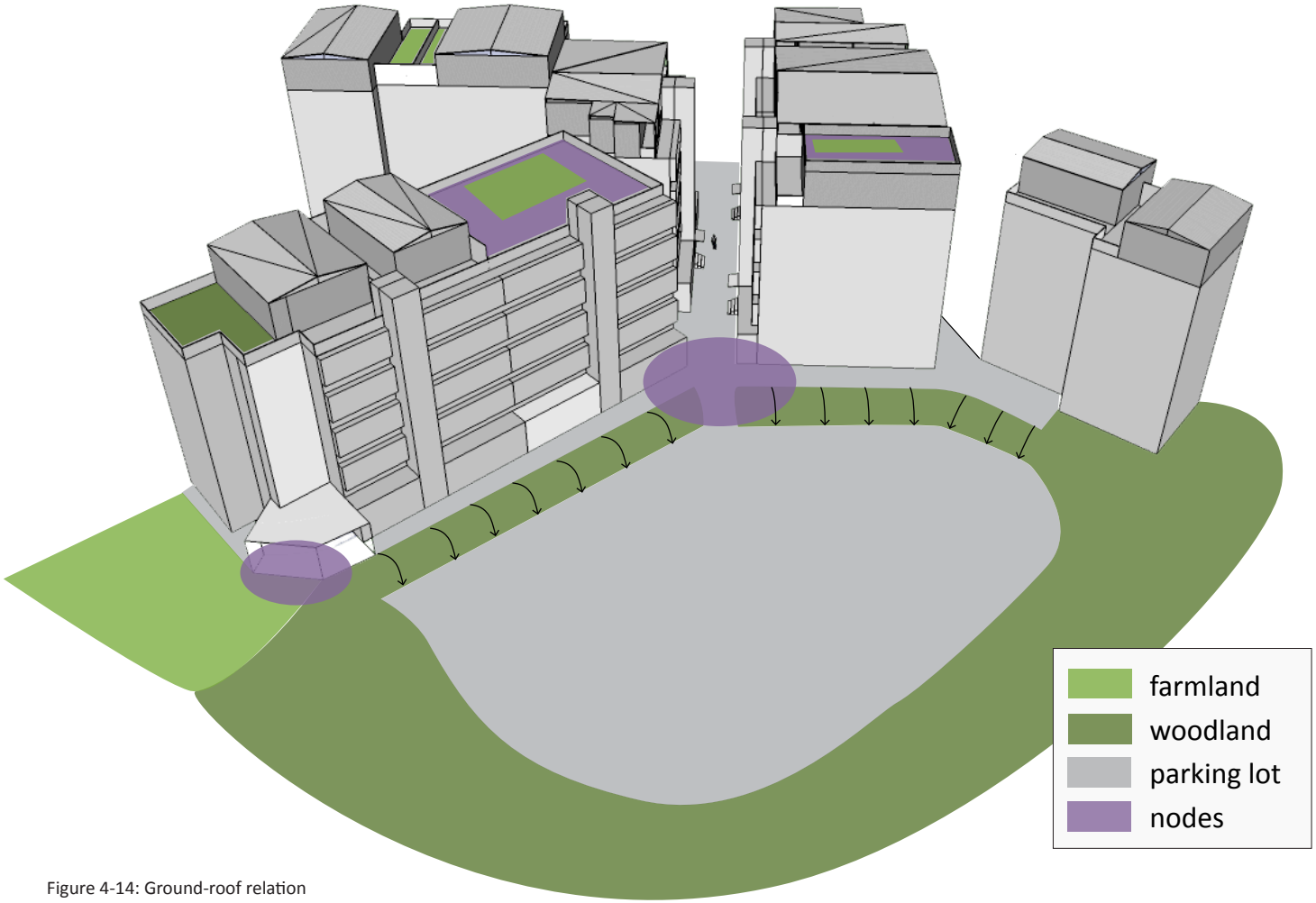


Figure 4-14: Ground-roof relation

Proposed Networks Connections

The challenge of rooftop networking is that there are a couple of spots need to be connected across different buildings. Some of them could be dangerous. Assuming the structural test is passed, as in figure 4-15, there will be one major connection between two major open spaces which creates a node, or activity hub, for this building cluster. Also, the dotted lines are connections for transporting goods, such as compost packages, vegetables or eggs. Furthermore, two free standing pitched roofs on the top of the flat roof extra stories are demolished to create more usable spaces. In figure 4-16, there is an triangle space designed to increase the visual connectivity from the ground floor to the sixth floor.

Figure 4-15: Proposed general connection and accessible surface area plan

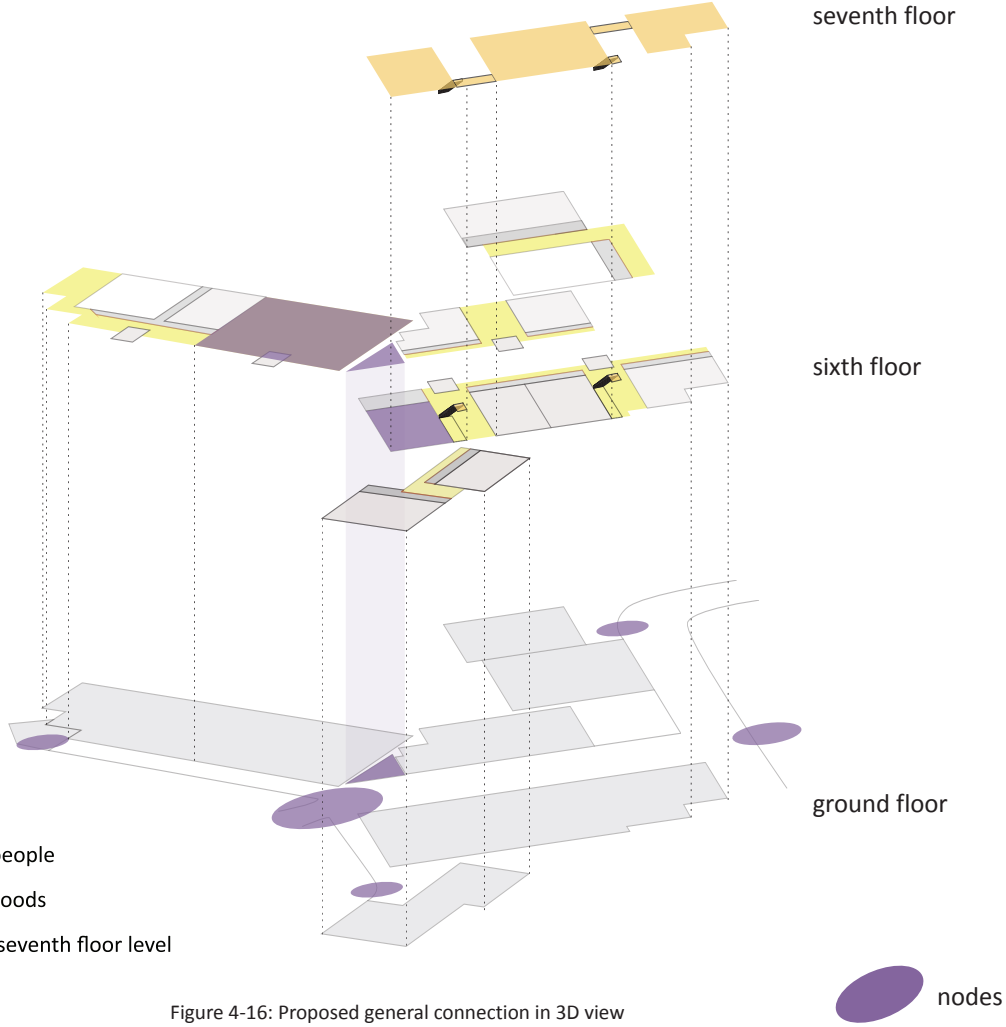


Figure 4-16: Proposed general connection in 3D view

Idea Exploration

Rooftops have many diverse functions. The duality of the rooftops makes them more interesting. You can stand in the dark and look at the lights in the city. The contrast of the scenes makes you feel you are in the city but at a distance, a feeling of being away but still involved. Rooftops also allow for private daily activities as well as public cultural events on a city scale that shape the identity of the rooftop. The publicness of the rooftop makes them alive and excited, and the private part makes it calm and quite. On the rooftop, the sky is the limit. You could imaging a lot of things happenning. One of the most interesting thing is the travel experience to the rooftop. The step-by-step grounded feeling makes our dream real.

