MixCity

Investigative Research & Evolutionary Design on Mixed Densification
in Shanghai's Living Neighbourhood

Graduation P4 Report

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Content

Introduction

“Understanding Lilong & Xiaoqu.”

Shanghai 2000

Shanghai 2019

Xiaoqu's Victory

Highrise Xiaoqu
Other Highrise

N

500m

Source: Google Earth, Shanghai City Center in 2000/2019, editted by author

Lilong

Lilong Buildings, Source: www.500px.com

Lilong Public Space, Source: www.500px.com

Xiaoqu

Xiaoqu Buildings, Source: www.500px.com

Xiaoqu Public Space, Source: www.500px.com

Shanghai Lilong and Xiaoqu, Source: photography by Yiyi, editted by author

Context

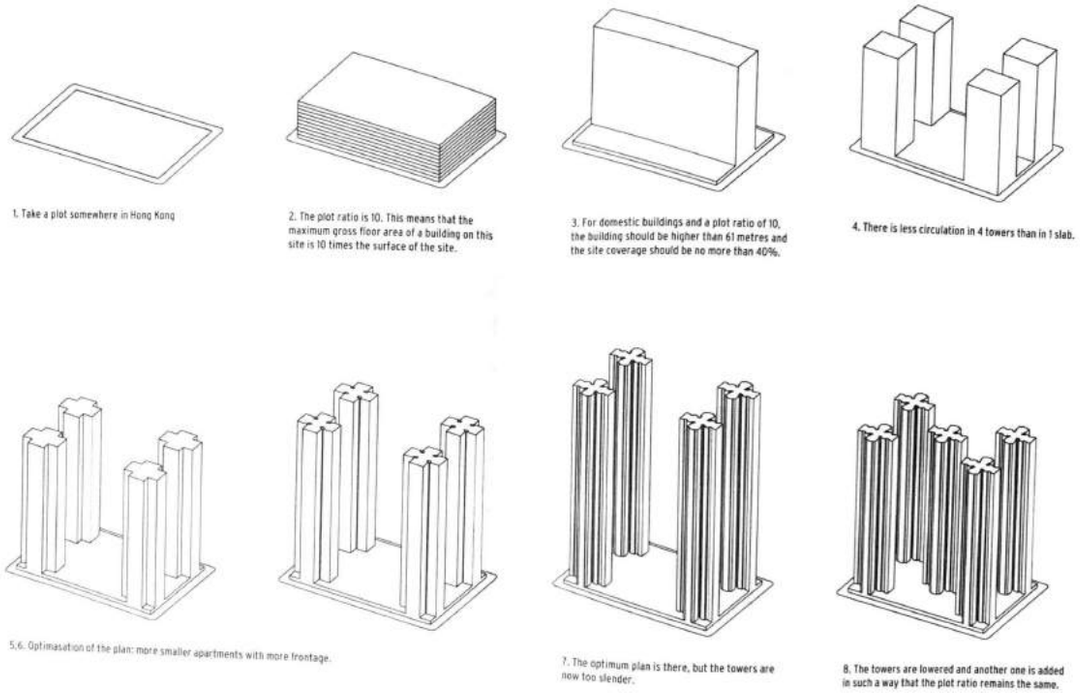
Xiaoqu's Victory

"Lilong" is a kind of alley house that widely distributed in Shanghai. The houses are densely arranged, and there are always small alleys in between. The alleys in the lilong neighborhood are called "longtang" in Shanghainese, so "Lilong" is also known as "longtang".

Lilong was born because of two reasons: population growth and real estate development (Sansan, 2007). In the 1950s, there are around 120 thousand Shanghaiese live in Shanghai's inner city(laochengxiang), but only hundreds of foreigners live in the Shanghai Concession area. When it came to the Taiping Rebellion in 1953, the rebellion army invaded Shanghai city, so lots of refugees from Shanghai's inner city and the surrounding area went to Concession Area for protection. In this condition, foreign businessmen found it is an effective way to make money by renting houses to refugees. Then, they invest most of their money in the real estate industry. At that time, a low-cost densely built houses that can meet the needs of local weather and lifestyle called Lilong was born. Lilong combined western row house style and traditional Chinese courtyard house style, and the houses are typically 2–3 floors (Zhigang, 2010). The layout of the Lilong neighborhood is quite compact, and it has a high GSI (gross space index).

Shanghai, as one of the biggest and most attractive cities in Asia, has a massive population growth from 14.25 million(2000) to 27.06 million(2020) during the last 20 years (World population review, 2019). It consists of not only local natural population growth but also numerous immigrants. To accommodate the growing population and increase density as well as improve the living quality, shanghai has been renovated old Lilong districts in past decades. In the 1990s, there are more than half of the people who live in Lilong (Yuan, 2019). In the process of the rapid development of Shanghai, the government has demolished old Lilong neighborhoods and build new Xiaoqu(means microdistrict, residential neighborhoods, normally highrise towers) since the 1990s. The number of Shanghai Lilong's area had dropped from 14 million square meters in 2000 to 7 million square meters in 2016 (Yuan, 2019). Till now, there are several ways for Lilong's urban renewal. For the few Lilong districts that have rich cultural value, government and developers would keep the low rise buildings and transform them into new districts like museum, cultural, and commercial areas, Xintiandi districts is such an example. In this case, density is barely added. For most normal Lilong districts, they were turned down, and the new land had been introduced other programs, including residential, office, and commercial function. The density level would increase in this condition. Among all the new lands that come from former Lilong, most of them are transformed into Xiaoqu . Xiaoqu is a typical living neighborhoods in China. Normally, the Xiaoqu urban block is quite large (300–500 meters wide), and it is closed by wall or fence. The program inside is residential only, and building typology is 18-33 floors towers or slabs.

In following papers, the author would analysis the downsides of introducing Xiaoqu to former Lilong and explain the Problem Statement.



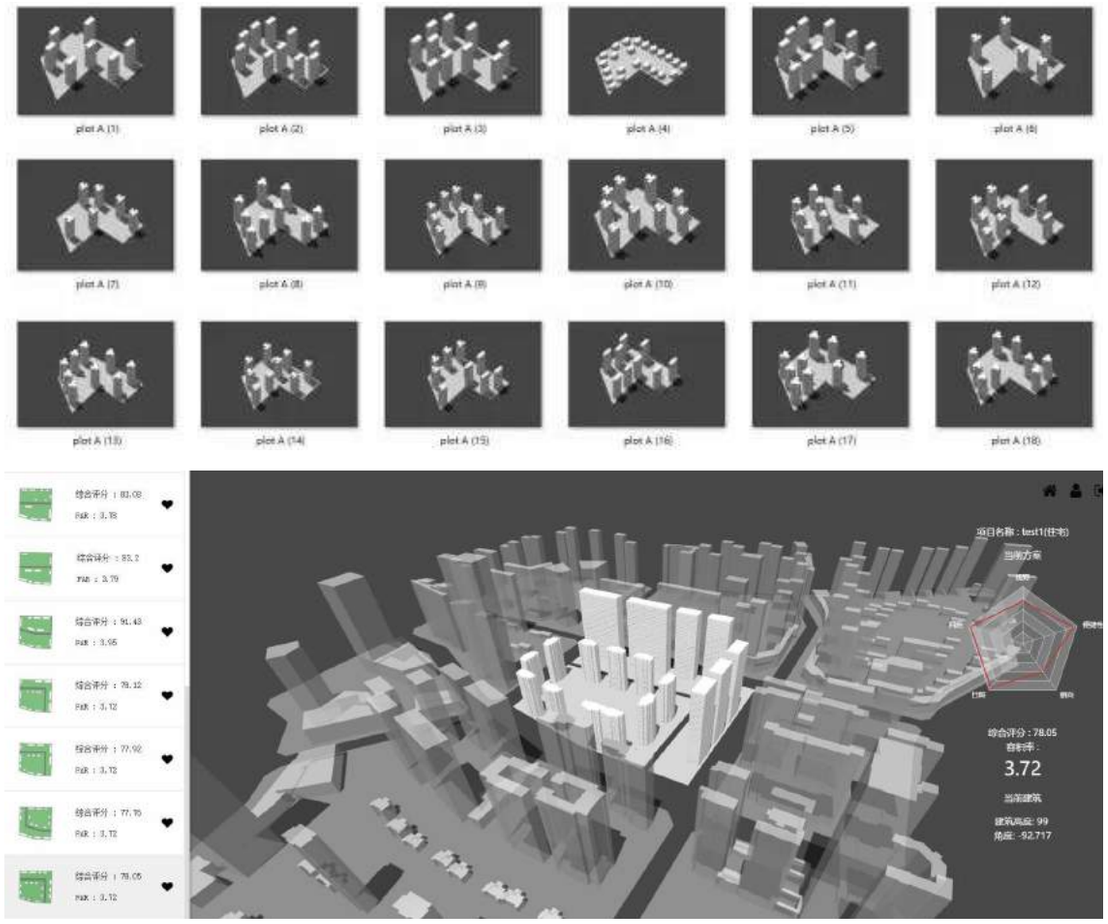
Evolution of Hongkong's flower-like highrise tower, Source: Jacob van Rijs, etc, 1998, FARMAX

Mechanism of Xiaoqu

In 1998, Jacob van Rijs's research explained the mechanism of Hongkong's flower-like highrise residential tower, and it is very similar to Shanghai Xiaoqu's situation.

The goal of introducing this typology is to maximize the FSI of the land. To reduce circulation, developers would build high towers instead of slabs or boxes. To maximize the surface area of the building's facade, the plan of the floor was designed in a flower shape rather than a simple box. To achieve the regulation of building codes, they limited a certain height for buildings and made sure a certain percentage of outdoor space.

The pattern was designed to achieve economic profit only, and the high FSI capacity is effective in accommodating such a large population in Hongkong and Shanghai. In Jacob's research, he pointed out the solution to achieve higher density is mix program.



xkool AI Architect, Source: www.xkool.ai

Xiaoqu Maker Machine

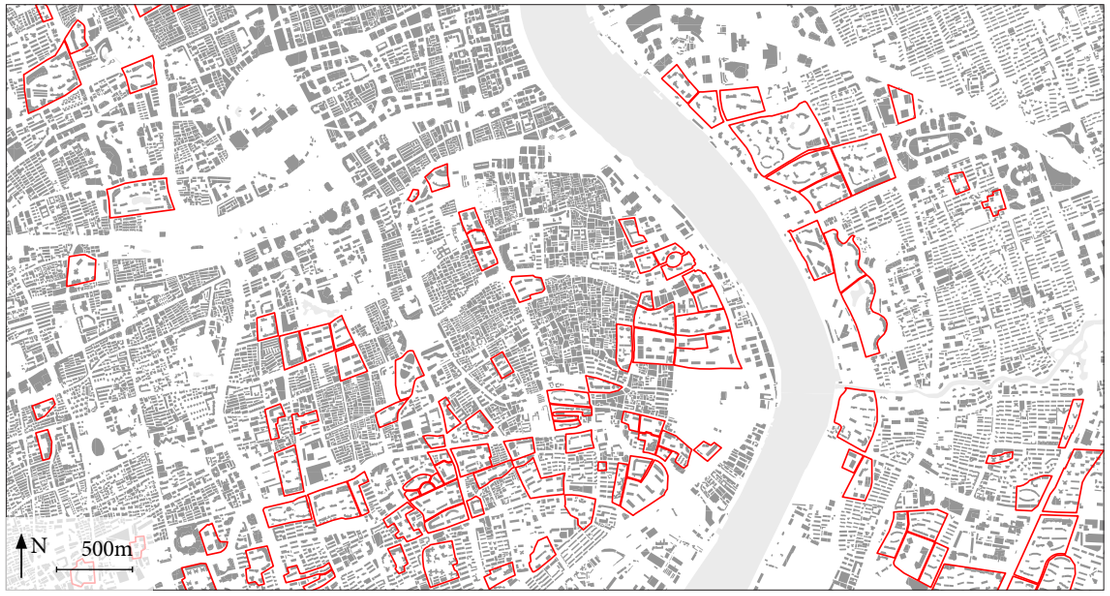
In 2017, a company called xkool was born, and it launched the so-called AI Architect. The AI Architect learns thousands of Xiaoqu cases, and it concludes how to maximize FSI in specific building codes in a site. The AI tool dramatically increases the productivity of arranging buildings in Xiaoqu and facilitates the process of Xiaoqu's Invasion.

Xiaoqu's Advantages

Xiaoqu's popularity is based on its huge advantages than Lilong or other building typologies.

- ***Sufficient Sunlight***
- ***Sufficient Outdoor Space***
- ***High Population Capacity***

However, Xiaoqu causes issues.



Closed Xiaoqus, draw by author, Based on Baidu Map Streetview 2017.9

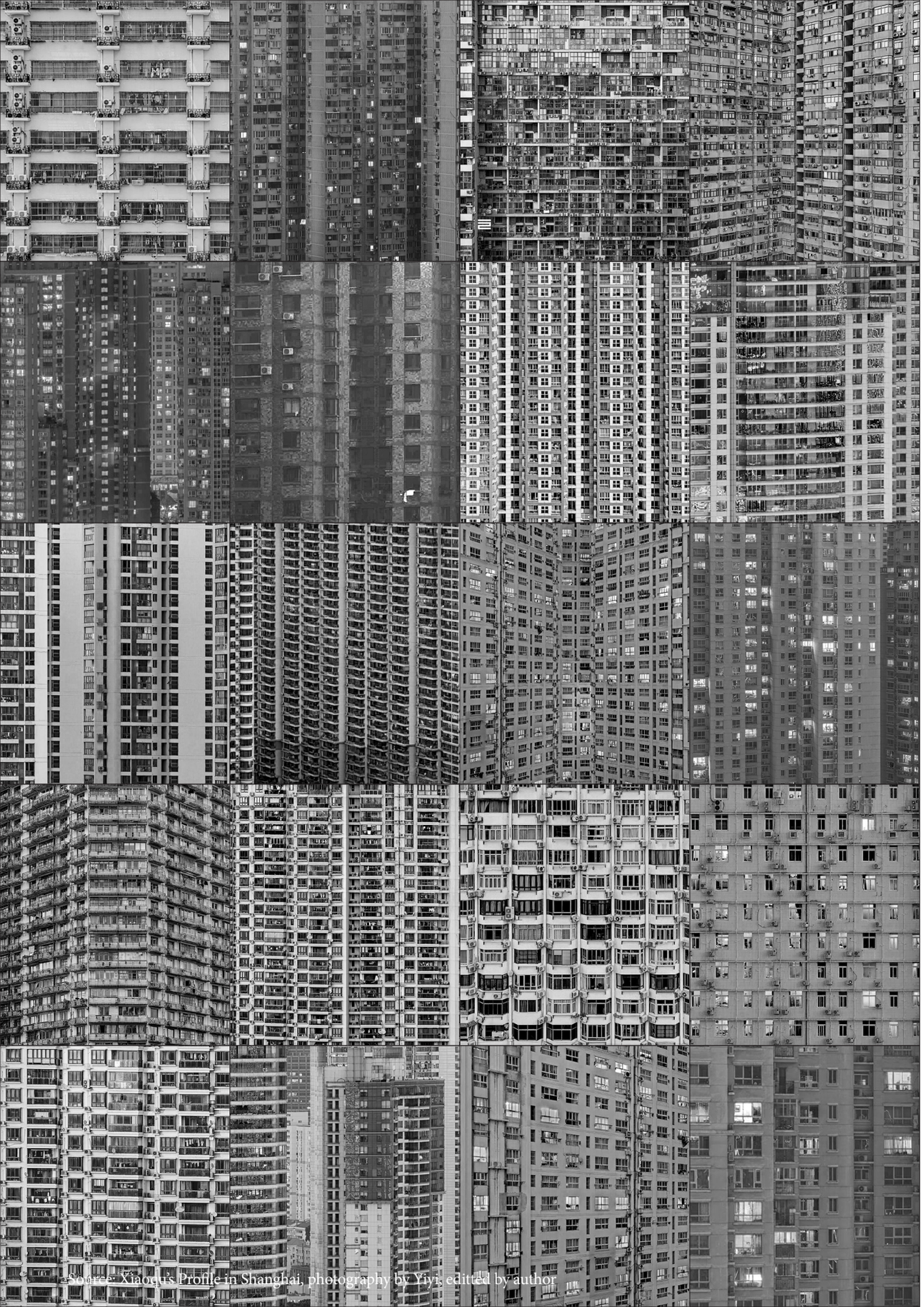
Shanghai Xiaoqu's Wall & Fence, Source: Baidu Map Streetview 2017.9, editted by author

Issues

Poor Walkability

To create a "better quality and safe environment"[1] for residents, Xiaoqus are always closed by either wall or fence. People who do not live in Xiaoqu are not allowed to go inside. This privatization makes the Xiaoqu walled garden. Inside the Xiaoqu, on one hand, local residents can walk around the green yard and have some exercise, the protection of walls and guards make them feel safe and quite. Howerver, on the other hand, people who pass by the Xiaoqu area have to walk along the walled pedestrian path, and it is always long and boring. This kind of poor walkability makes the city separated, and Xiaoqus become a set of isolated islands in the city.

1. Often used as propaganda for household selling in China



Source: Xiaoqus Profile in Shanghai, photography by Yiyi, editted by author

Issues

Faceless Neighbourhood

In the process of rapid urban regeneration, in order to provide standard household to home buyers in a short time, as we can tell, the highrise buildings show a similar fabric. Shanghai's former identical Lilong fabrics are replaced by these characterless and homogenous patterns shared by almost all Chinese cities and even other Asian cities. The highrise towers killed spatial identity and local culture, the faceless space made those parts of Shanghai no different than other cities.

Nanhui East Wetland, source: Nanhui Wechat Channel

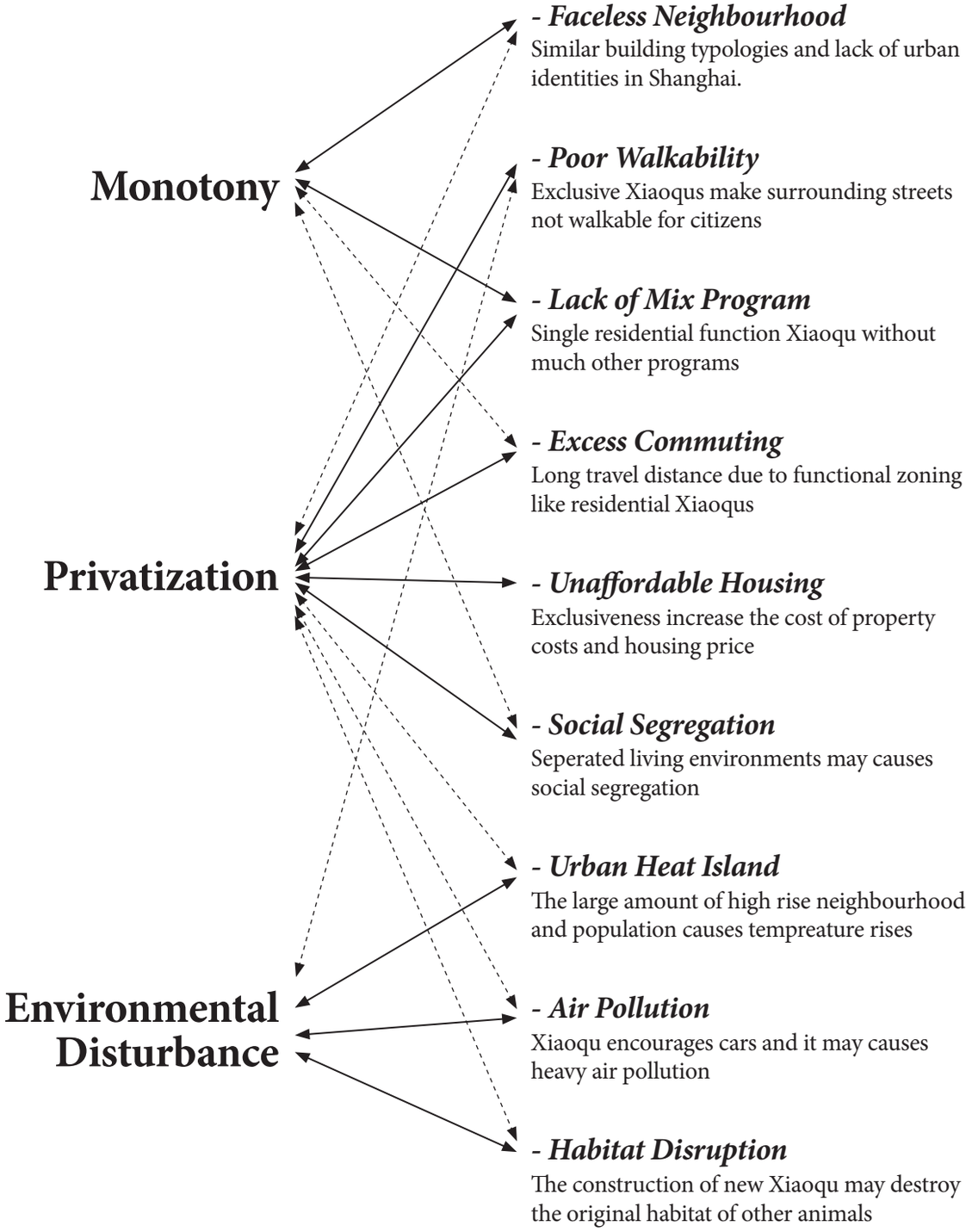
“Stop! Save Birds!”, source: Nanhui Wechat Channel

Issues

Habitat Disruption

Xiaoqu, as the main part of the residential neighborhood, plays an important role in city development. However, that development sometimes causes environmental disruption. Nanhui East Wetland is one of the most famous wetland located in Eastern Shanghai; there are a lot of birds coming to the wetland to spend the winter. But nowadays, the amount of birds is declining because of the nearby construction of city development. Thus, Xiaoqu has a connection to the environmental disturbance.

Problems



Problem Statement

Profit-Driven Urbanism

To accommodate the increasing population, Shanghai transformed a large amount of lowrise Lilong neighborhoods into highrise Xiaoqu neighborhood in past decades. It is an effective way of providing more homes and improve living quality for citizens, and it densified Shanghai in terms of gross built-up area. However, those Xiaoqu neighborhoods case many issues. Firstly, Shanghai suffers monotony, it causes many negative results like faceless neighborhood and lack of mix program. Besides, the privatization of Xiaoqu leads to poor walkability and social segregation. Moreover, the development of Xiaoqu affects habitat disruption and air pollution indirectly.

Overall, we can tell that Xiaoqu development is mainly focused on profit other than for people or for our planet. In this case, urbanism was dominated by the short-term economy. It is not sustainable for a city in a long period.

Aim

Sustainable Living Neighborhood

From Lilong and Xiaoqu's context and vision from Shanghai Masterplan 2017–2035 (Qiyu, 2019), We could envision a sustainable living neighborhood in Shanghai, it shouldn't only about profit, but also for people, and for our palnet.

The project aims to explore a sustainable mode for Lilong's urban regeneration. Namely, envision a sustainable living neighborhood.

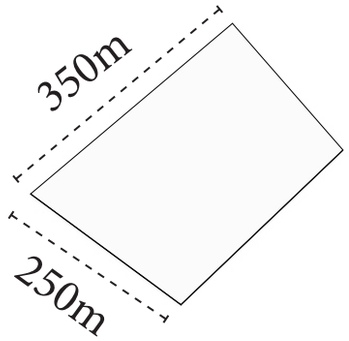
Rather than adopting the traditional dutch "design by research" methodology, this project would also try to learn the "research by design" approach. By involving the design part in the first place rather than implementing it after the research part, this project explores a mutual relationship of design and research.

1st Design Test

"Reseach by Design."

Site Comparison

Before the design test, the author firstly took a site in Shanghai and compared the urban fabrics with other global cities. In this comparison, we can found that Shanghai Lilong's grain is quite small; it is similar to Paris and Amsterdam. Yet the Xiaoqu building in Shanghai bund is rather big; the size is more prominent than other cities except anther Chinese city Beijing.



Shanghai

Shanghai_Bund

Beijing

NYC

London

Paris

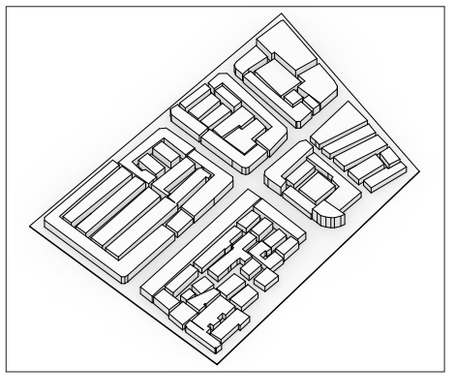
Tokyo

Barcelona

Amsterdam

Delft

Lilong: Pros & Cons

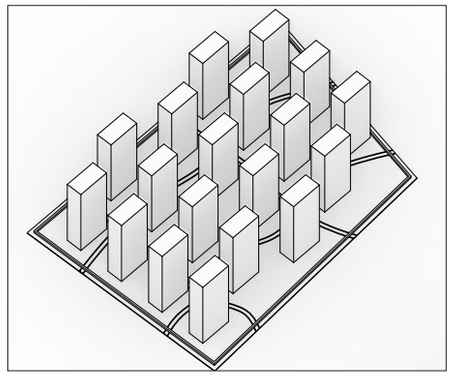


FSI: 2.1

To make clearer guidence for the design test, the pros and cons of Lilong & Xiaoqu are summarized. For Lilong, the outdoor space in Lilong is positive since it was surrounded by buildings; this intimate space can facilitate social activity. Besides, the ground floor of Lilong building are always diverse programs rather than residential, function like commercial and local public service made Lilong a vivid place to live. Apart from that, the small block is more accessible in a city. People can easily reach each building with few steps. Moreover, although there are different degrees of publicness of public space in Lilong. In general, Lilong is open to all citizens.

Meanwhile, Lilong has its cons, such as limited sunlight, open space, and green space. Low capacity of residential programs.

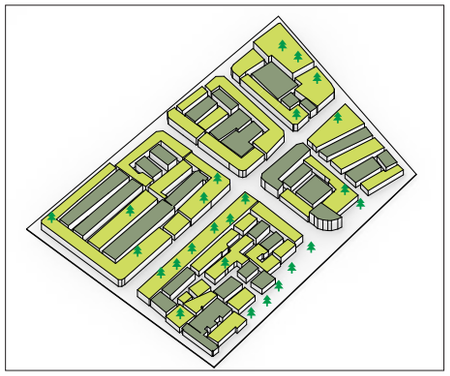
Xiaoqu: Pros & Cons



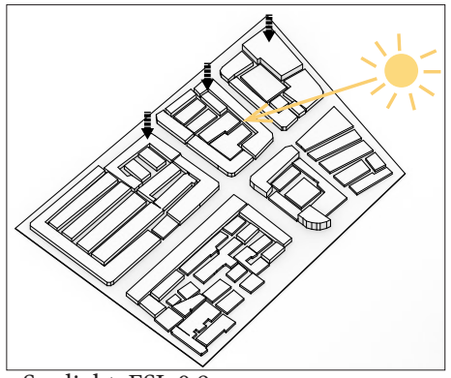
FSI: 5.3

In contrast, Xiaoqu has its advantages. Firstly, homes in Xiaoqu has enough sunlight since the residential building was designed toward the better sunlight direction. Besides, the population capacity in Xiaoqu is quite high for the highrise residential towers. Moreover, there is quite a lot of open space and green space in the Xiaoqu neighborhood though it is not for the public. On the other hand, Xiaoqu has its drawbacks. The walkability of streets around Xiaoqu is poor since there are always walls and fens. People would travel a long distance to buy things because the neighborhood is residential only. And people feel separated since the distance between buildings and other people is far.

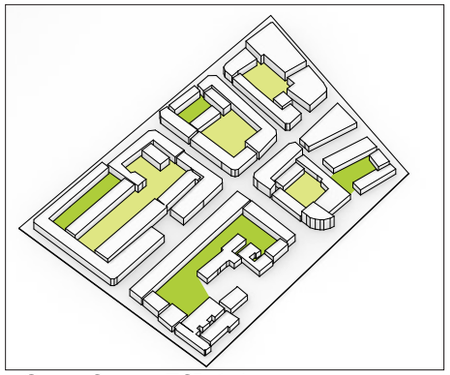
First Test: Add Xiaoqu Pros to Lilong



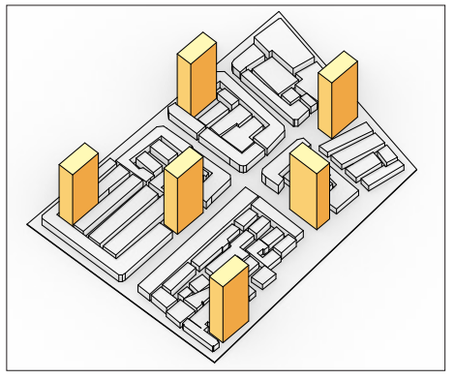
+Green, FSI: 2.1
Cost: rebuild roofs and plant trees
Benefit: add green & ecological value



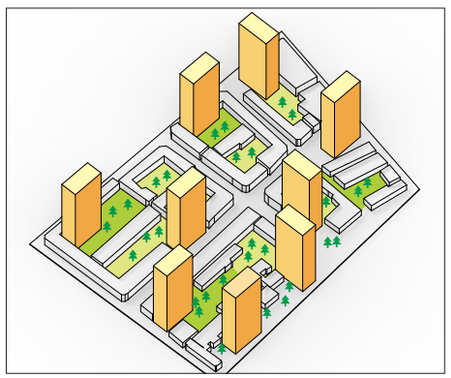
+Sunlight, FSI: 0.9
Cost: Cut roofs, lose FSI
Benefit: limited improvement of sunlight



+Open Space, FSI: 1.4
Cost: turn down some old lowrise, lose FSI
Benefit: increase open space, improve quality

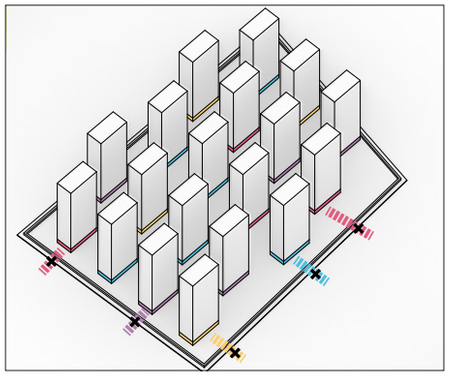


+Highrise, FSI: 3.8
Cost: turn down some old lowrises, Build new highrise.
Benefit: improve FSI to certain extend

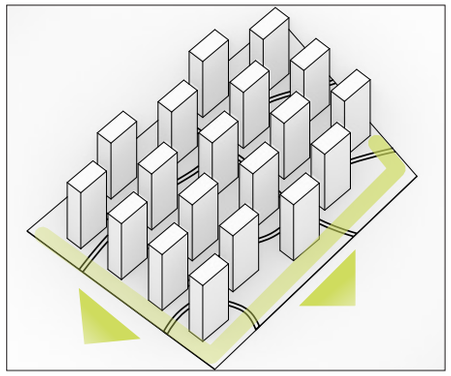


+Xiaoqu Pros, FSI: 3.8
Cost: turn old lowrises, Build new highrise, plant trees
Benefit: improve ecological value, add more open space and sunlight, and incease FSI

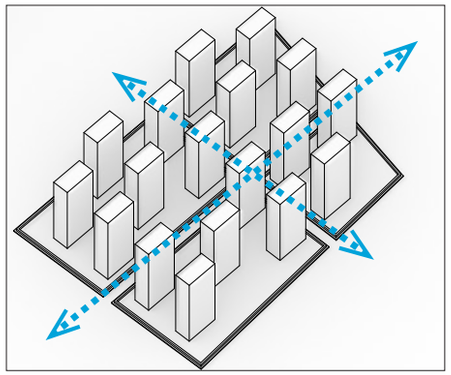
Add Lilong Pros to Xiaoqu



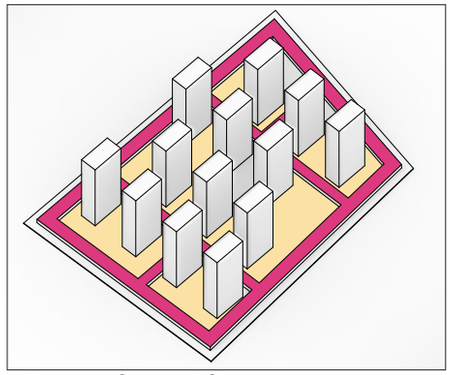
+Mix, FSI: 5.3
Cost: limited
Benefit: mix program, but bad accessbility