These diagrams are inspired by the mandala drawing method. The process are: firstly, to draw a circle which represents the cosmos; and then to draw whatever occurs in your mind or whatever your hand wants to draw. This is a powerful process for me using in meditation purpose, inspiration purpose and metal health purpose for over five years. This time, when I draw, I try to capture any thoughts of my experience on the rooftop and put them on the paper. I did not set any expectation on my drawing and surprisingly there are some patterns of this series even it looks like just some doodling. From these diagram exploration, there are three potential themes for rooftop networking: 1. rooftops as a ground provides medium for producing food in the city, 2. playgrounds on rooftops can let children's imagination to come alive, 3. rooftops can also serve as a form of basic need for those seeking shelter or an oasis in the city, can be used as a stage for performances.

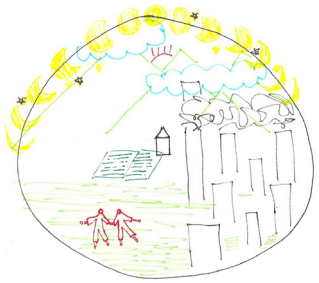


Figure 4-17: Urban agriculture theme

urban/nature
people together
time passing
stars, sun, cloud and grass
mountain and moon
home

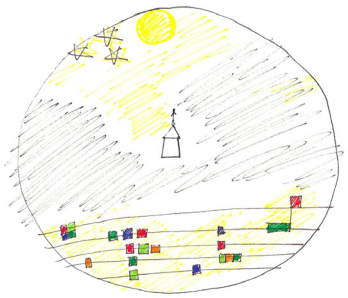


Figure 4-18: City oasis theme

standing on the rooftop
seeing the lights
shining
while you standing in the dark
home

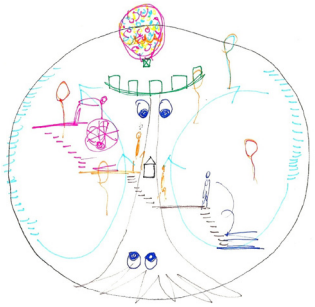


Figure 4-19: Playground theme

up and down
climbing and falling
dreaming and being on the ground
reality

Figure 4-20: Daily life on the rooftop

daily stories
culture, shared value
mystery and imagination

Programming and Prototype Design

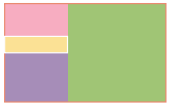
There are different programmings I want to put into the rooftop networking. First of all, the urban agriculture is the key. The community gardenning could bring the community together, provide oppurtunities for environmental education and increase accessibility for fresh vegetables. Secondly, the physical activities such as exercise equipments could enhance the health condition for people living in the city and have less motivation to go to the park that is away from their home. Furthermore, even if there is no exercise equipments, climbing up to the rooftop is already a good exercise. As I mentioned before, the travel experience to the rooftop should be considered into the rooftop network plan. Next, the social events are important to bring people together. The program could varies from daily routine chating space to exibition ground. It is important to hold events according to the national festivals and turns them into the tradition on the rooftop. Or, creating traditions on the rooftop by residents is also a good way to get people together. The last one is the quite space for passive activities to maintain the being-away feeling. It could be tea table for elders, sofa area for people who want to read or take a nap.

To sum up, four programming categories are: agricultural use, physical activities, social events, and passive activities. The design of the rooftop should accommodate diverse programs as much as possible by using movible furnitures and space arrangements. Because the rooftop space is limited, making rooftops become a network so that people could share the space is crucial. With the design principles in mind, the main idea is to balance all the uses, from passive to active, and to put them into small rooftop spaces, to separate potentially conflicting programs and to be aware of the private-public buffer.

For prototyping purpose, I will use the percetage of the urban agriculture space as a basic criterion. It ranges from sixty percent, forty percent to twenty percent. Combing with the three themes, the sixty percent prototype will be urban agriculture theme, the forty percent prototype will be playground theme and the twenty percent prototype will be city oasis theme. The following prototype design will be presented by the functional zoning diagram, the networking patterns, the plan and sections, sketches of different spaces and will end with visions for each of the three themes.

Categories of Programming

- Urban agriculture
- Physical recreation
- Events, social programming
- Passive activities



Urban Agriculture Theme
60% Agricultural Use

Urban agriculture creates a rooftop network based on exchanging agricultural experiences and products. It would be important to use the advantages of each rooftop for different crops or animals. The distribution methods and community processes are crucial for this prototype.

Playground Theme
40% Agricultural Use

This prototype is designed for clusters that demand a children's playground or a space for teens. The agricultural area will be separated from the physical activities by planters or social spaces. The agricultural method will be more towards container gardening rather than fixed location planters or fields. The flow of kids moving is important to be considered

City Oasis Theme
20% Agricultural Use

This prototype is designed for clusters that want to use the space for leisure and relaxation after work. The design will be more park-like with agricultural opportunities for people who want to garden. The side facing west with the view is considered the best place to put seats and private corners. The ecological aspect is also explored in this prototype.