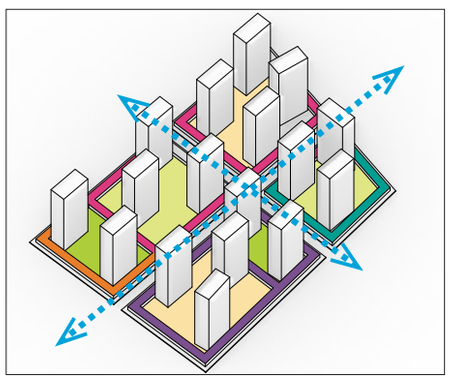
+Open, FSI: 5.3
Cost: Increase cost of maintain inside green space
Benefit: openess and accessibility for citizens



+Small Block, FSI: 5.0
Cost: build new roads with own money
Benefit: improve accessibility and walkability

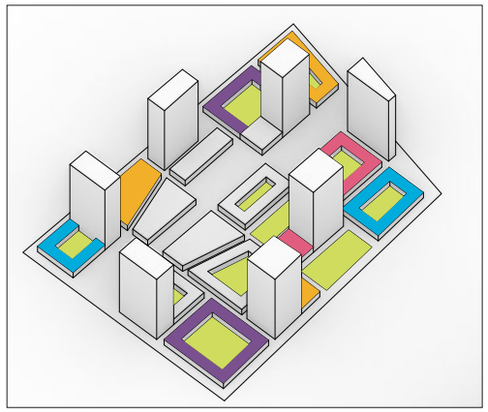


+Positive Space, FSI: 5.1
Cost: sacrifice area of homes, fire problem?
Benefit: increase positive space

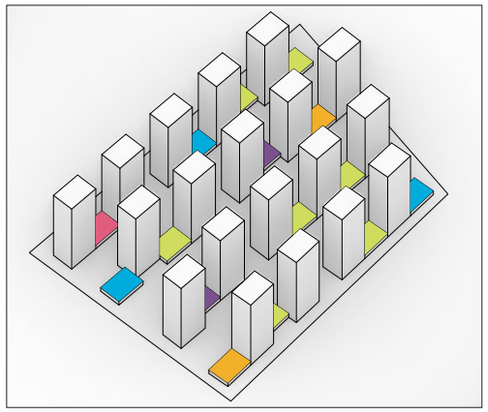


+Lilong Pros, FSI: 5.2
Cost: sacrifice areas, use own money to built roads, possible fire problem?
Benefit: more postive space, mix program, better accessibility and walkability

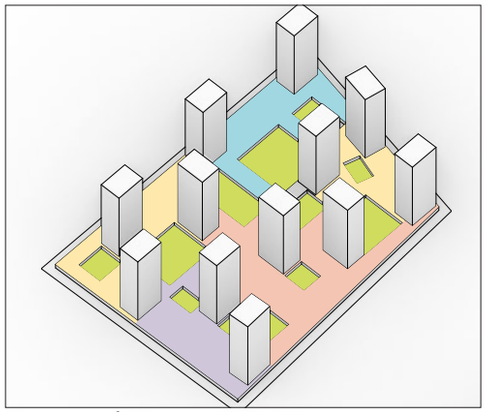
First Test: Add All Pros to New Design Test



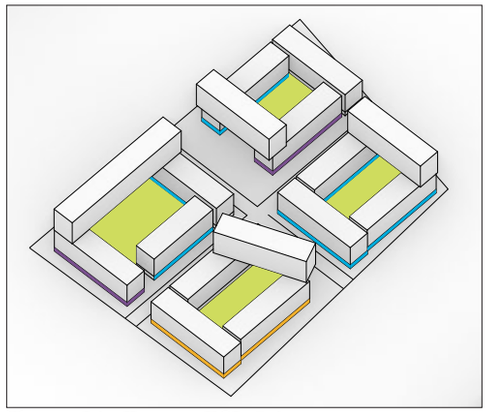
Barcode, FSI: 4.2
Cost: limited FSI improvements
Benefit: mix program + diverse space



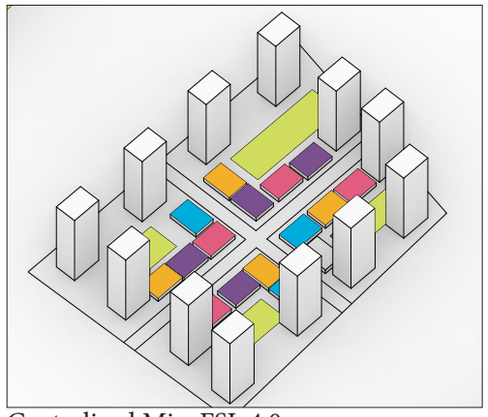
“Row House”, FSI: 5.8
Cost: stiff space
Benefit: mix program



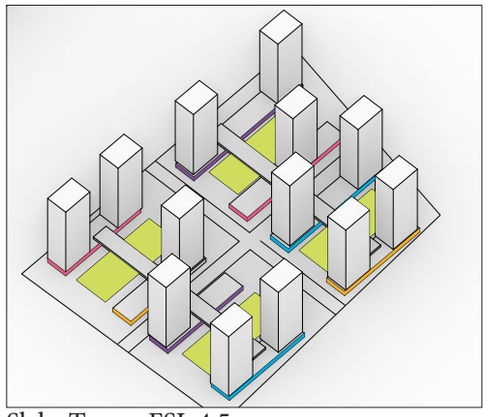
Courtyard Xiaoqu, FSI: 5.0
Cost: too much program?
Benefit: mix program, fire problem?



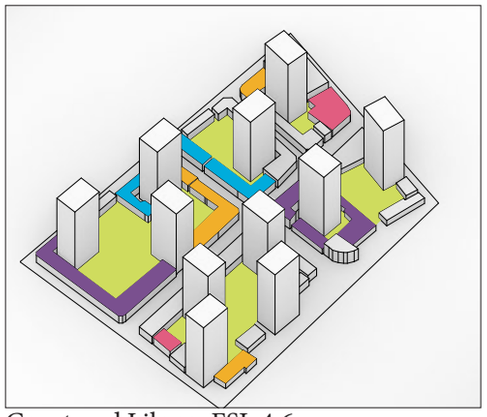
Tower Lie Down, FSI: 5.3
Cost: Limited
Benefit: mix program, collective space



Centralized Mix, FSI: 4.0
Cost: limited FSI improvements
Benefit: mix program, Agglomeration effect

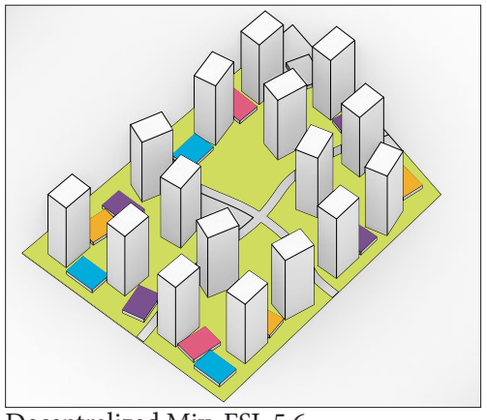


Slab+Tower, FSI: 4.5
Cost: limited
Benefit: mix program

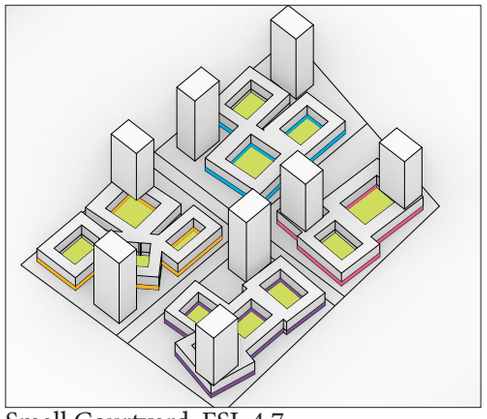


Courtyard Lilong, FSI: 4.6
Cost: FSI improvements, old house maintainance
Benefit: combine old and new, mix

Stacked Lilong , FSI: 5.0
Cost: maintain cost for old house
Benefit: combine old and new, mix

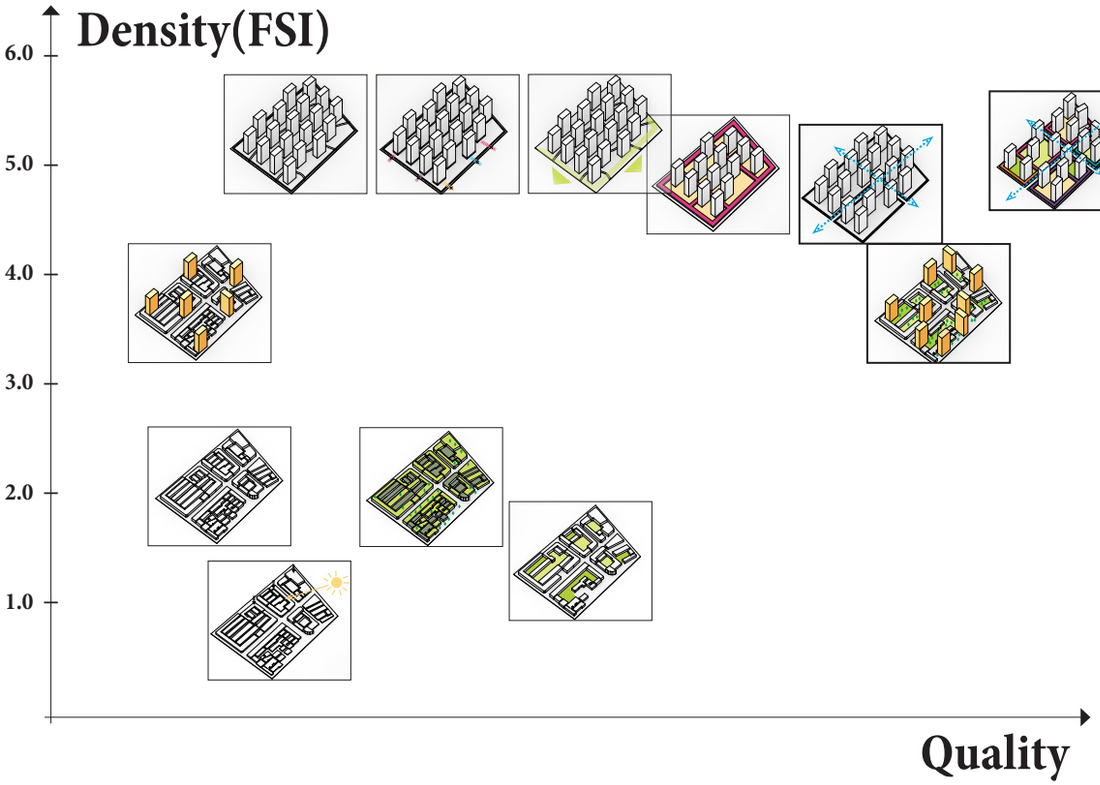


Decentralized Mix, FSI: 5.6
Cost: maintain cost
Benefit: mix program

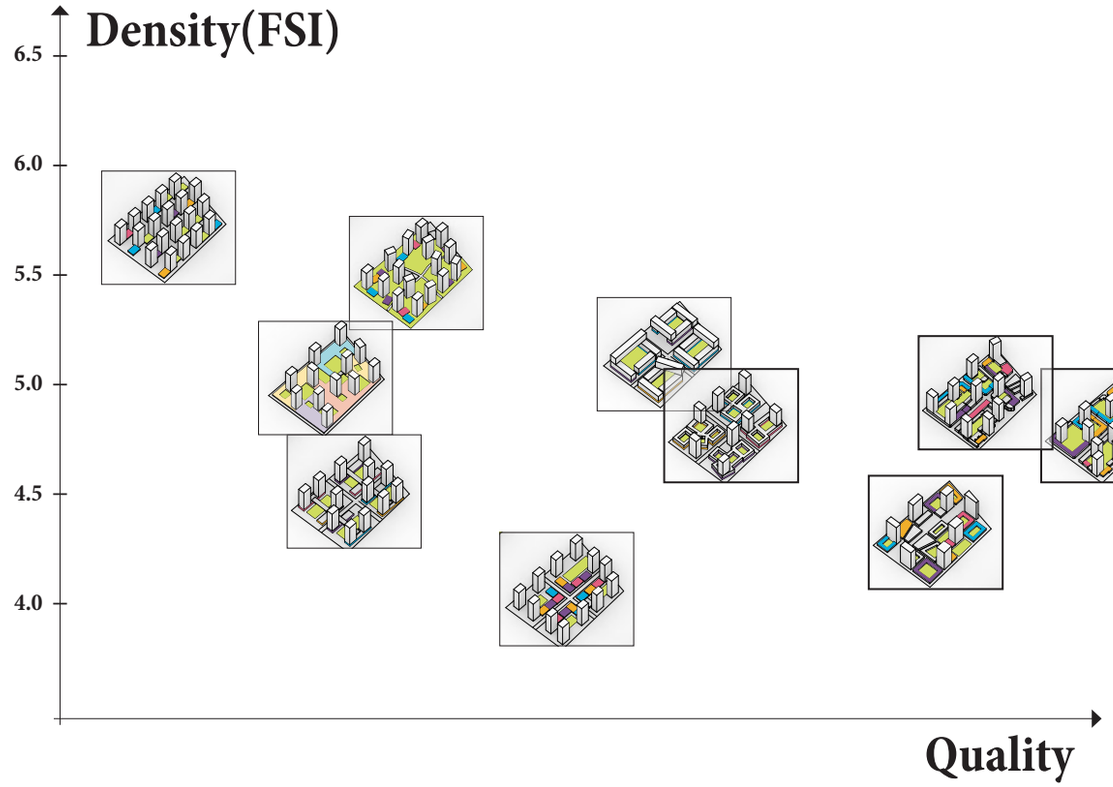


Small Courtyard FSI: 4.7
Cost: bad sunlight
Benefit: mix program, collective space

Comparison



To summarize the design test, the author create a chart with a density axis and quality axis to roughly evaluate the sacrifice of density each design cost and the quality each design gets. By position the changed Lilong and Xiaoqu and the new design test, we can get some findings.



As we can see from these two charts, the design at the right top corner with both high quality and high density may be the relatively better design direction. By comparison, we can found that those options all share diverse functions and building forms.

Method Chapter

Alignment Table

Main Research Question	Sub Research Question	Methods	Expected Outcome
How to achieve sustainable living neighborhoods rather than introducing Xiaoqu in the old Lilong area in Shanghai's densification Process?	Why regenerate Lilong in Shanghai?	Literature Reading: on Shanghai's population growth and housing capacity.	Conclusion of Shanghai's housing shortage and necessity to regenerate Lilong for more houses.
	Why there are a large amount of monofunctional highrise residential neighbourhoods in Shanghai now?	Literature Reading: on Chinese planning codes (Konggui) and FARMAX	Conclusion of feasibility study about building typology in Chinese context.
	What is the vision of this design project?	Literature Reading: on sustainable urbanism theory.	Design goals of expected qualities of future living neighbourhood.
	What qualities should be included in sustainable living neighbourhood?	Context Study: pros & cons in Lilong&Xiaoqu Literature Reading: Shanghai Planning 2035.	Find out qualities for Shanghai to achieve open and sustainable neighbourhoods.
	How to evaluate density of research areas?	Spacemate: evaluate density, GIS Mapping	Density index chart of research areas.
	How to make comprehensive research in Shanghai's living nrighbourhood?	Selected Sample Study	Choose representational sample sites according to parameters such as density index and program mix.
	How to determine site for detailed design?	Design test on multiple sites	Choose the representational one design site.
	How to determine vision of program in a site?	Program comaprison of selected sites and surrounding enviroments.	Conclude the possible program scenario of chosen sites.
	How to include Lilong's spatial character in new design?	Urban fabrics study of the traditional Lilong pattern.	Design of mixed living neighbourhood with ideas about Lilong.
	How to choose design option and refine design?	Option test and adapt evolutionart method	selected design options and refined design.

Research Approach

1.Design Test

Through practicing the "research by design" approach, we can see design itself as a tool for research. In this approach, without doing deep research on the urbanism concept. Take this project as an example. With some qualities like enough sunlight and accessible streets, we can start test some design options to see what do we gain and what do we lose in the design. Instead of doing detail research on sunlight analysis and accessibility. In this case, the design was regarded as a tool instead of the final result.

2.Spacemate: evaluate density and infer building typology

The Spacemate/SpaceMatrix theory was initially developed by M. B. Pont and P. Haupt in 2004. In the book Spacemate: The Spatial Logic of Urban Density, they introduced a scatter chart to include various density variables like FSI, GSI, OSR, L. In my perspective, the chart is an effective way to interpret urban density in many ways. For example, Chinese people are mainly focused on FAR(FSI) as the most crucial density figure, but FAR's correlation with other variables like GSI, OSR, L are also crucial in urban density. So, I am wondering it would be reasonable if I first interpret the Chinese context with Spacemate theory, then "play with density variables" in a parametric way. Hopefully, I may found the new development mode through the process.

3. MXI: evaluate the degree of program mix

There are different ways to assess the diversity of the program. I found out the MXI (Mixed-use Index) that was developed by J. Hoek(2008) is maybe the most suitable one for my research. In the thesis The MXI (Mixed-use Index) as Tool for Urban Planning and Analysis, he defined all building typologies as "Unmixable Non-housing," "mixable Non-housing," and housing. By giving values to urban blocks according to their degree of mixing program, we can gain an index figure of mix-use neighborhoods. For example, the 0-20 scores blocks are maybe factories or offices, 40-60 scores could be city center, 80-100 scores blocks are obviously, residential neighborhoods. In my case, I could use this MXI system to evaluate the degree of mix-use in Chinese urban blocks quickly. Combined with the Spacemate theory, I may have a better understanding of diversity and density and apply it to design.

4. Parametric Programming on Density Study

Urban density includes many variables like FSI, GSI, L; the variables can be regarded as parameters when designers are doing building typology study. It is hard for an urban designer to visualize the building's volume typology because they need to change the parameters continuously. The advantage of parametric design is that a designer can change only a few parameters, and the remainder of the model can react and update accordingly(Jabi, 2013). "These derivative changes are handled by the software but are based on associative rules set by the designer. Associative and parametric geometry, in essence, describes the logic and intent of such design proposals rather than just the form of the proposal itself."

Design Goal & Expected Deliverables

According to the Shanghai Master Plan 2017–2035, the city wants to formulate more open, mix, pedestrian-friendly urban blocks and create 15mins LifeCircle[1] for in coming years. But it is difficult to achieve such ambition with the closed Xiaoqus. Therefore, the design goal is to introduce a mixed densifying urban regeneration project that meets and beyond the plan's requirements. Besides, we can envision a sustainable living neighborhood.

Expected final deliverables include:
- City scale and block scale research on sustainable living neighbourhood: for people, for profit, and for planet.
- Neighborhood scale urban design combined with the research.

1. People can access main public service by walking within 15 minutes

Theory Chapter

Theoretical Framework (Key Literature)

FARMAX: Excursions on Density
Winy Mass, 1998

FARMAX is a book about the density in urban design. In the chapter Far East (p175), the author explained the spatial logic of a typical Asian highrise residential tower. In his discussion, the reason for this typology was driven by the maximum economic benefits and local building codes. In my project, the book can help me understand the inner connection of urban form and the mechanism behind it.

Sustainable urbanism: Urban design with nature
Farr D, 2011

In this book, Farr illustrates the sustainable theory in urbanism. He clarified that sustainability should contain qualities for people, for profit, and for the planet. In my project, since now the Xiaoqu development is mainly focused on the profit part, I can first do research on the profit part(FSI). To encourage the urbans design for people and for planet, there would be some sacrifice of decreasing profit. The goal of this project is to archive not only profit sustainability but also people and planet's benefits.

Spacemate: The Spatial Logic of Urban Density
Meta Pont, 2004

The Spacemate/SpaceMatrix theory was developed by M. B. Pont and P. Haupt. They introduced a scatter chart to include various density variables like FSI, GSI, OSR, L. For my project, Spacemate is not only an effective way to evaluate density, it bridges the gap between density index and buildings' morpho-typology. By playing with density variables, I can "calculate and generate" different urban typology, and the building typology is one of the two parts I will discuss in my MixCity project.

Shanghai Mater Plan 2017–2035: Striving for The Excellent Global City
Shanghai Urban Planning & Land Resource Administration Bureau, 2018

In the recent city master plan, the Shanghai government had introduced an ambitious vision for Shanghai's next 20 years. The master plan consists of comprehensive aspects of goals and policies. In terms of urban blocks scale and housing part, the plan introduced the concept 15 mins LifeCircle for urban design. In the LifeCircle, 99% of citizens can walk to main public services like education and sports field within 15 minutes. The requirements of LifeCircle also pointed out the importance of designing the open block, mix-use block, and pedestrian-friendly block. So, this part of the Shanghai Master Plan can be seen as a guidebook for my graduation project. It envisioned the quality of neighborhoods that design should meet and satisfy.

The MXI (Mixed-use Index) as Tool for Urban Planning and Analysis
J. Hoek, 2008

There are different ways to assess the diversity of the program. I found out the MXI (Mixed-use Index) is maybe the most suitable one for my research. In the thesis The MXI (Mixed-use Index) as Tool for Urban Planning and Analysis, he defined all building typologies as "Unmixable Non-housing," "mixable Non-housing," and housing. By giving values to urban blocks according to their degree of mixing program, we can gain an index figure of mix-use neighborhoods. In my case, I could use this MXI system to evaluate the degree of mix-use in Chinese urban blocks quickly.

Qualities in Sustainability

Learning qualities of sustainability theories from Gilbert(2010) and Basiago(1998) and other scholars, we can get the qualities of sustainability in three aspects: sustainability for people, for profit, and for the planet. Among those qualities, the author picked some of them that linked with Xiaoqu and transformed the qualities in Shanghai Xiaoqu's context.

- For People

- High Rate Employment
- Liveability
- Protected Privacy
- Healthy and Safety
- Gender Inclusive
- No Poverty
- Community Participation
- ...

- For Profit

- Economic Growth
- Profitable Industry
- Increase Local Investment
- Operational Profitability
- Service Affordability
- Increased Business Flexibility
- Clarity on Revenue System
- ...

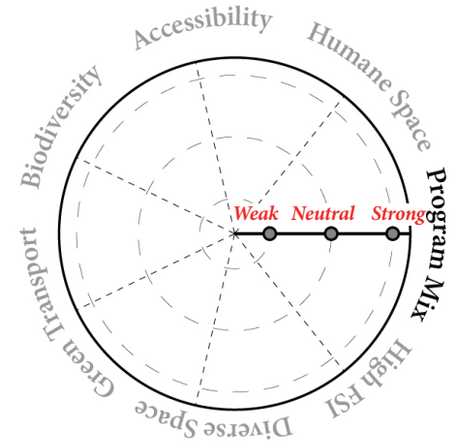
- For Planet

- Clean Energy
- Clean Air
- Water Recycling
- Increased Biodiversity
- Waste Recycling
- Habitat Restoration
- Eco-System Integrity
- ...

Quality Measurability

In the following parts, the author takes three main visions about mix for three types of sustainability. For the visions, the author elaborates on the qualities of them and evaluates the measurability of qualities.

In the right "radar diagram", we can see the degree of each aspects, this diagram would be used as evaluation tool for future design.



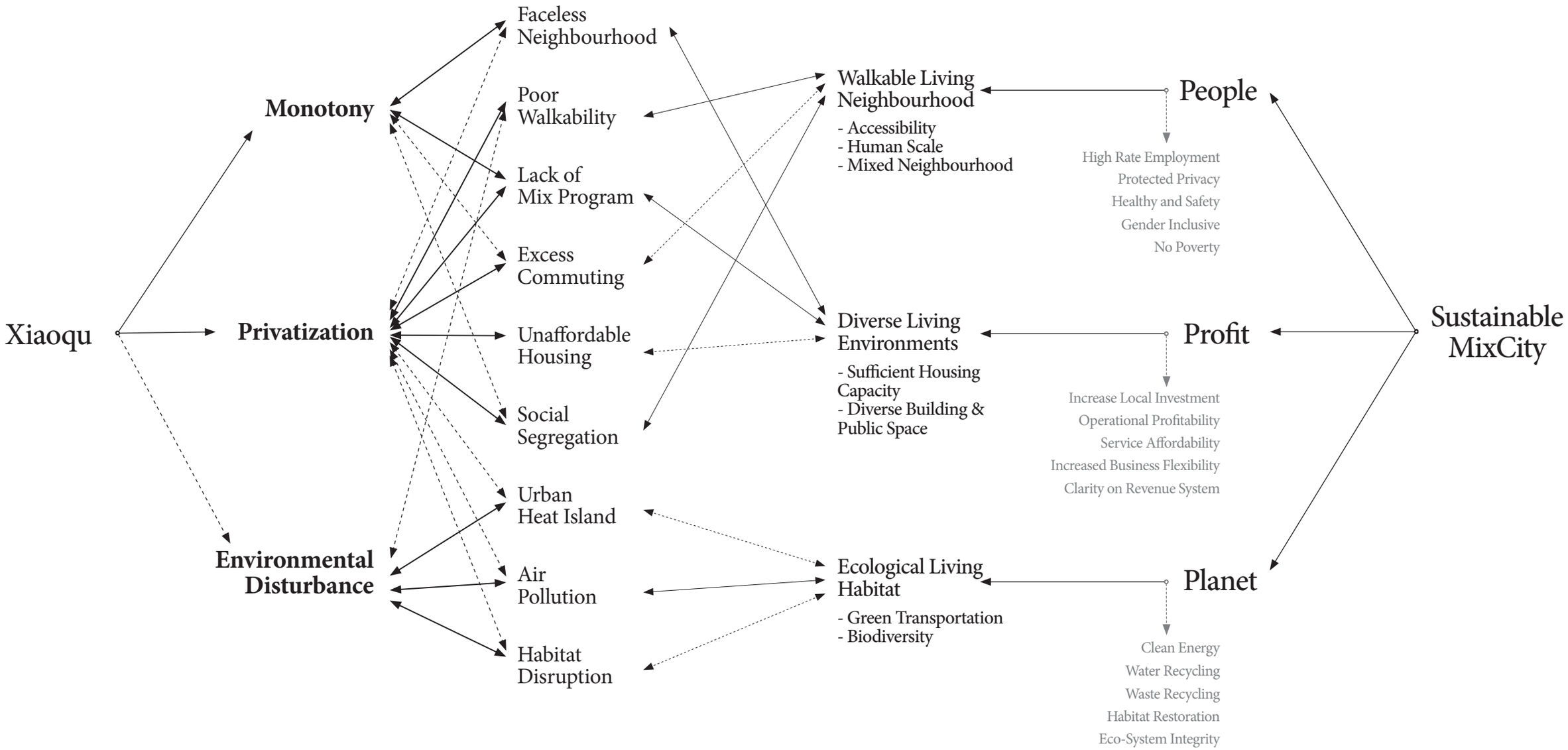
Sustainable MixCity

For People	*Measurability*	*Assessment*
Walkable Living Neighbourhood		
Accessible Neighbourhood *Accessible to public facilities within 15 mins*[1]	Measurable	Space Syntax
Human Scale Street *Friendly for pedestrian to walk*	Non-Measurable	Street Profile Analysis
Mixed Neighbourhood *Diverse program for people to reach*	Measurable	Program Calculation
For Profit		
Diverse Living Environments		
Sufficient Housing Capacity *Sufficient housing for growing population*	Measurable	FSI Mapping
Diverse Building & Public Space *Avoid faceless neighbourhood*	Transformable	Typology Test
For Planet		
Ecological Living Habitat		
Green Transportation *Encourage bike travel to ruduce air pollution*	Transformable	Cycleway Mapping
Biodiversity *Increase biodiversity of neighbourhood*	Non-Measurable	Case Study

1. Requirements form Shanghai Masterplan 2017–2035

Conceptual Framework

Context ⟷ ***Problem*** ⟷ ***Quality*** ⟷ ***Vision***



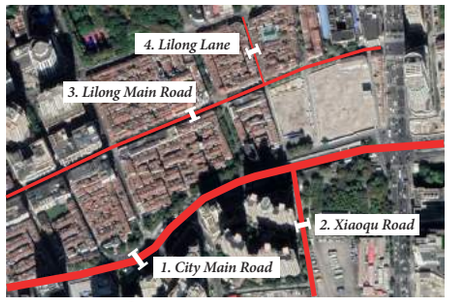
Analytical Chapter

Research on Quality for People

Walkable Living Neighbourhood

In this chapter, the author takes three perspective to analysis walkability. From human-scale street, we can gain an understanding of the walkable feeling at eye level. From accessibility, we can calculate the connectivity with space syntax on a macro scale. From the program mix analysis, we could understand the degree of mix in each block within the site, and it would be an inspiration for future design.

Street Scale

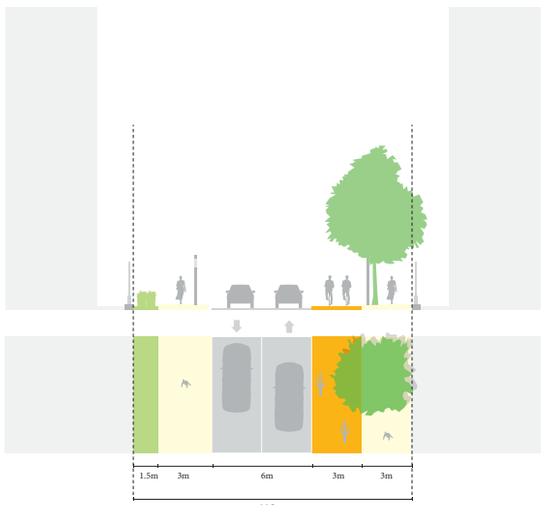


Location of Sections

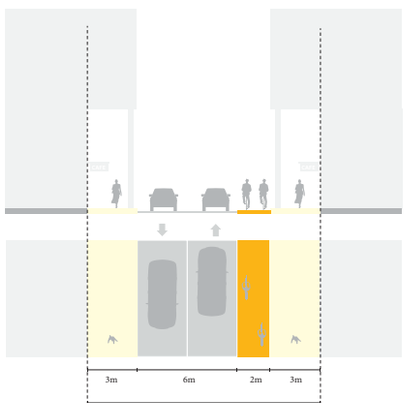
It is obvious that the main city road is designed for cars, and the way around Xiaoqu is closed by fences and walls. None of them are pleasant for people to walk. However, the streets and lanes in Lilong are human-scale thanks to its cozy dimension and grey space.