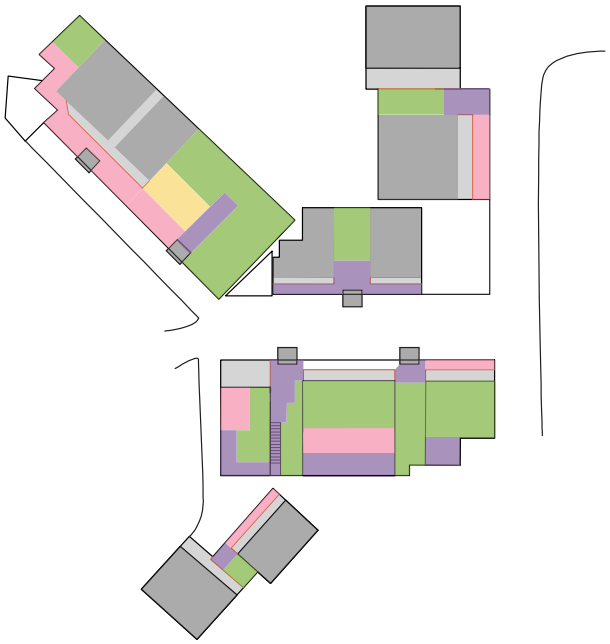


Figure 4-21: Urban agriculture theme functional zones

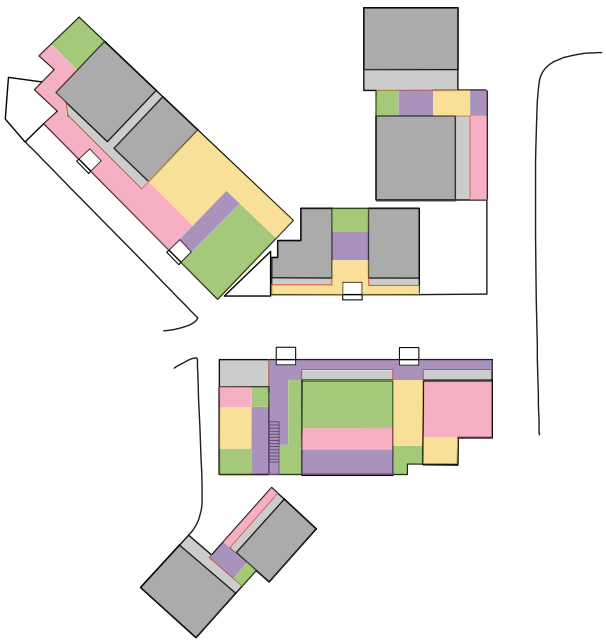


Figure 4-22: Playground theme functional zones

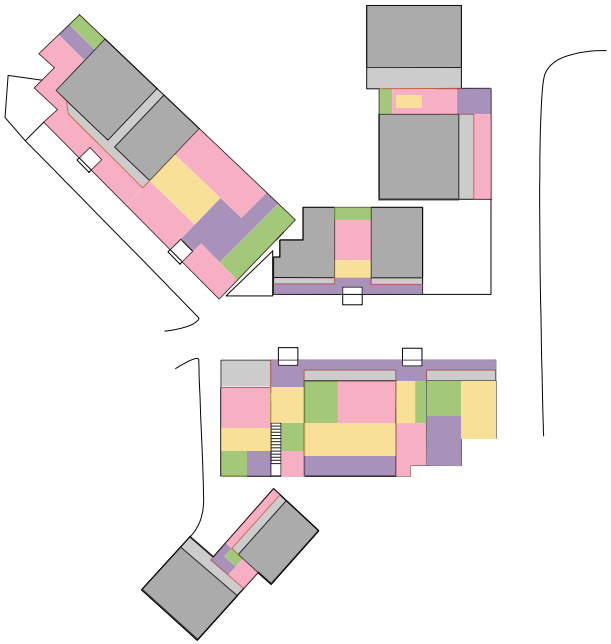


Figure 4-23: Urban Oasis theme functional zones

Urban Agriculture Theme: 60% Agricultural Use

Networking is the most important thing for rooftop agriculture. In this prototype example, the biggest rooftop will have a greenhouse for starts and so on. The space that is covered will be used for growing mushrooms and keeping fish. Other places will have chickens, compost and general vegetables. Although each rooftop will have its own main role, mixed planting is important for healthier plants and richer gardening experiences.

Figure 4-24: Urban agriculture theme networking diagram

This is the example design for 60% agriculture theme. At the building cluster node is the main patches for agriculture use with greenhouse at the back. It also has a viewing deck on both major vacant flat rooftops to maximizing the advantages of rooftops. The programming for this prototype is domined by agricultural use. It could have working party and simple kitchen device for cooking party to enhance the relationship between people. Couple metal sheet structures have been demolished and turned into garden patches. The gray triangle in the middle is a new storage and exchange space for community agriculture products.

Figure 4-25: Urban agriculture theme design example

Urban Agriculture Theme: 60% Agricultural Use

Figure 4-26: Urban agriculture theme vision

Playground Theme: 40% Agricultural Use

According to assumed needs, the largest rooftop area will be basketball court in the morning and movie theater at night. The second largest rooftop space will be the main playground for children under twelve and will serve as an after-school care center. Adult sport facilities and tea making facilities, including Chinese chess boards, will be placed near the playground.

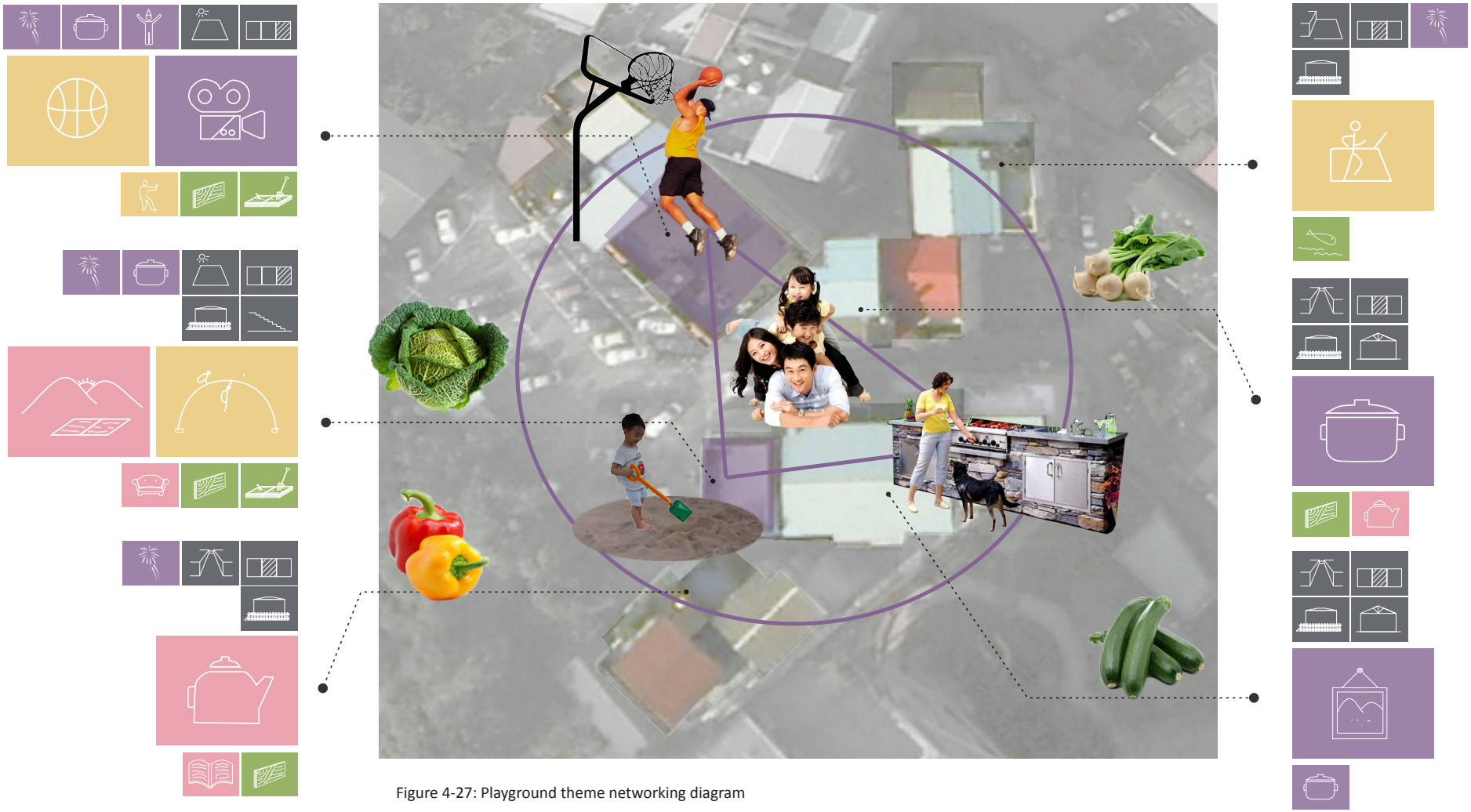
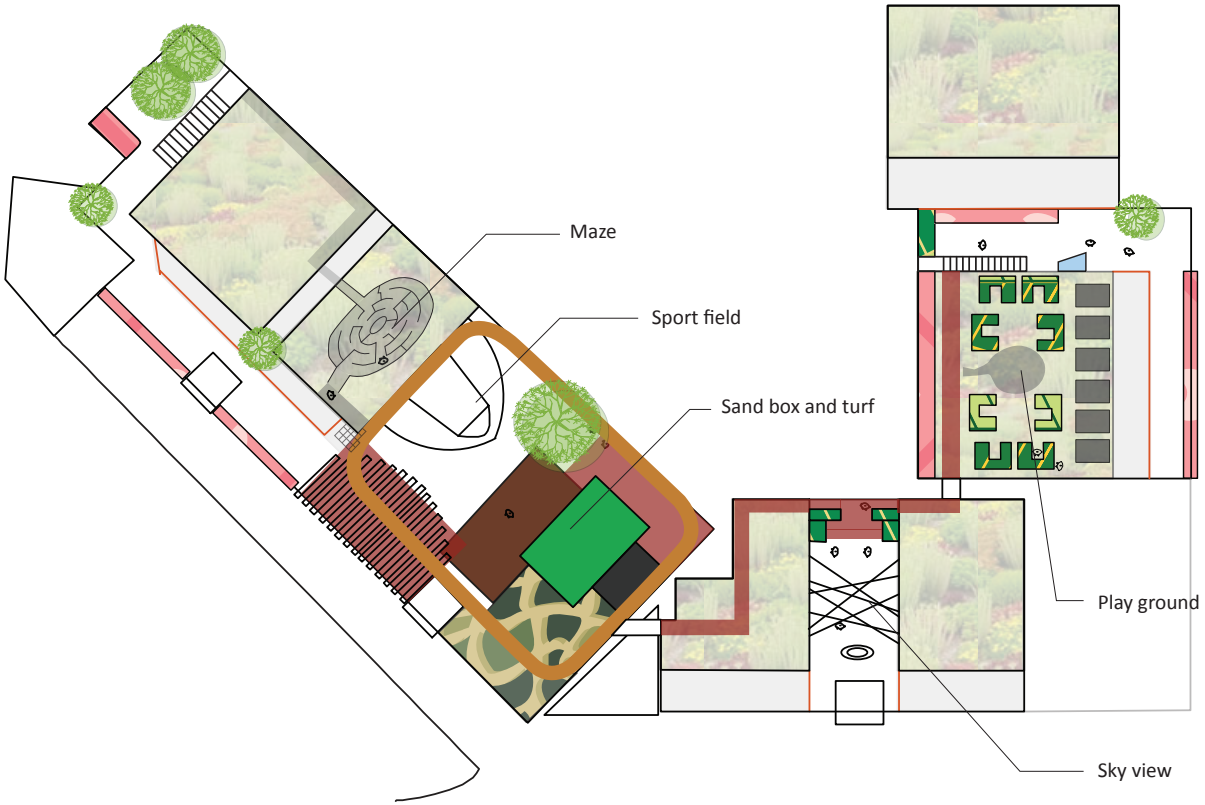