1. City Major Road
Designed for cars, too spacious for pedestrian

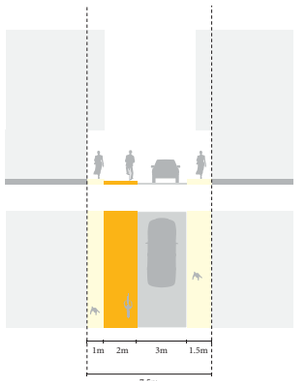
2. Xiaoqu Surrounding Road
Closed by fence, exclusive for pedestrian



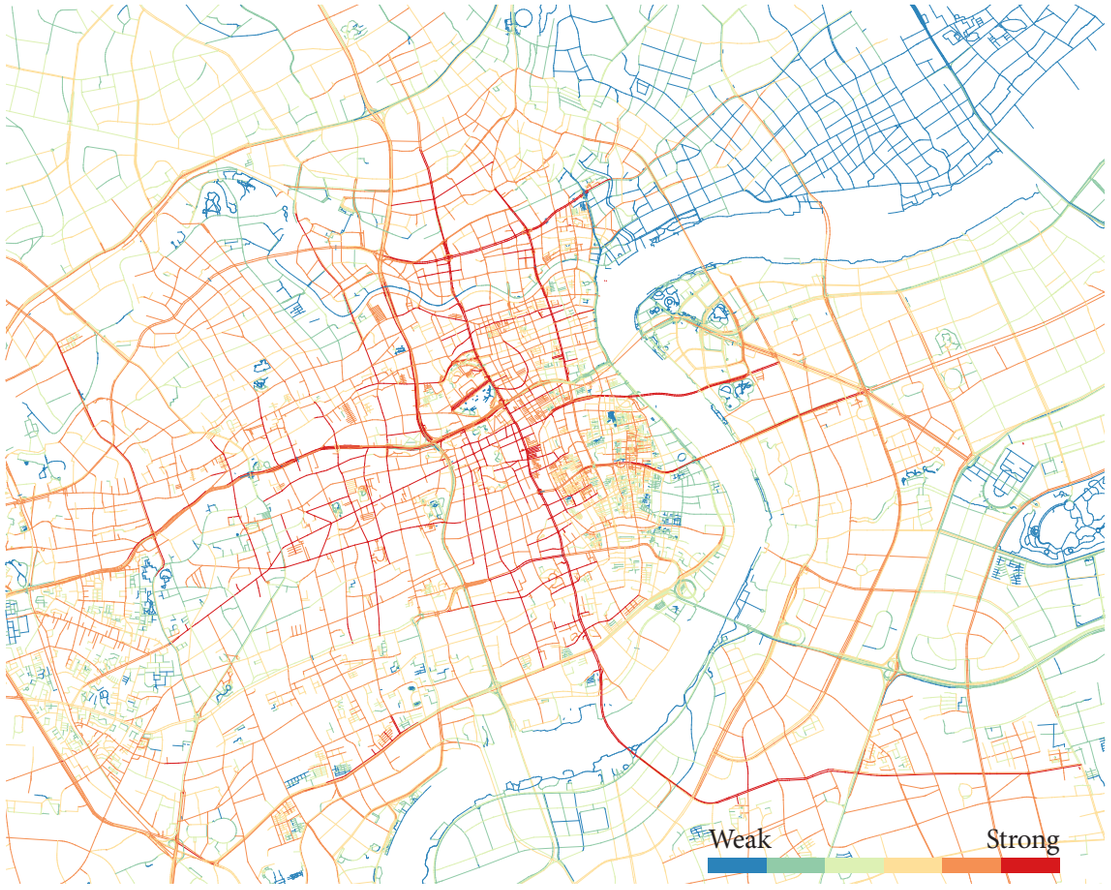
3. Lilong Main Road
Human scale feeling, friendly for people and bikes



4. Lilong Lane
Cozy, a bit too narrow for both cars and pedestrian



Accessibility Analysis



Through the accessibility analysis of Space Syntax, we can easily tell that the inner lane in Lilong is not very accessible and it is worse in Xiaoqu. To create a walkable street, it is necessary to improve its accessibility.

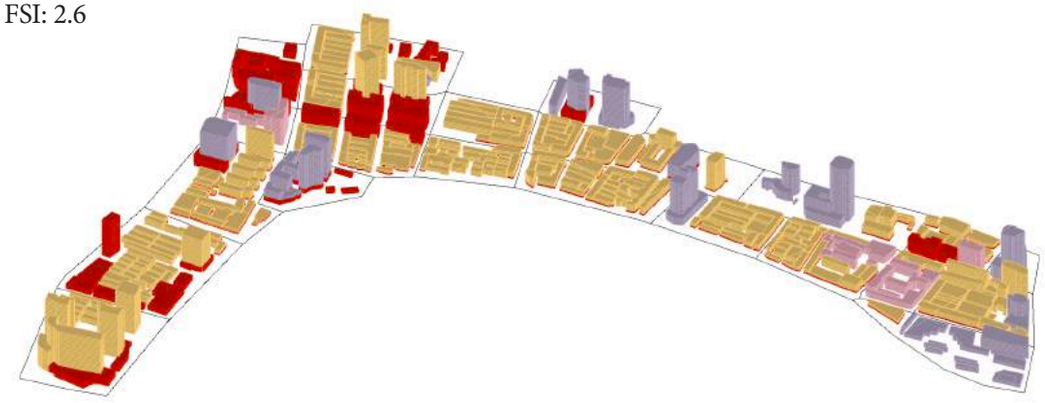
Low Level Mix

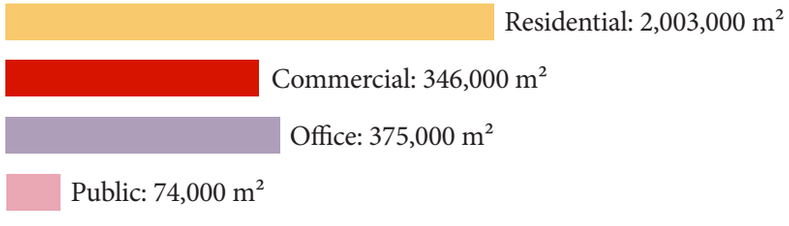
Location in Shanghai, Souce: Google Earth

Mixed Lilong, Souce: www.500px.com

*Program Data Based on Baidu Streetview

Site Area: 570,000 m²
FSI: 2.6



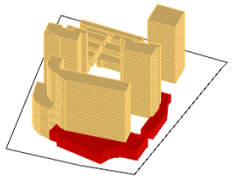


By visualizing the program type of buildings, we could understand the division of functions in a 3d perspective. As we can tell from the drawing, though the area is mixed on a macro scale and there are some vertical mix in buildings, most urban blocks have separated programs in sites. The level of the mix is quite low, and there is a lot of potential to mix programs on the micro-scale.

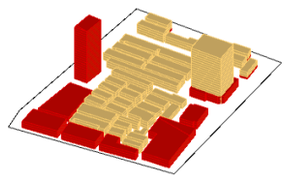
Program Mix in Blocks

Residential Commercial Office Public

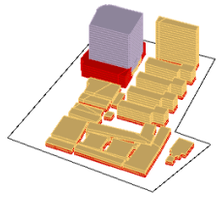
By zooming into individual blocks, we can see the specific program distribution of each. From this inventory we can find out that though many blocks are quite mixed in program. Some of them is quite monofunctional.



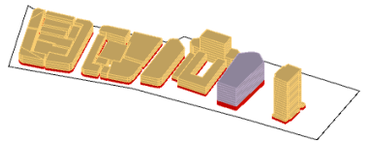
Site Area: 43,000 m²
FSI: 3.9
150,000 m²
15,000 m²
0 m²
0 m²



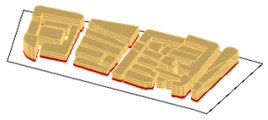
Site Area: 50,000 m²
FSI: 1.9
58,000 m²
34,000 m²
0 m²
0 m²



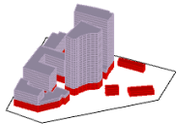
Site Area: 41,000 m²
FSI: 2.5
38,000 m²
26,000 m²
36,000 m²
0 m²



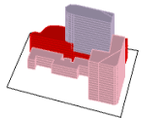
Site Area: 40,000 m²
FSI: 2.0
50,000 m²
14,000 m²
15,000 m²
0 m²



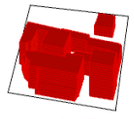
Site Area: 28,000 m²
FSI: 1.8
42,000 m²
8,000 m²
0 m²
0 m²



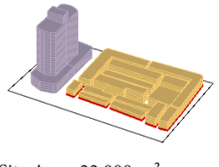
Office Block
Site Area: 18,000 m²
FSI: 3.2
0 m²
15,000 m²
43,000 m²
0 m²



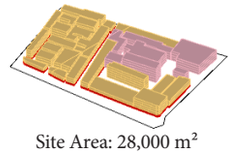
Site Area: 15,000 m²
FSI: 4.0
0 m²
19,000 m²
16,000 m²
26,000 m²



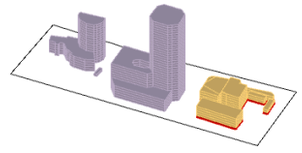
Commercial Block
Site Area: 20,000 m²
FSI: 3.0
0 m²
60,000 m²
0 m²
0 m²



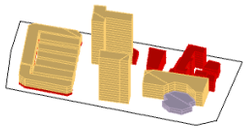
Site Area: 22,000 m²
FSI: 3.0
24,000 m²
4,000 m²
36,000 m²
0 m²



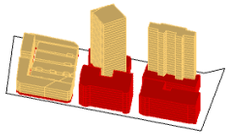
Site Area: 28,000 m²
FSI: 1.9
27,000 m²
7,000 m²
0 m²
18,000 m²



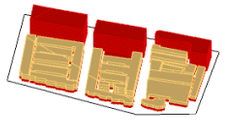
Site Area: 31,000 m²
FSI: 2.7
11,000 m²
3,000 m²
70,000 m²
0 m²



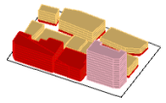
Site Area: 32,000 m²
FSI: 2.1
51,000 m²
15,000 m²
2,000 m²
0 m²



Site Area: 24,000 m²
FSI: 4.2
58,000 m²
42,000 m²
0 m²
0 m²

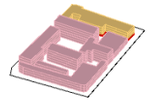


Site Area: 30,000 m²
FSI: 2.2
21,000 m²
44,000 m²
0 m²
0 m²

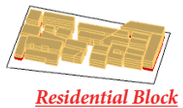


Site Area: 15,000 m²
FSI: 3.0
16,000 m²
19,000 m²
0 m²
9,000 m²

Office Block
Site Area: 8,000 m²
FSI: 4.9
0 m²
0 m²
40,000 m²
0 m²

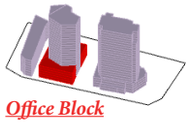


Site Area: 13,000 m²
FSI: 2.0
4,000 m²
1,000 m²
0 m²
21,000 m²

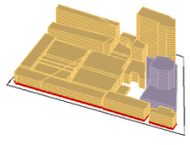


Residential Block
Site Area: 17,000 m²
FSI: 1.4
22,000 m²
2,000 m²
0 m²
0 m²

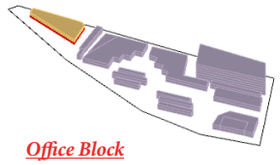
Residential Block
Site Area: 19,000 m²
FSI: 1.7
28,000 m²
3,000 m²
0 m²
0 m²



Office Block
Site Area: 17,000 m²
FSI: 4.1
0 m²
6,000 m²
63,000 m²
0 m²



Site Area: 25,000 m²
FSI: 3.6
63,000 m²
6,000 m²
21,000 m²
0 m²



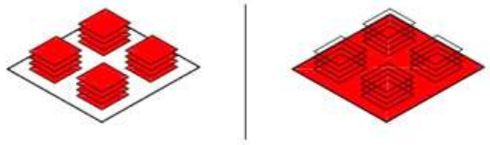
Office Block
Site Area: 30,000 m²
FSI: 1.2
2,000 m²
1,000 m²
35,000 m²
0 m²

Research on Quality for Profit

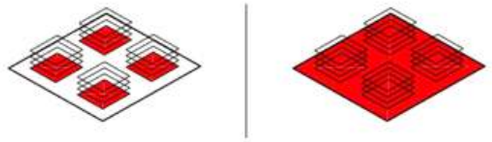
Diverse Living Environments

The faceless neighborhood is a maximized result of economic profit. By changing the building typology, the neighborhood would be more diverse and interesting to live in through the FSI, and profit would sacrifice a bit. This chapter studied spacemate methodology and introduced a parametric tool based on it to tuning the building diversity. Its flexibility of building typologies would be helpful for future design.

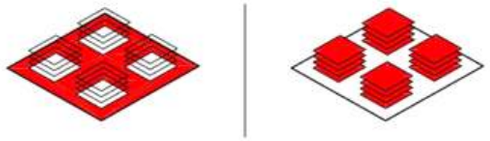
Spacemate



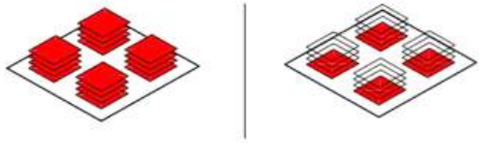
FSI (Floor Space Index)
The FSI expresses the built intensity of an area.
FSI = gross floor area / plan area



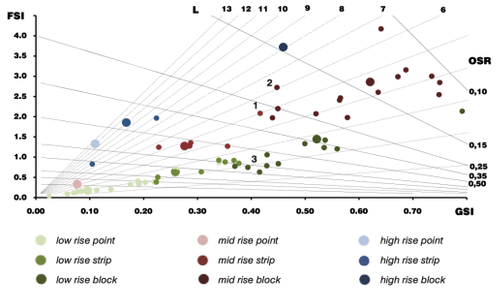
GSI (Gross Space Index)
GSI, or coverage, demonstrates the relationship between built and non-built space.



OSR
The variable OSR, or spaciousness, is a measure of the amount of non-built space at ground level per square meter of gross floor area.



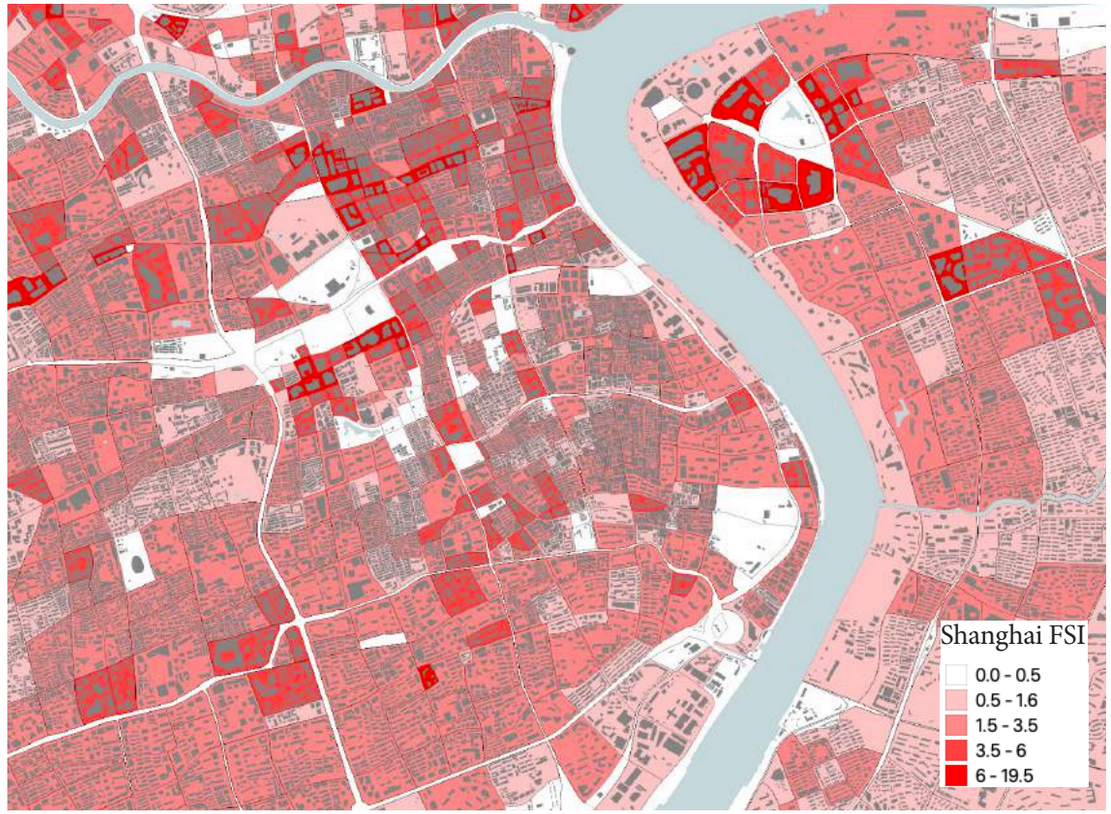
L
Average number of floors.



All dutch samples in Spacemate, (Meta.B, 2010)

Meta's Spacemate methodology clearly explained the relationship from the spatial form to the density index. This project took advantage of her idea and discussed the relationship from the density index to the building form.

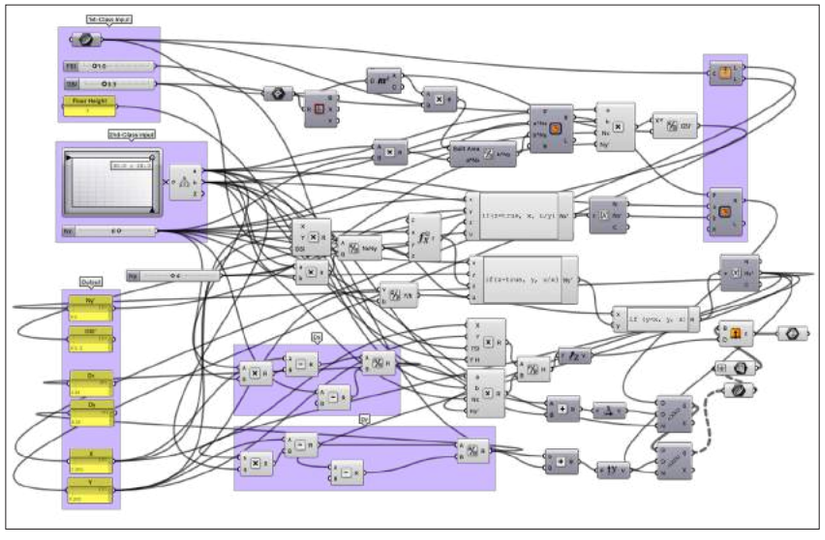
Sufficient Housing Capacity



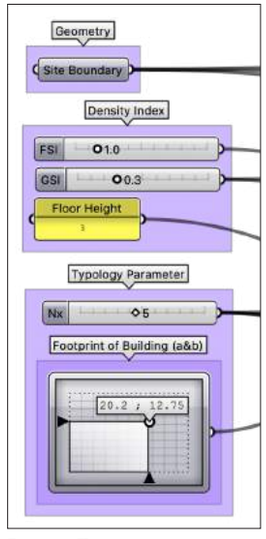
From the FIS Mapping, we can see that the urban blocks(normally Xiaoqu or Offices) with bigger buildings have higher FSI, those with small grain buildings(normally Lilong) have a relatively lower FSI.

In this case, due to the increasingly growing population in Shanghai, it is urgent to increase the housing capacity of old Lilong blocks. Namely, to densify Lilong for higer FSI.

Diverse Building & Public Space: TypologyMaker



Algorithm of TypologyMaker in Grasshopper3D



Input Parameters
in TypologyMaker

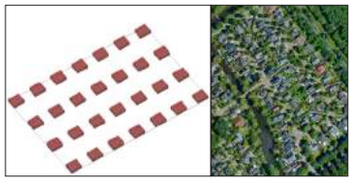
The programming script was developed in Grasshoppper3D, and the responsive outcome is displayed in Rhinoceros. In TypologyMaker, we can gain generated 3d model by adjusting the input parameters:

Geometry: Site Boundary
Density Index: FSI, GSI, Floor Height
Typology Parameter: the plan of a building(including length and width of a building), number of buildings one direction.

Since the victory of Xiaoqu is driven by economic parameters like FSI and GSI of urban blocks, the key to analysis diverse building forms is to explore the relationship of density index and building typology. Thanks to parametric tool TypologyMaker, we can quickly generate building forms by playing with input parameters like FSI and GSI. This research offers us a more profound and intuitive understanding of building typology and provides inspiration for later MixCity design.

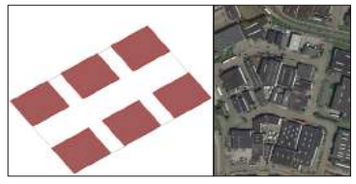
In the design, this parametric tool would be used to explore the possibility of building typologies.

1. Villa, FSI: 0.5, GSI: 0.2

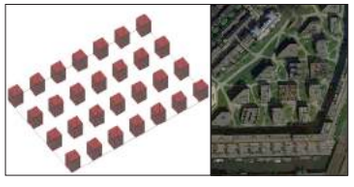


2. Suburb, FSI: 0.5, GSI: 0.4

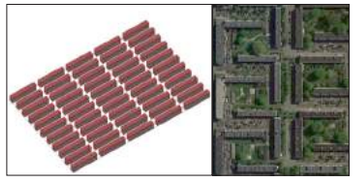
3. Warehouse, FSI: 0.5, GSI: 0.6



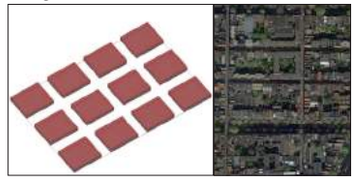
4. Middle-rise Point, FSI: 2.0, GSI: 0.2



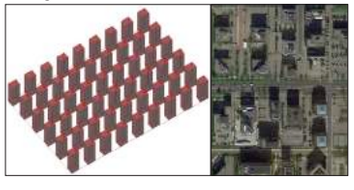
5. Slab, FSI: 2.0, GSI: 0.4



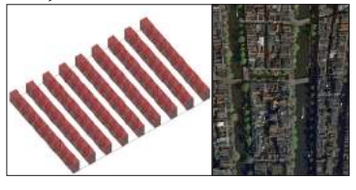
6. Big Block, FSI: 2.0, GSI: 0.6



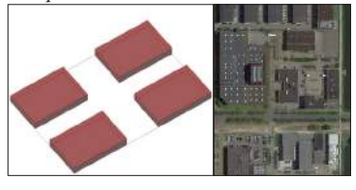
7. High-rise Point, FSI: 3.5, GSI: 0.2



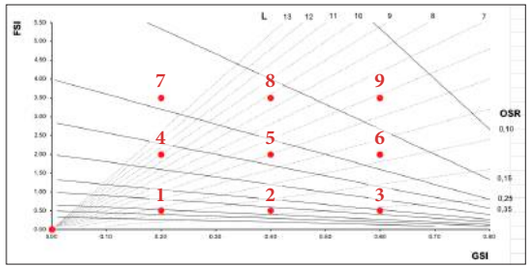
8. City Center Row House, FSI: 3.5, GSI: 0.4



9. Super Block, FSI: 3.5, GSI: 0.6



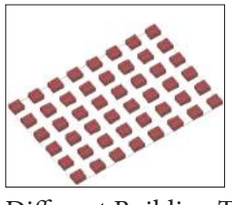
Building Typology Test of 9 Typologies by TypologyMaker & Real Life Cases



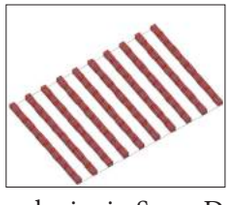
9 Typologies in Spacemate Chart

By playing with different density indexes in the TypologyMaker, we can get distinctive typology outcomes. Besides, when input the same FSI and GSI numbers, we can also get different typology results by adjusting the dimension and quantity of buildings.

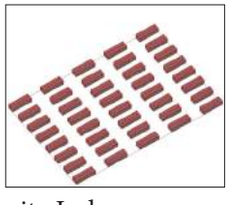
Villa, FSI: 1.0, GSI: 0.3



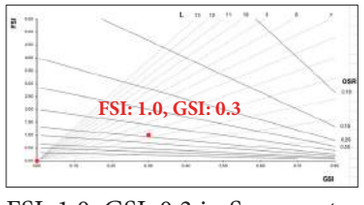
Row, FSI: 1.0, GSI: 0.3



Slab, FSI: 1.0, GSI: 0.3



Different Building Typologies in Same Density Index



FSI: 1.0, GSI: 0.3 in Spacemate

Research on Quality for Planet

Ecological Living Habitat

China enjoys its rapid GDP growth in the past decades. However, people are more focused on the economic value of urban development. The ecological habitat suffers from the development. Problems like air pollution, decline of biodiversity are urgent to be improved nowadays.

Biodiversity

Source: www.climateaction.org

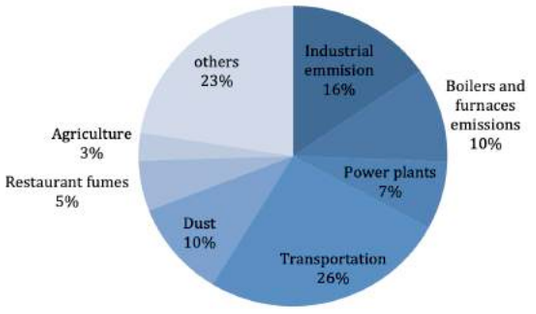
Case Study: Malmö Eco-City

Sweden has one of the highest per capita electricity consumption rates in the world because Swedish people have to pay high heat cost for the cold weather. Malmö, as the third-largest city in the country, has transformed a former industrial area (Western Harbor) into a sustainable living neighborhood to be supplied by 100 percent renewable energy since the 1990s. In this neighborhood, the innovative heating and cooling system was introduced, and electricity was generated by wind turbines. For green space, the former harbor is filled with diverse plants, and rainwater can be recycled. This practice project is helpful as a case study for my sustainable living neighborhood design.

Source: www.climateaction.org

Green Transportation

Shanghai Air Pollution (Source: sina.com)



Major air pollution source, fan yang, 2013, The research of long-term haze pollution in Shanghai, China

In recent years, air pollution has been a major problem in big Chinese cities. In Shanghai, Fan's report shows that the main source of air pollution is from transportation. In this case, it is reasonable to look at the transportation mode in Shanghai.

Transportation: 1980s vs. 2015

Shanghai 1980s (Source: sina.com)

Shanghai 2015 (Source: sina.com)

Forbidden Cycle Map

(Source: dtcj.com)

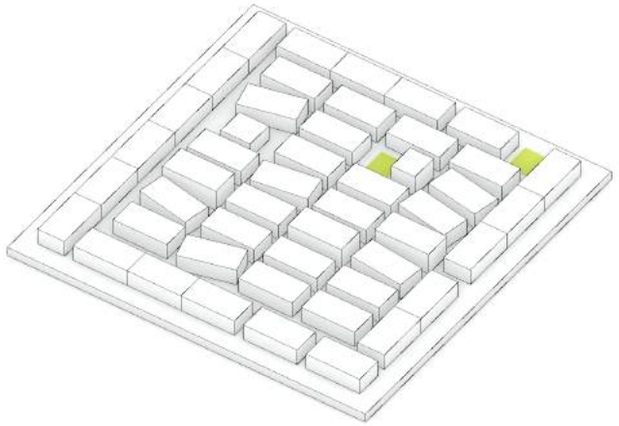
Back in the 1980s, people in Shanghai prefer to travel by bike thanks to its low cost and convenience. However, as economic development, the amount of cars is rising dramatically. And some ways are even forbidden for bikes. The waste gas from cars causes a major part of air pollution. It is time to rethink the transportation mode in SHanghai and bring back bikes to the city.

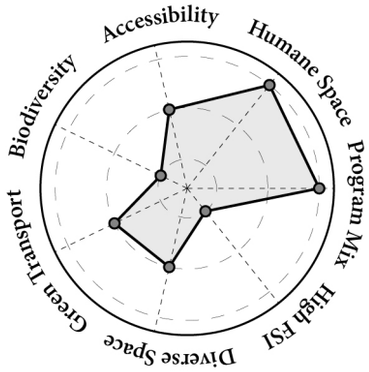
Conclusion Scenario

Paset: Lilong, FSI: 2.1

People | Profit | Planet

Normally the Lilong is open and walkable for citizens but the green space is limited, and population capacity is low.

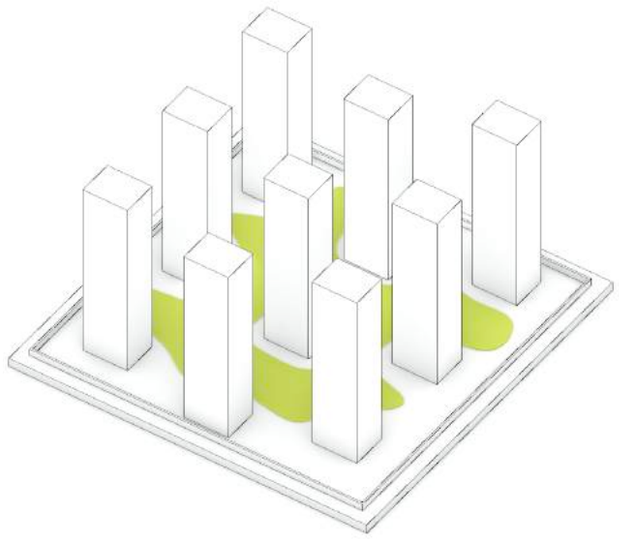


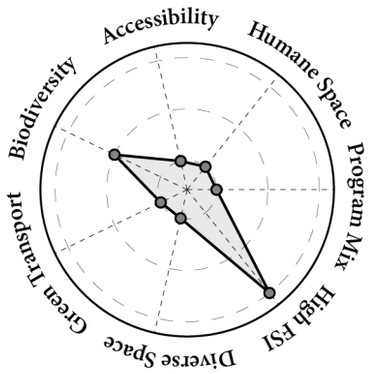


Now: Xiaoqu, FSI: 5.3

People ↓ | Profit ↑↑ | Planet ↑

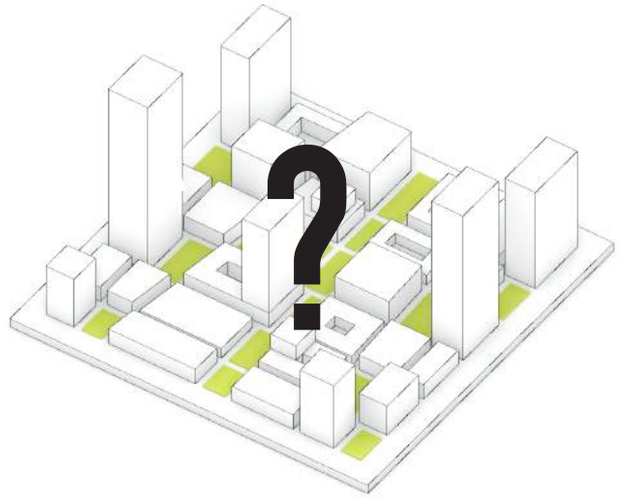
A certain type of Xiaoqu may be this bad situation, the exclusiveness damage the benefit for citizens and the increasing green area is for private use.

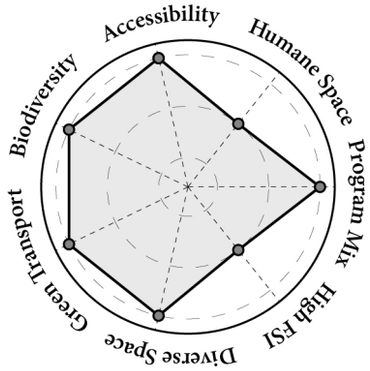




Future: MixCity, FSI: 2.1–5.3

People ↑ | Profit ↓ | Planet ↑





From the above researches, we can conclude the future scenario of MixCity. Since the economic profit in Xiaoqu is already maximized, whatever design change happens in MixCity would decrease the FSI level in current building regulations. Through this may sacrifice some building areas, we can increase the qualities for people and our planet. In the following chapter, the author would introduce three design test options to envision the MixCity.

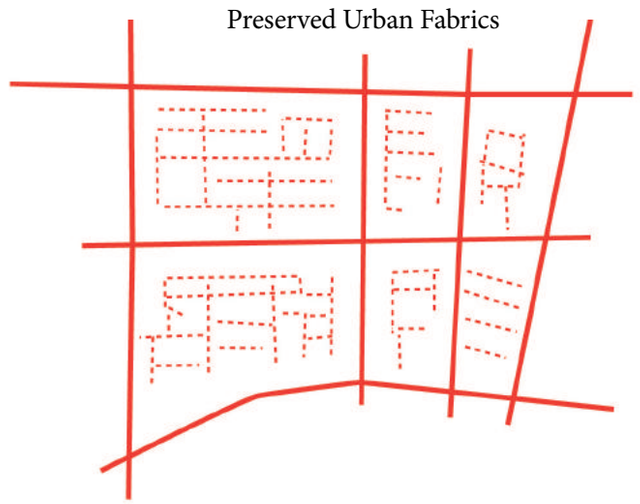
2nd Design Test

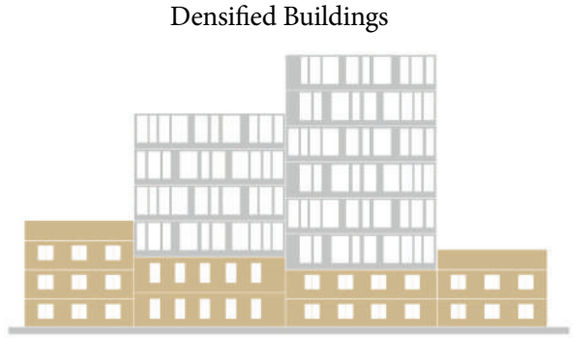
“Research for Design.”