Figure 4-27: Playground theme networking diagram

The design for 40% agricultural use with playground theme serves families and kids. At the main node rooftop, the basketball will be in the one end and agricultural patches will be at the other end in order to minimize the conflict between activities. The color is a visual connection between different buildings with decoration by kids. The narrow rooftop spaces aim to create a connection with the sky. There will be some dormer embeded on the shelter structure. Couple metal sheet structure have been demolished and merged into the paths for kids to explore. Solar panals also install on one rooftop for experiment and education purpose for kids.



Estimate numbers for benefits

Garden beds and crop field area: 218 m^2

Green roof area: 401 m^2

Water retension: 2,500 gallons

Money saving from AC: 700 NTD/month

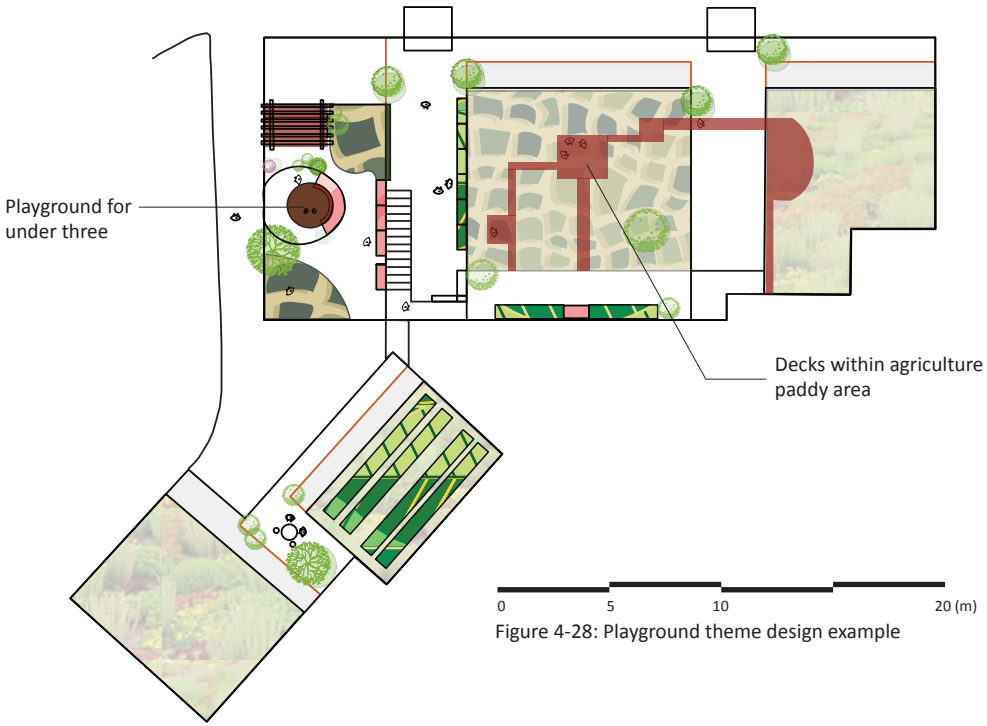


Figure 4-28: Playground theme design example

Playground Theme: 40% Agricultural Use

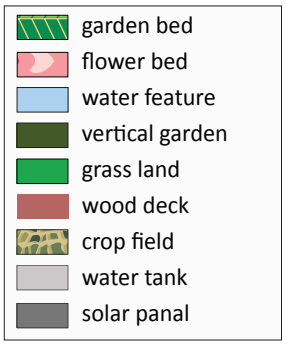
Figure 4-29: Playground theme vision

City Oasis Theme: 20% Agricultural Use

The spatial park-like theme strings up the whole rooftop network and also visually connects it with the greenroofs. In this setting, passive use lends more flexibility for other uses such as galleries. The agriculture will be mainly through container gardening. The planter spot near an outdoor kitchen could be designed as an herb garden to make the cooking experience more relaxing and fun. The idea of intersecting living space with park-like public space shows the uniqueness of a rooftop as a community space.

Figure 4-30: City oasis theme networking diagram

Designing for 20% agricultural use with city oasis theme, there is more sitting area serve with different size of group. Some of them are more private than others. The water feature is another design element for the city oasis theme through out the rooftop network. The larger wild open space brings more possibilities for social events. Becaues this theme is also focusing on ecological and energy aspect, most of the rooftop will have solar panals on the top of the green roof. The green roof will not touch the actual roof structure. It will use the double roof idea for isolating the heat from the sun. The water catchment experimenting rooftop will be installed in the middle rooftop as well.