Design Test

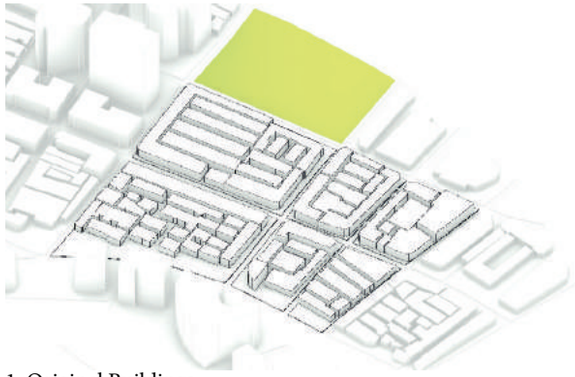
Option 1: Densified Fabrics

The idea of this option is to preserve all the urban fabrics of the original Lilong. Through the renovation and transformation of all the buildings, the organic spatial pattern can be kept. To solve the problems of traditional Lilong, some changes are introduced. The designer creates multiple paths to make the inner block more connected and accessible, the entrance space is enlarged, and green parks replace some buildings. To gain a more area to achieve the higher FSI, several highrise buildings are introduced.



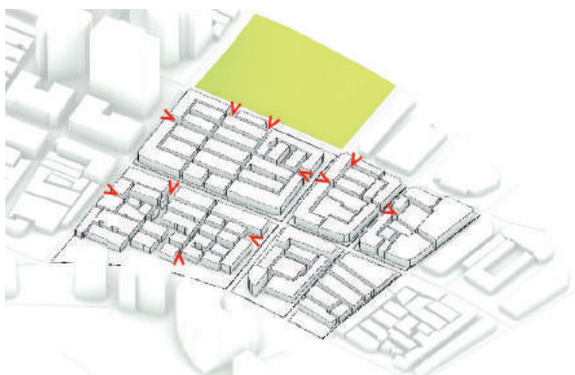


Step Story

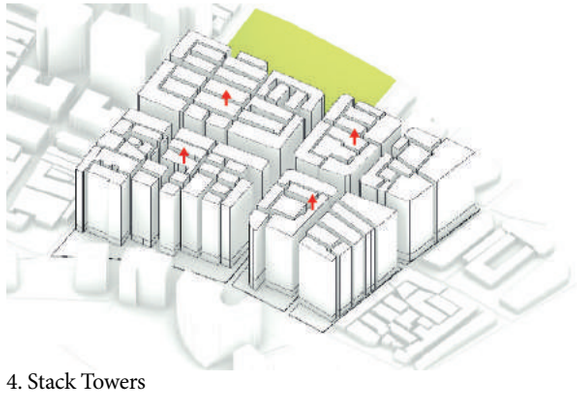


1. Original Buildings

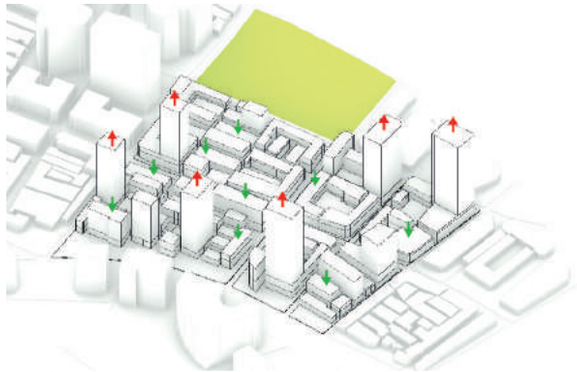
2. Create Path



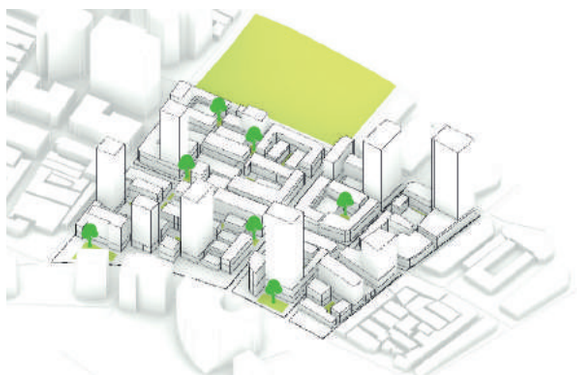
3. Enlarge Entrance



4. Stack Towers

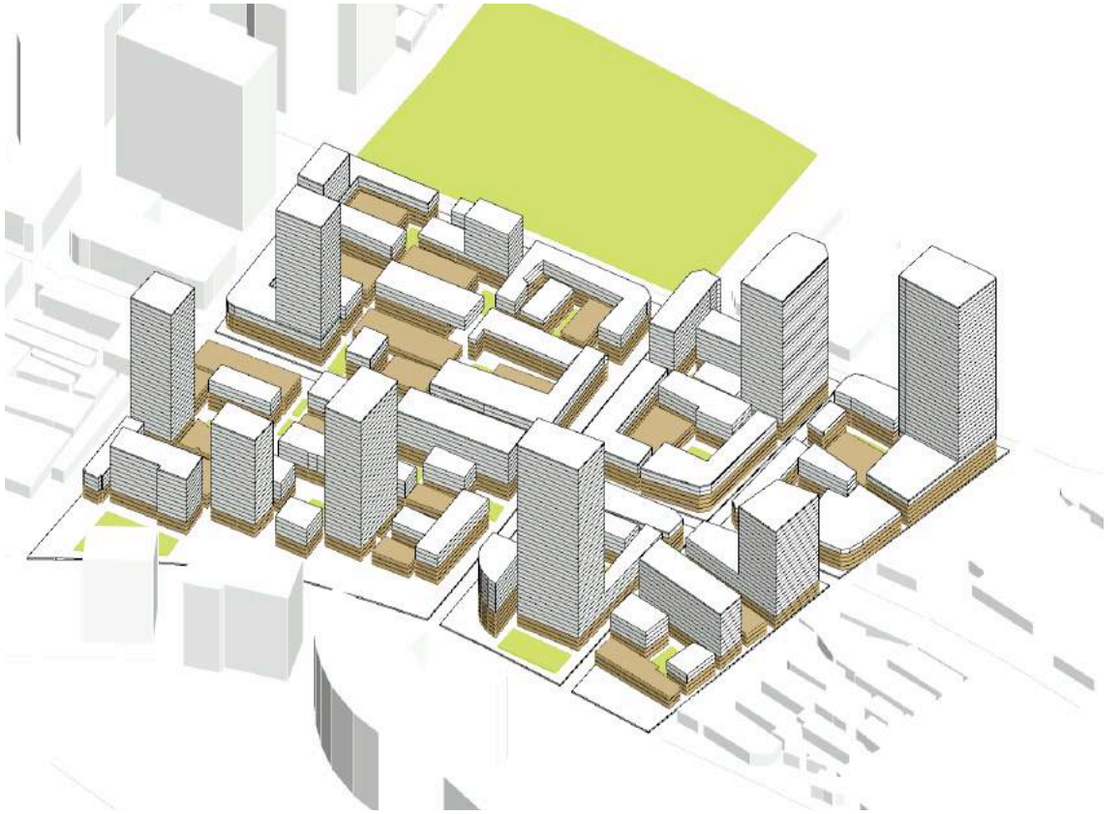


5. Adjust Height



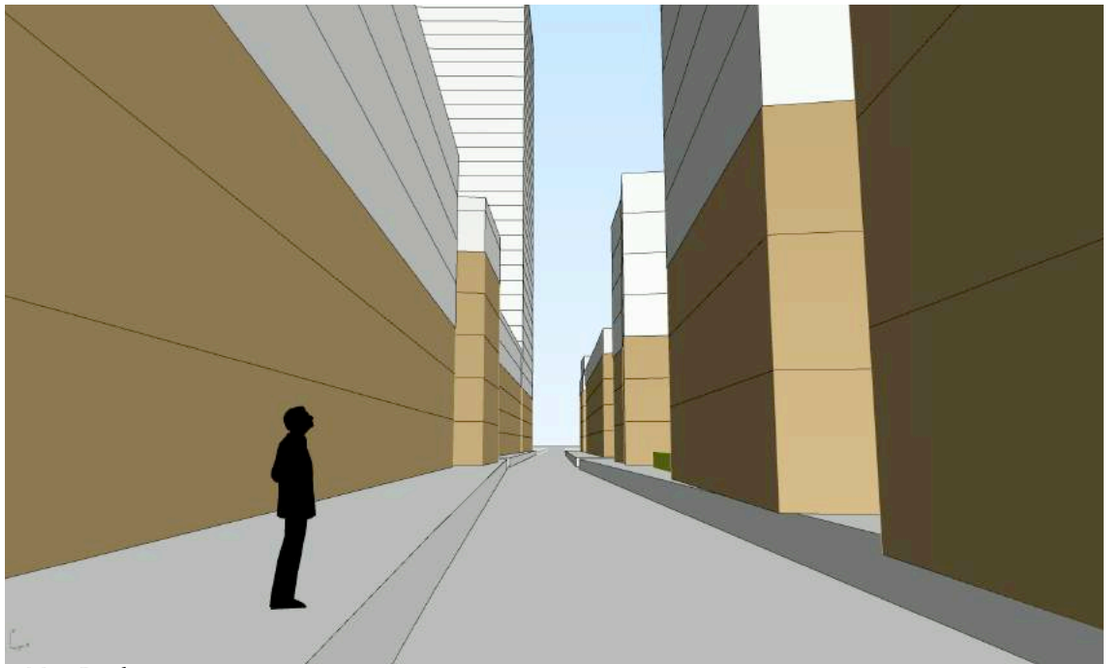
6. Make Parks

Masterplan



Plan

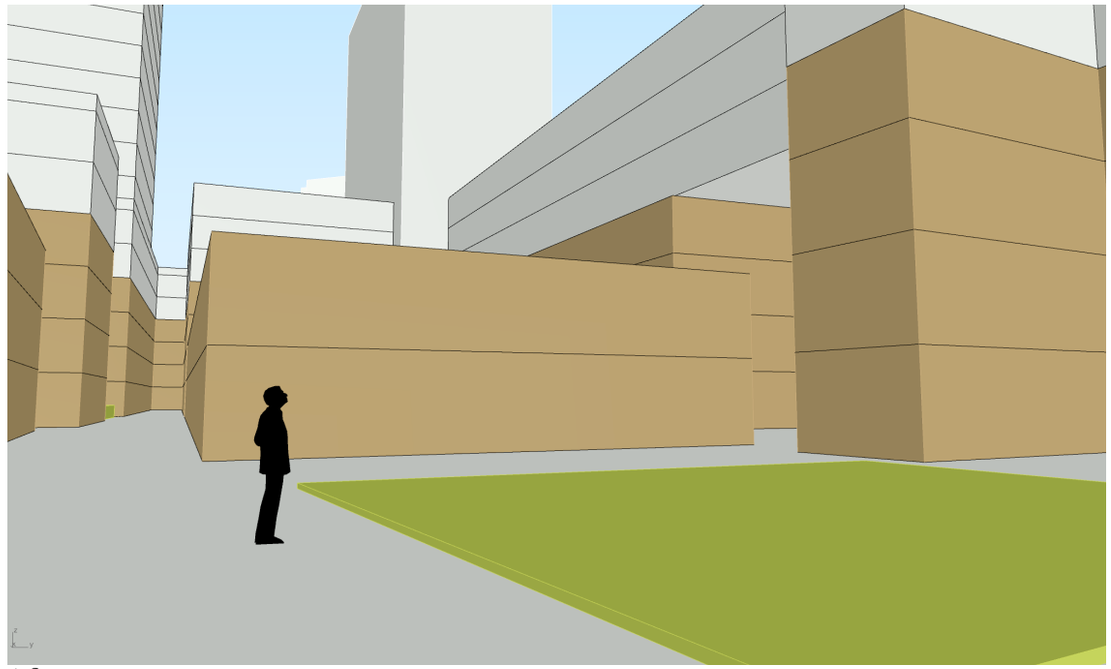
Eye View



1. Main Road

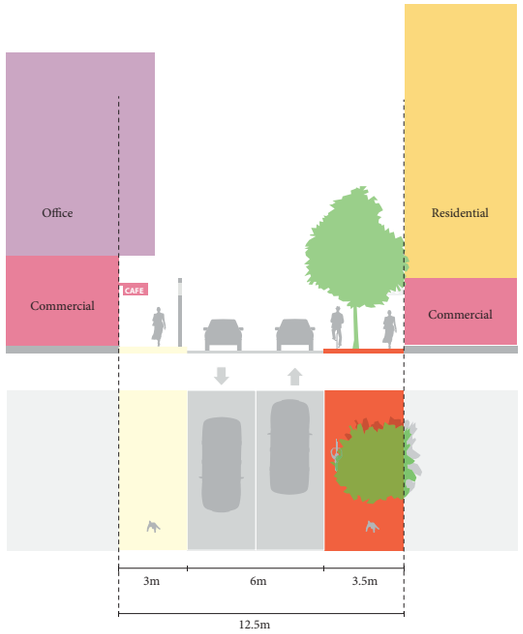
2. Inner lane 2

3. Inner Lane 1

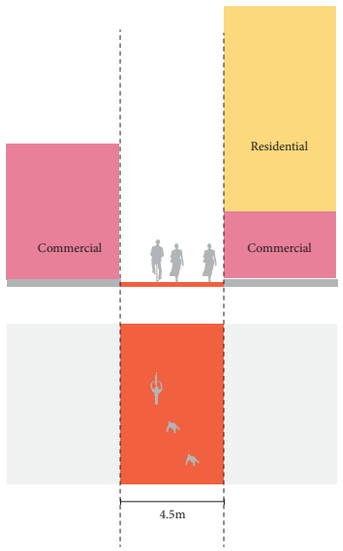


4. Square

Section

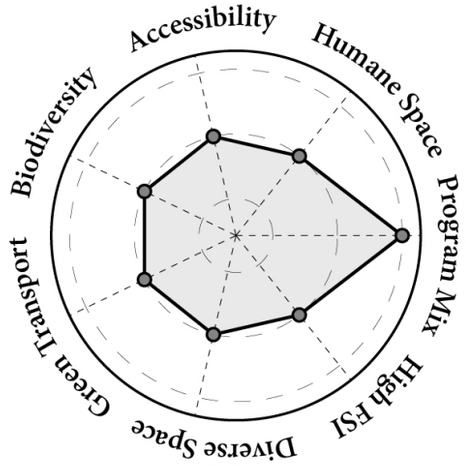


A-A Main Road



B-B Inner Lane

Assessment



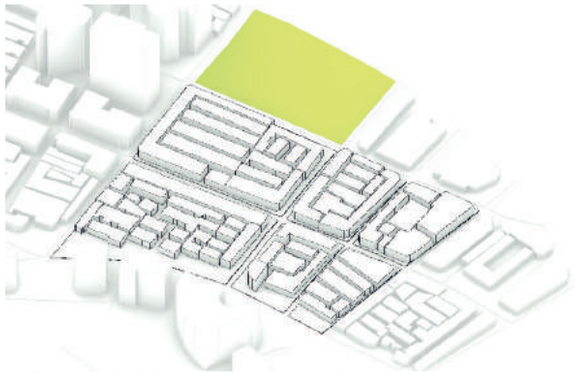
	Pros	Cons
People	- Preserve traditional urban pattern - Preserve most historical buildings	- Street too narrow - Relatively low accessibility inside blocks
Profit	- FSI: 4.9, High level of FSI	- High cost for old building maintainence - High cost of engineering for combining old and new buildings
Planet	-	-

Design Test

Option 2: Preserved Streetscape

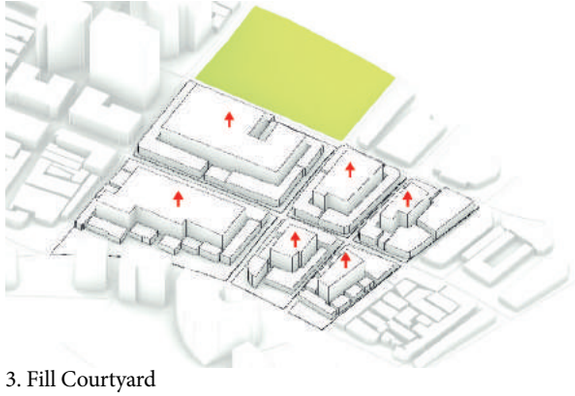
In this option, the main idea is to keep the buildings around the block so the traditional streetscape can be preserved. That is because those buildings are towards public streets, that is where most citizens walked. The traditional Lilong neighborhood is famous for its hierarchy of publicness in alleys. In this condition, the new buildings that are created inside the community echoed this idea. The inner lanes are designed in multiple levels from public-semi public-private.