Estimate numbers for benefits

Garden beds and crop field area: 112 m^2

Green roof area: 431.4 m^2

Water retension: 1,876 gallons

Power generate: 4000 kW

Money saving: 37,800 NTD

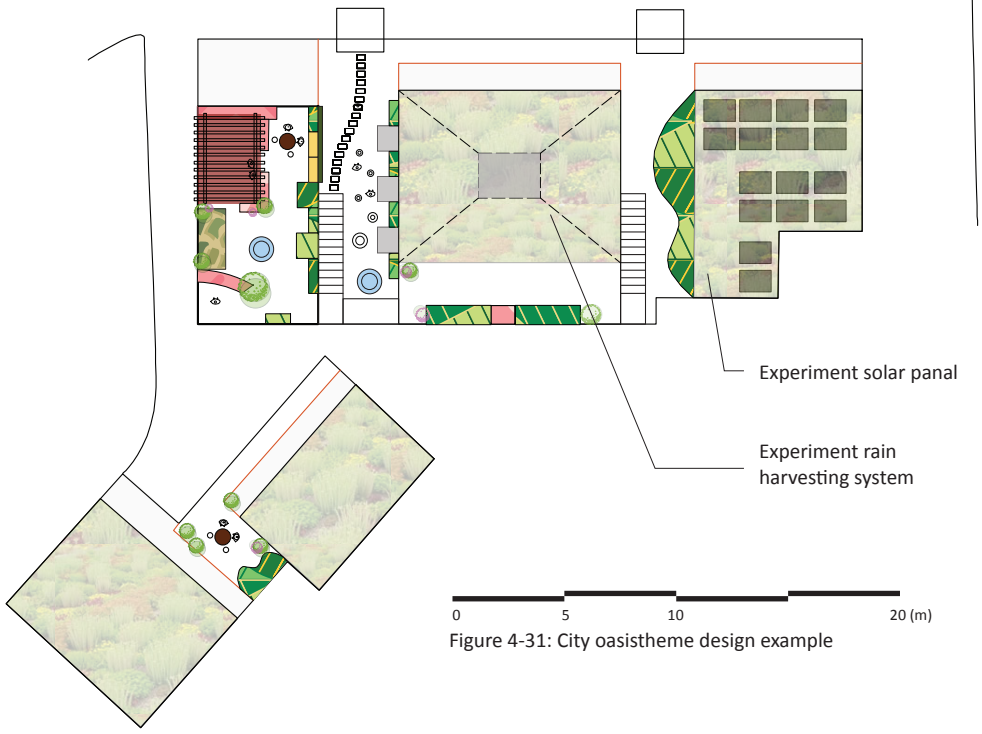


Figure 4-31: City oasistheme design example

City Oasis Theme: 20% Agricultural Use

Figure 4-32: City oasis theme vision

BACK TO NEIGHBORHOOD SCALE

Proposed rooftop map

After exploring the possibility of one building cluster, let's look back to the neighborhood rooftop map and lay out a networking map for the whole neighborhood. The urban agriculture theme can occur on larger rooftop space. The city oasis theme occurs when the needs are more towards relaxing and social activities, such as in office buildings. The playground theme can occur at unexpected points or intersections between different buildings.

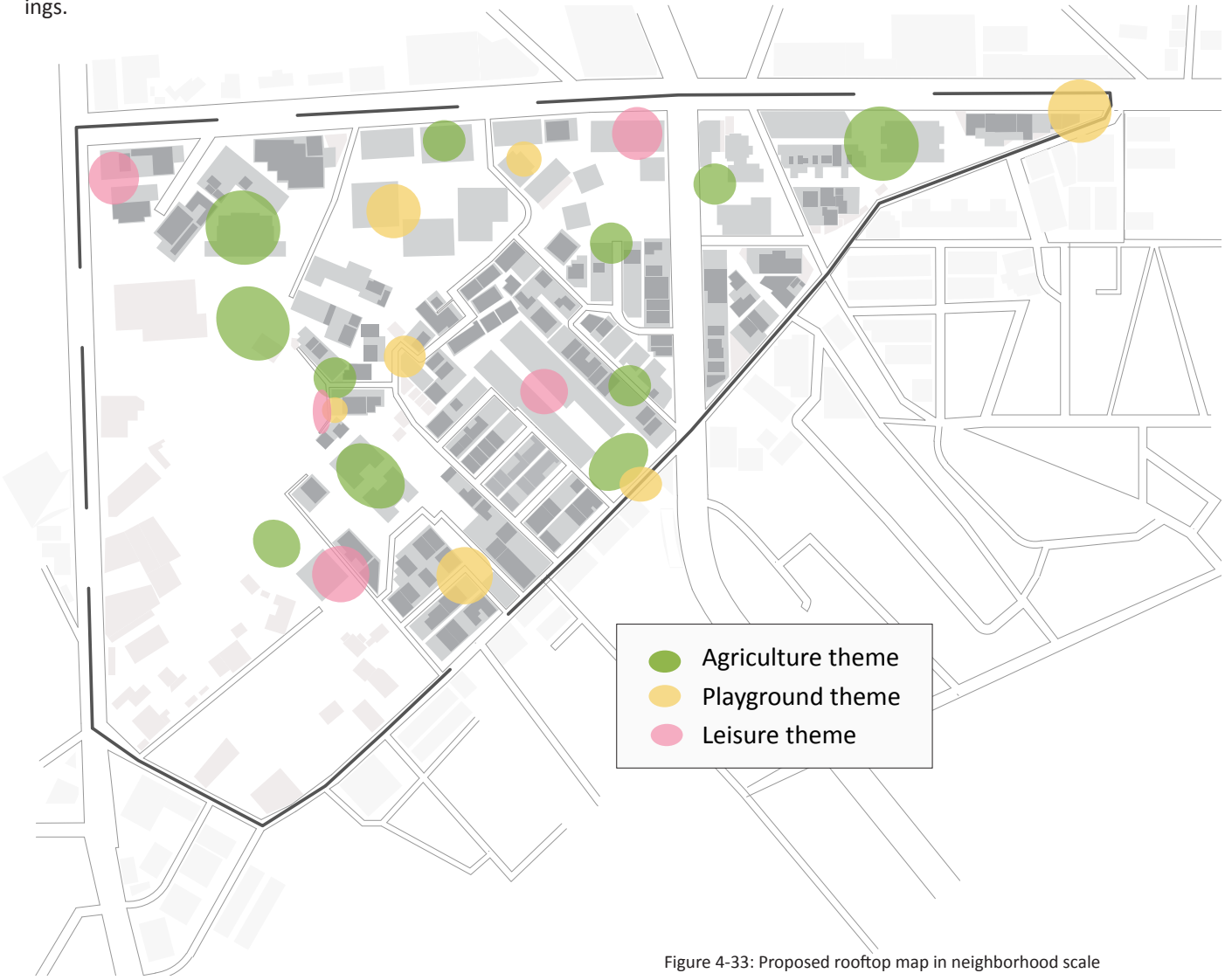


Figure 4-33: Proposed rooftop map in neighborhood scale

Phasing

In the fifth type of building cluster, phasing is needed because all the individual buildings are independent. The network starts at the largest rooftop or where there is highest interest from the residents. The ideal starting point needs to consider the location within the building cluster. The graphic here shows the starting point is on a larger rooftop that is located at the middle of the cluster and that has a potential connection with the node on the ground. Then, it's necessary to expand the rooftop shared area and create a connection to the ground, both visually as a way to promote the rooftop space, and spatially for the greenery and for establishing social connections. The third phase would be to expand the nodes and strengthen the connections between them.

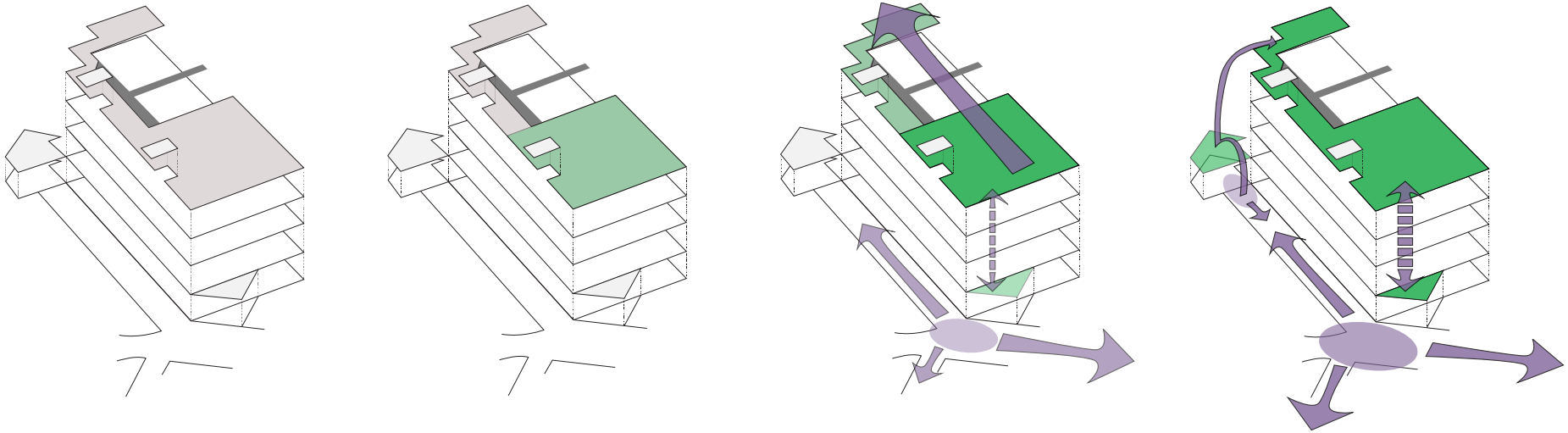


Figure 4-34: Phasing diagram

Phase One:
Start from one node of rooftop

Phase Two:
1. Connect with ground via visual connection and programming
2. Connect with adjacent rooftops

Phase Three:
Expend and strengthen connections

This chapter introduced a design framework for building a rooftop network by identifying building clusters on a whole neighborhood scale, finding nodes and connections within the neighborhood and between building clusters, and finally to rooftop mapping on a building cluster scale. Then, according to different demands from neighborhood with three different percentages for agricultural use, three themes of design prototype have been developed as a start point for people to adapt and adjust to their own desired designs.

Chapter Five: Conclusion

The journey to the rooftop is almost over. I enjoyed being on the rooftop, being away from the ground, and being closer to the sky. Rooftops are so special that I will continue working with them. They are another kind of ground space created by human activities. They are always there to protect but not to show off. They are bounded within the human living realm and daily routing. This is a whole different world that you could easily get in the city.

Figure 5-1: Differences use of rooftop spaces

In this thesis, I am trying to find a way to design a rooftop network that could increase community interaction and towards a livable environment. Rooftop networks designed with people's needs and existing building conditions is my experiment to try out the possibilities to let daily life connect on the rooftop. It's important to design rooftops as living objects, one's that change with people's needs and reflect the local micro-climate while also connecting with other buildings. Using the rooftop as a basic common start point can create a place that will allow everything to happen, and can give people a reason to stay in the neighborhood and participate in a broader social network.

Return to research questions

The first research question is "What are the factors that support or are barriers to rooftop uses?" The most serious factor that is a barrier to rooftop use is lack of awareness. In residential areas in Taipei, there is awareness of the availability of rooftops, but there isn't awareness of existing rooftop gardens. People are confused by the complex ownership of the rooftop and by vague social norms and policies. It's important to start promoting the rooftop space and showing people the "new" role a rooftop can have. Incentives from government policies, and knowledge and technical support from outside organizations are two ways to trigger the motivation to use rooftops.

The second question is "How do people want to use the rooftop space?" The results I found in the questionnaire is that almost everyone wants to use the rooftop even if they are not the top floor residents. The rooftop represents a shelter; it is a safe place for people to relax and get away. The questionnaire respondents have lots of creative ideas and ambitions for how to use the rooftop. Some of the most popular needs are an environmentally friendly design, a gathering space, a space for urban agriculture, and a space for other social events such as barbecues and outdoor movies. The interesting point is that the most popular needs are almost all group needs. (Being alone to have daydreams is the only popular one that is not social event). The rooftop could serve these multiple and diverse needs of the community.

The third question is "What are the differences between building a community space on the ground than on a rooftop?" A rooftop is different than a ground space because of its higher location, its level of accessibility, and

the building conditions in terms of construction concerns. Also, there is a closer relation between living space and rooftop space. Thus, designing a rooftop has many benefits; at the same time, structural constraints, security and privacy issues need to be considered. Moreover, a green rooftop can remediation urban heat in the city. Just like urban forests and parks, rooftops bring the green back to the concrete world; this is very important as a goal of rooftop networks.

The last question is “How can a rooftop system be designed to invite people to use it and serve multiple purposes?” The rooftop network is designed to invite people and serve many purposes by considering the diverse needs and programs that will gather people together. Designing a rooftop network involves designing a community process for discovering the rooftop landscape and finding possibilities that meet with the community’s needs. Giving community members a place to start discussing community affairs and creating a larger sense of community is the basic concept of a rooftop network.

How to use this thesis and more to do in the future

This thesis aims to create a tool for helping communities to start developing a rooftop network. The literature about rooftops can be used as an advocacy tool for explaining why and how rooftop re-utilizing is an important thing to do and what are the basic considerations for creating rooftop networks. The eight design principles could be used as an educational tool for letting people know the details they should be aware of in the design and implementing processes. The community process part is mainly for organizations who are doing the rooftop work.

Secondly, for people who want to start work related to rooftops, the questionnaire is a great start to understanding how people think and use rooftops and also their primary concerns. This questionnaire will be a long-term research project that will be used for future rooftop network development. The questionnaire is also a tool to make people start to think about the future of rooftops. One of the respondents wrote: “Wow, [a] rooftop really is a place full of imagination.” As of right now, rooftops are not in daily use and only few people have noticed that. Thus, to raise awareness about this topic and make people think about it is where the project starts.

Third, the rooftop map shows people how to understand the rooftop network and adopt it for their own situation. The design framework is meant to balance community needs as well as the reality that rooftops are small and everyone needs to share it with other people. The overall message is: “the rooftop is a shared space that everyone can use. But building a rooftop network needs everyone’s help. It can create a new destination for social space other than the movie theater downtown.”

Future Research

There are still many things that need to be considered other than the points I made in this thesis. It’s an on-going process that will lead me closer to my vision for functional rooftop networks in Taipei. In order to do future work on rooftop networks, alternative policies for existing rooftop issues, such as the extra story, need to be researched and had more details. The legal processes are extremely important because rooftops are so close to living space and people’s private benefits. Secondly, the technological research needs to be in more detail and needs professional citations. Finally, the design framework, for other building types such as office buildings or gated communities is the next step in my research.

Personal Reflection

The intention of this thesis project is that I want to design a process and framework that can gather neighborhood people together. Due to my experience and interests, I choose to use a rooftop as a stage for gathering people. I want to know how people think about rooftops, how people use them, how people want to use them in the future, and what can I do with these answers. I learned a lot while discovering different ways to approach this. Different professors have different ways to do the research and design. Friends are always people who can teach you more of what you don’t know. I believe every community has their own way to do rooftops project as well. This thesis is just a starting point.

This is a project that is different from other projects I’ve done in the past. Since the foundation of the rooftop project is community members, creating a language that could easily be understood by the community is crucial and leads me to think about different ways to present and organize the design principles and design frameworks.

The toolkit language, the drawings and the way to explain things are different, too. I learned how to see things from both a larger scale and a smaller scale.

There are more and more studies about rooftops from multiple perspectives in recent years in Taiwan. Some government policies related to rooftops have also been established. I believe rooftop networks will not be confined to this thesis but will reach out to the community and create a new community open space system in the city.

Appendix One: Questionnaire

Questionnaire

0. What's the first impression when you heard "rooftop"?

_____

Building information

1. What type of building do you live in?

□ 7 or under stories apartment □ 8-16 stories apartment □ 16-24 stories apartment

□ 25 stories or over apartment □ dorm □ house with courtyard □ Tau Tian Tsu

□ villa

2. How old is the building?

□ less than 5 years □ 5-10 years □ 11-15 years □ 16-20 years □ over 20 years

□ I don't know

2. Do you have elevator? □ yes □ no

3. What type of rooftop do you have? □ flat □ slope

4. Which floor are you live in? ____

5. How many years have you live in this building

□ less than one year □ 1-8 years □ over 8 years

6. Do you have elevator? □ yes □ no

7. What's the manage mechanism of the rooftop?

□ manage by community committee □ manage by individuals with written rules

□ manage by individuals with oral rules □ there is no rule

□ I don't know □ other

8. What's on the rooftop?

□ green roof □ green roof with structure/ furnitures (self-built)

□ green roof with structure/ furnitures (built by landscape company) □ container garden

□ Infrastructure only □ metal sheet roof □ nothing □ I don't know

□ rain harvesting facility □ solar power generator □ green roof

□ others _____

9. Do you know any general issues that are related to rooftop use?

□ leaking a lot, hope no one use the rooftop

□ too many people want to use and argue a lot

□ one more story on the top

□ lack of use

□ I don't know, no common

10. Are you top floor resident? □ yes □ no (to question 15)

Top floor residents question

11. Do you have extra story on the top of the original building? □ yes □ no

12. If yes, what's the material?

□ reinforced concrete □ metal sheet rain shelter □ metal sheet structure

13. Is the rooftop space open to toehr people live in the apartment

□ yes □ no □ no, but if people ask, they could use the rooftop space

14. As a top floor resident, what concerns do you have in terms of people using the rooftop space?

□ water leaking □ noise □ unsafe □ others

15. Have you ever go to rooftop space? □ yes □no (to question 24)

Rooftop user questions

16. Why do you use rooftop?

□ it's wasteful to not use existing rooftop space □ I like the feeling of close to sky

□ I want to do gardening □ I want to BBQ with friends □ I want to dry cloths

□ other

17. How often do you use the rooftop?

□ once a year □ once a month □ at least once a week □ almost everyday

18. What time do you often go to the rooftop?

□ before 9 am □ morning □ noon (lunch) □ afternoon

□ evening (dinner) □ night □ midnight

19. Whom are you often go up with?

other family members-- □ husband/wife □ children □ elderly

□ friends □ alone □ other

20. Whom do you meet on the rooftop and how often?

□ I often meet neighbors, chatting, doing laundry or gardening

□ irregularly meeting with friends

□ seldom meet people, only me □ seldom meet people becasue we have different time schedule

□ I live on rooftop, so mostly only me using rooftop space □ other

21. What do you often do on the rooftop?

□ laundry □ charring □ viewing, watch stars □ dining □ day dreaming

□ play with children □ gardening □ partying (BBQ...) □ fire work during Chinese new year

□ others _____

22. If you have chance to use the rooftop space in other ways, what are the things you want them to happened on the rooftop?

□ family party □ party □ BBQ □ gardening □ raising pigeon □ raising chicken

□ view point □ kids' playground □ greenhouse □ sofa area

□outdoor movie theater □ gallery □ green roof (only plants)

□ environmental friendly facilities, such as rain harvesting and solar power generator

□ others _____

23. Do you do gardening on the rooftop? □ yes (to question 26) □ no (to question 31)

Non rooftop user questions

24. Why don't you go out to the roof?

□ someone occupy it □ no interest, I don't have time □ there is nothing

□ I afraid the height □ I am lazy to climb upstairs □ it's hot and windy out there

□ others _____

25. If you have chance to use the rooftop space, what are the things you want them to happened on the rooftop?

□ family party □ party □ BBQ □ gardening □ raising pigeon □ raising chicken

□ view point □ kids' playground □ greenhouse □ sofa area

□outdoor movie theater □ gallery □ green roof (only plants)

□ environmental friendly facilities, such as rain harvesting and solar power generator

□ others _____

Question for gardener

26. What things do you grow?

□ leafy vegetable □ melons □ ornamental plants □ mushroom

□ vines □ other

27. How's the harvest condition?

□ plenty, enough for me to eat □ so so □ most of them are eaten by birds

□ it's not edible but many ornamental plants

28. How do you use the harvest? eat or give to others?

□ eat and use by yourself □ give them to other people □ compost them □ other

29. Do you have agriculture experience before?

□ yes, I grow up in farm village □ yes, my balcony have plants □ yes, school taught us

□ yes, I have huge interest in gardening □ no

30. What facilities are you using to gardening?

□ pots □ professional green roof □ high raised planter

□ vine structure □ other

Question about rooftop network, connecting rooftop spaces

31. In Taipei, there are many row apartments, if there is a way to connect all the rooftop space as a whole, will you agree? □ prefer yes □ prefer not

32. If prefer yes, what are the reasons?

□ bigger space to use □ meet more people □ have more activities □ other

□ have supportive network □ none of these, I strongly disagree to connect rooftop space

33. If prefer no, what are the reasons?

□ the more people use the rooftop, the more security issues might be arised

□ too much trouble for management □ it's a big construction project, cost lots of money

□ none of these, I strong agree to connect rooftop space □ other

Respondents' information

34. Age: □ Under12 □ 12-18 □ 19-30 □ 31-40 □ 41-50

□ 51-60 □ 61-70 □ Over 70

35. Gender: □ Male □ Female

36. Occupation:

□ housewife/ husband □ Student □ Full-time worker □ Part-time worker

□ work at home □ retired □ other

37. ownership □ Renter □ own the whole apartment □ own the living unit

38. Please leave some rooftop stories that you would like to share _____

Thank you for your patient. If you want to share more, please leave your email: _____

Answer for question 0: What's the first impression when you heard "rooftop"?

1. close to sky
2. rooftop garden and gardening
3. fire work, BBQ, gardening and growing vegetables
4. privatized extra structure, dry cloths
5. dry cloths, gardening, being alone
6. extra story
7. ceramic tile, fire work, BBQ
8. concrete heat
9. metal sheet
10. swimming pool
11. place where no one will pass by
12. if I could dry comfort there, that will be great!
13. hot and massing
14. Wen Lan (music) (singer's name)
15. singing your song on the rooftop~ (lyric)
16. attic
17. dry comfort, dry radish, suntan, watch moon, enjoy winds, meeting people, eat together with friends, grow vegetable and flower
18. put building facilities
19. --
20. a place where I can screaming, families could see the sky, stars and fireworks together, a place to grow dry-tolerant plants
21. sun protection, dry cloths, growing fruit
22. gardening
23. My first thought are about flower beds and vegetable patches, the next thoughts is high-end shopping mall rooftop in Singapore, there are night views, restaurants and swimming pool, very good commercial idea
24. watch star and sky
25. Taiwan's rooftop is really hot but I have trees that could be shade and also have a good laundry place
26. rooftop garden
27. sunshine, vacant, dirty
28. water tank, water proofing
29. water leak
30. very hot and no one use it
31. bright sunshine
32. rooftop garden and vegetable patches, there could plant many plants and have relax area
33. protect people from rain and wind, extra story, metal sheet
34. more space
35. shade for people
36. water tank
37. garden
38. protect the building
39. flat area wher could have many good things happening
40. freely grow wild flower garden

Answer for question 38: Rooftop Stories

5. I don't remember since when, my rooftop started to have more and more plants. I like to grow plants more and more. I will observe them everyday and now I have more than fifty plants and the number will be growing.

16. Vacant is vacant. In fact, all the kids are going out and being a parent is very boring at home. Thus, I like to do gardening more or less. At the end, I talk to them.

20. relax, enjoy the view and see what are people doing down there.

22. Giving other people the things I grow is really excited thing.

25. It's really fun. My grand parents will report the progress in the garden and I'll see them in my dinner meal. When relatives come, they will help to fix planting boxes. Further, they will exchange seeds and experience. Gardening really enrich elder people's life. It's good to have herbs such as mint, cilantro, basil and rosemary that I could use for the meals. Growing flower is also our family interest. Different flowers have different seasons. Lastly, my family is not allowed to have pets so my sister and I will go to rooftop next door to play with two huskies.

26. Because I attended some permanculture lessons and learned agricultural techniques, I started to grow some vegetables on the rooftop. For rooftop, I turned my negative attitude to the situation that I go to rooftop everyday now. To observe the progress of growing plants. It also brings more activities happened on the rooftop. There is not big harvest happening but they will grow up eventually.

35. I live in the extra story. There is a outdoor balcony in front of the door. My mother and I like to grow green plants so that we have more and more flowers. There are many wild life come to our house and birds singing. Gradually, mom started to grow some vegetables. The harvest rate is not very good yet but it's really fun. Every moon festival, our family and friends will come to the rooftop for BBQ. In the summer, I could feel breezing. Family usually chat and kids play around here.

Bibliography

Alexander, Christopher, Ishikawa, Sara, Silverstein, Murray (1977). A Pattern Language: Town, Buildings, Construction. Oxford University Press.

Belinda Y., Wong N. H. (2005). Resident perceptions and expectations of rooftop gardens in Singapore. Landscape and Urban Planning 73 (2005) 263-276

Brenneisen, S. (2006). Space for Urban Wildlife: Designing Green Roof a habitats in Switzerland. Urban Habitats, 4(1), 27–36.

Clare Cooper Marcus, Wendy Sarkissian (1986). Housing As if People Mattered: Site Design Guidelines for Medium-Density Family Housing. University of California Press, Ltd.

Clark, C., Adriaens, P., & Talbot, F. B. (2008). Green Roof Valuation: A Probabilistic Economic Analysis of Environmental Benefits. Environmental Science and Technology, 42(6), 2155–2161.

Diers, Jim (2004). Neighbor Power: Building Community The Seattle Way. University of Washington Press.

Earth Pledge. (2005). Green roofs: Ecological Design and Construction. (M. Arpels, Ed.) Atglen: Schiffer Books.

Engelhard, B. (2010). Rooftop to Tabletop: Requrposing Urban Roofs for Food Production. University of Washington.

Gehl, Jan (2010). Cities for People. Island Press.

Francis, Mark, et al. (1984) Community Open Spaces: Greening Neighborhoods Through Community Action and Land Conservation. Island press.

James Berryman (2010), Living Green Roofs! Urban Green and Permaculture!, Modelling a Green Roof and the Benefits to Storm Water Management, Retrieved March 5, 2014, http://kevinsonger.blogspot.in

Matanovic, Milenko (2007). Multiple Victories: Pomegranate Center's Art of Creating Community-crafted Gather-

ing Places. Pomegranate Center

Introduction of Old tree community. (2010). Retrieved January 11, 2013, from http://www.wretch.cc/blog/old-tree11/7042863

Osmundson, T. (1999) Roof Gardens-History, Design and Construction. W.W. Norton and Company, Inc.

Taib, Nooriati, & Abdullah, Aldrin. (2012). Study of Landcsape Gardens: Expectations and Users' Perceptions of a High-Rise Office Building. Social and Behavioral Sciences, 50, 633–642.

Toronto City Planning. (2010). Using Green Roofs to Enhance Biodiversity in the Ciyt of Toronto. Toronto. Retrieved from http://www.toronto.ca/greenroofs/pdf/greenroofs_biodiversity.pdf

Weiler, S. K., & Scholz-Bath, K. (2009). Green Roof Systems: A Guild to the Planning, Design and Construction of Landscape over Structure. New Jersey: John Wiley & Sons, Inc.

Werthmann, C. (2007). Green Roof--A Case Study. Princetion Architectural Press, New York

Zhang, X. et al. (2012). Barriers to Implement Extensive Green Roof Systems: A Hong Kong Study. Renewable and Sustainable Energy Reviews, 16, 314–319.

Yuen, B., & Hien, W. N. (2005). Resident perceptions and expectations of rooftop gardens in Singapore. Landscape and Urban Planning, 73, 263–276.

Chinese Resources:

簡資修（ Jian, Zi-Xiu）(1995) 公寓大樓屋頂平台之產權研究（ Study of the ownership for apartment rooftops），法學專刊(Law Magazine)

楊昇樺（Yang, Sheng-Hua）（2011），台北縣公寓住宅屋頂平台違建處理模式與改善策略之研究--以庶民觀點探討（Research on the processing pattern and the improvement strategy of unlicensed buildings on

flat roof apartments in Taipei Conty: From a civil viewpoint），建築系碩士論文（Architecture Master Degree Thesis），國立台灣科技大學（National Taiwan University of Science and Technology）

洪鳳雅，Hong (2009)，台灣鐵皮屋住宅現象之研究 (A study on the illegal light gauge steel roof structure in Taiwan-in case of Tainan) ，國立成功大學碩士畢業論文

台灣屋頂綠化協會（Taiwan Green Roof Association）（2012），我愛綠屋頂 (I Love Green Roof）（2011），麥浩斯（My House Publisher）

錫瑠環境綠化基金會綠屋頂專題網頁（Hsiliu Foundation Green roof website），綠屋頂的功能，Retrieved March 10, 2014, http://hsiliu-greenroof.blogspot.in/2008/02/1_23.html

怪老子理財（managing finance），如何計算電費(How to calculate electricity cost)，Retrieved march 10, 2014, http://www.masterhsiao.com.tw/CatOthers/PowerRate/PowerRate.htm