Step Story

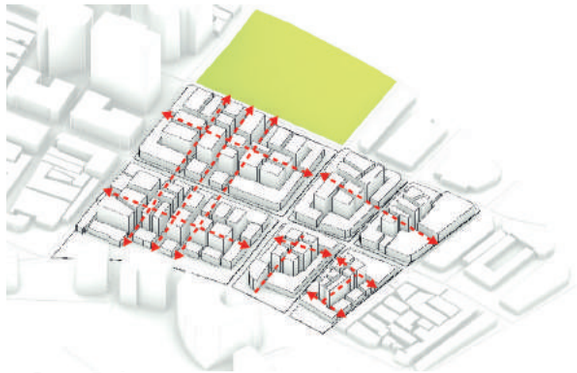


1. Original Buildings

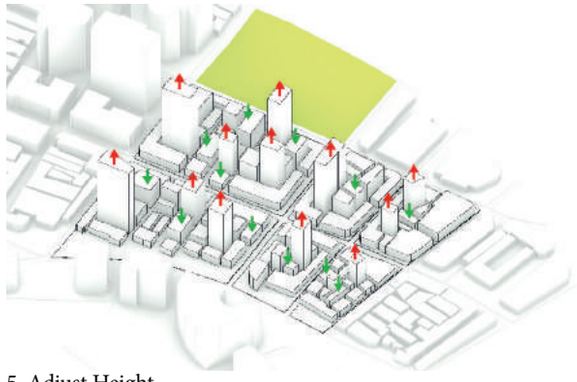
2. Preserve Streetscape



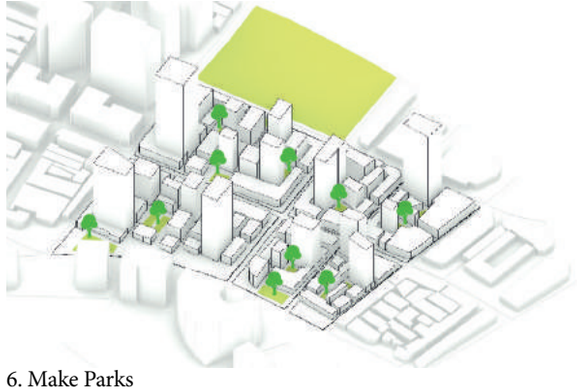
3. Fill Courtyard



4. Create Path

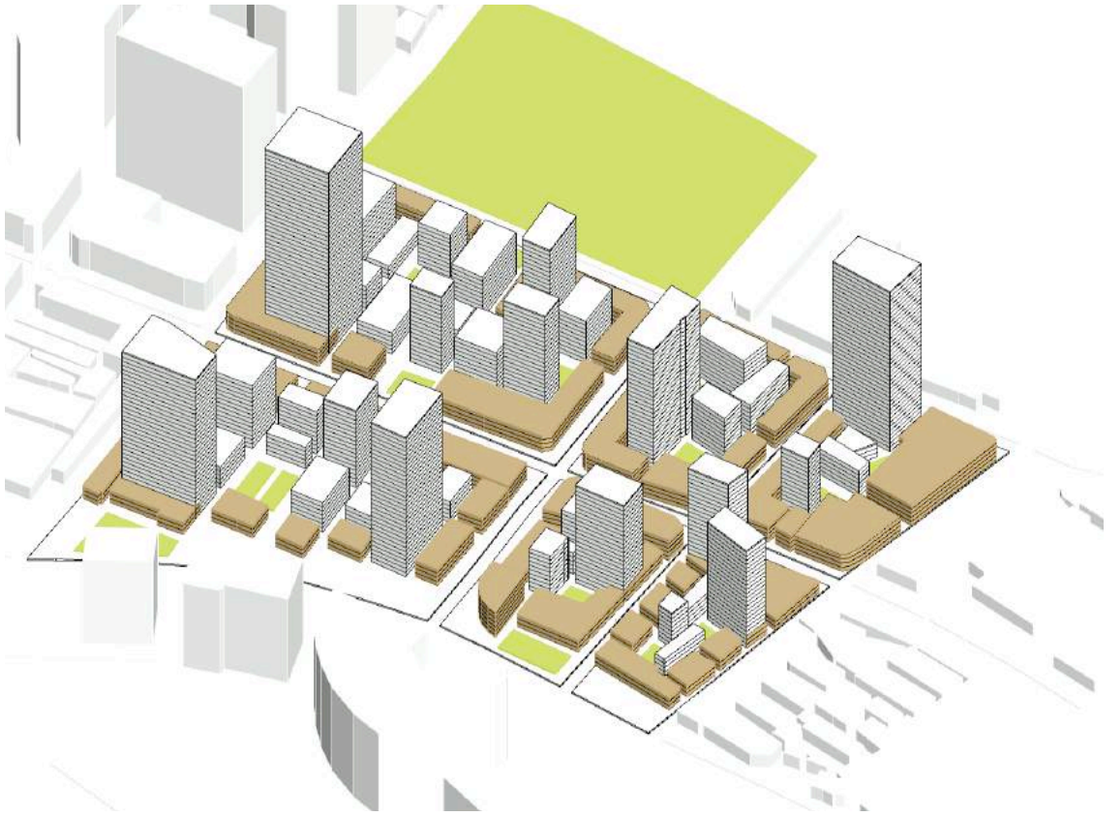


5. Adjust Height



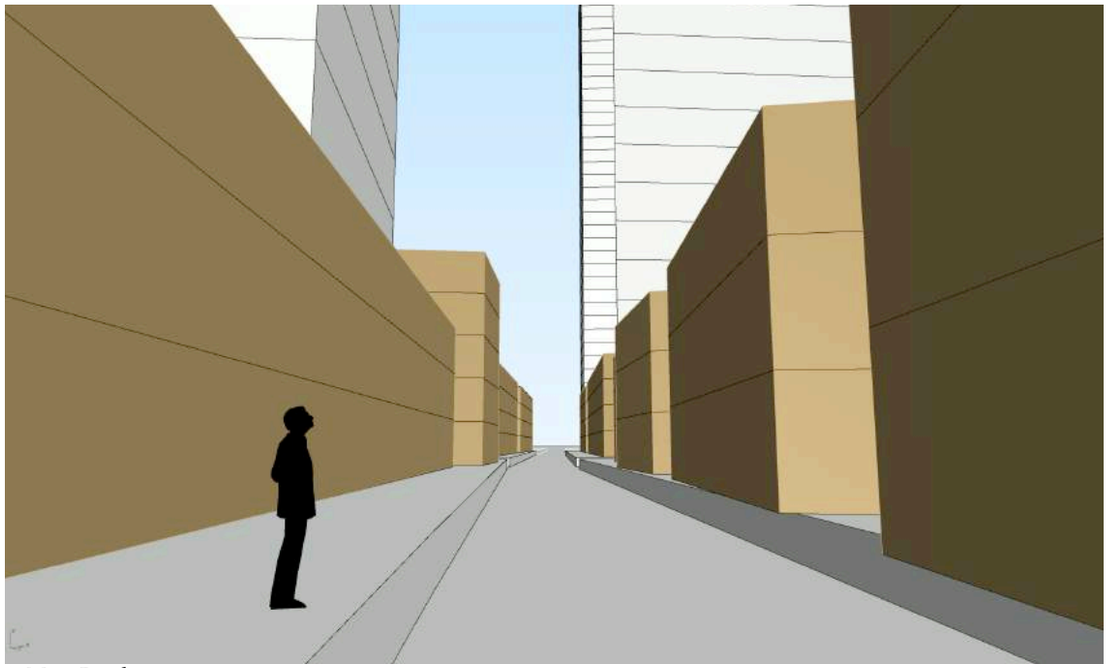
6. Make Parks

Masterplan

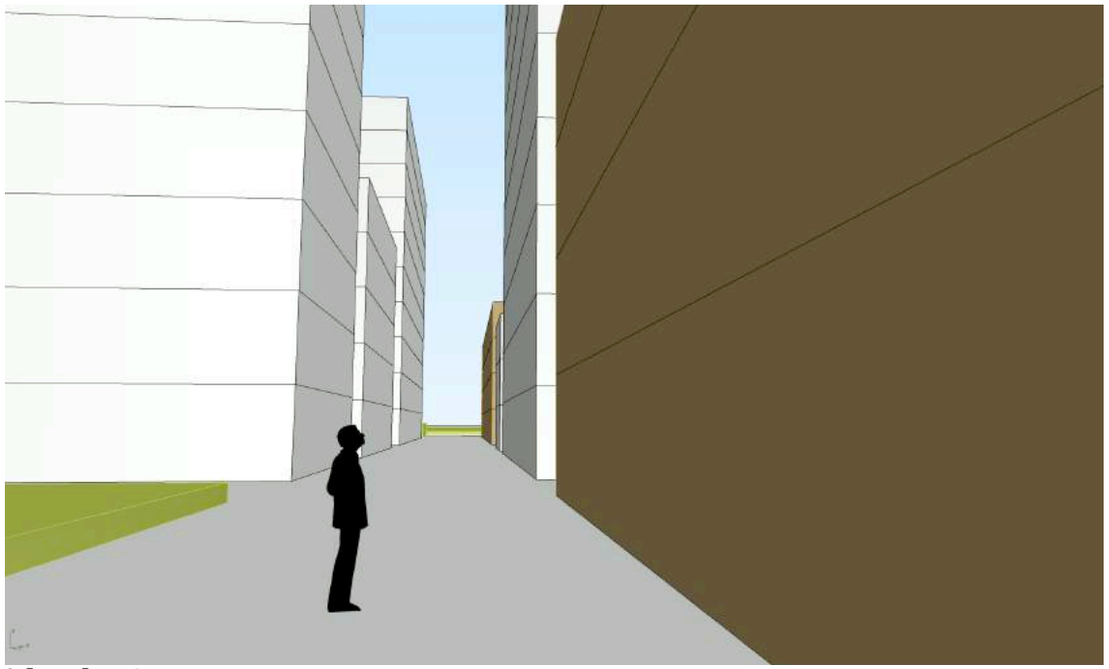


Plan

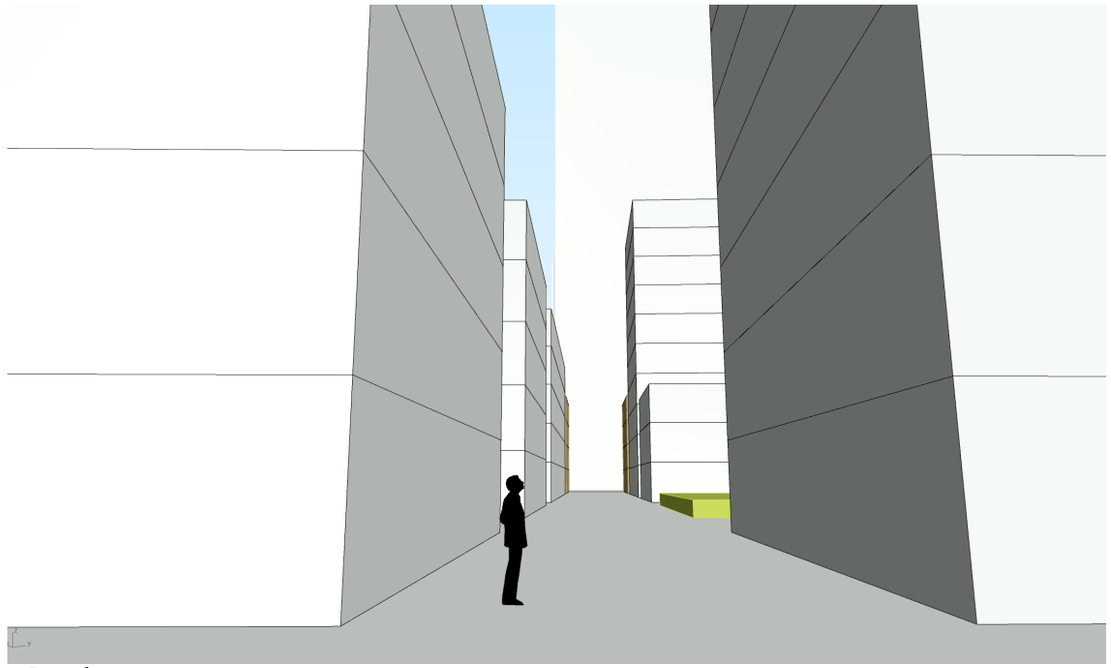
Eye View



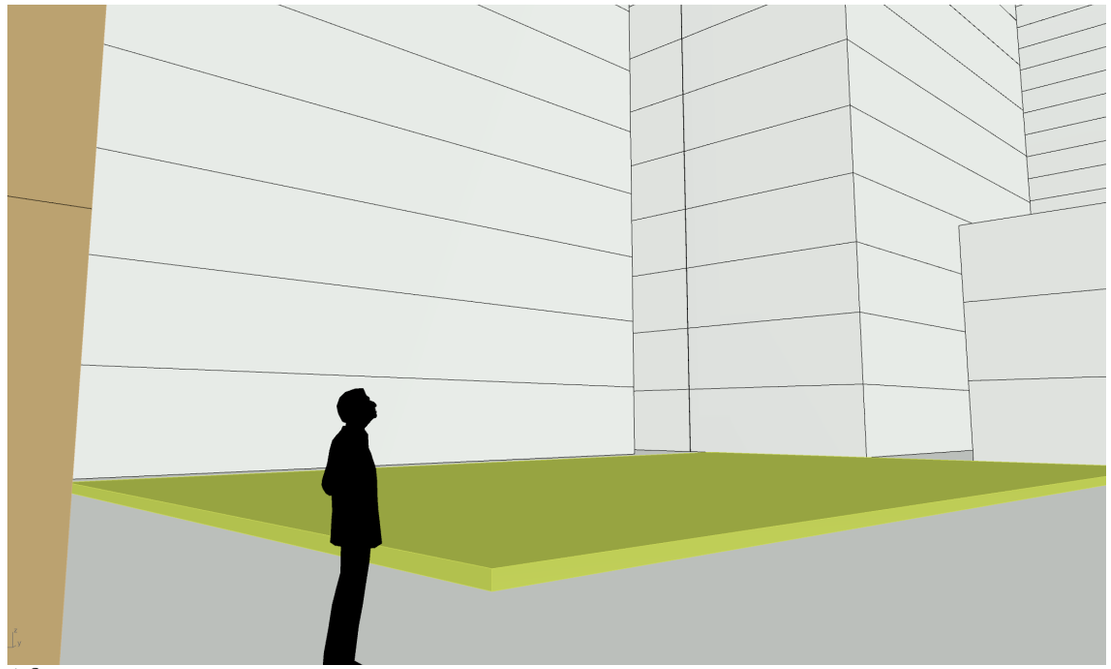
1. Main Road



3. Inner Lane 1



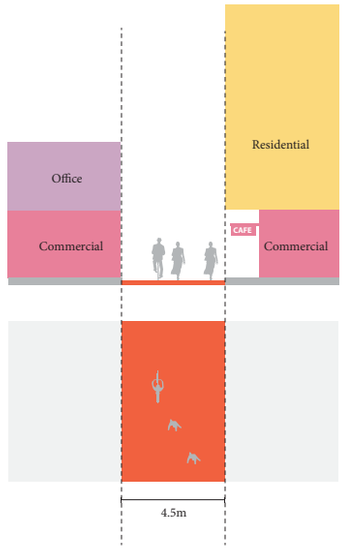
2. Inner lane 2



4. Square

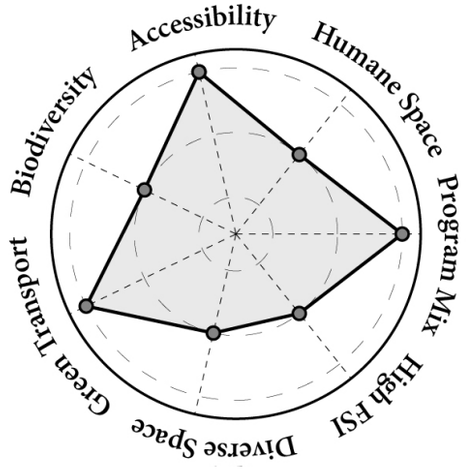
Section

A-A Main Road



B-B Inner Lane

Assessment

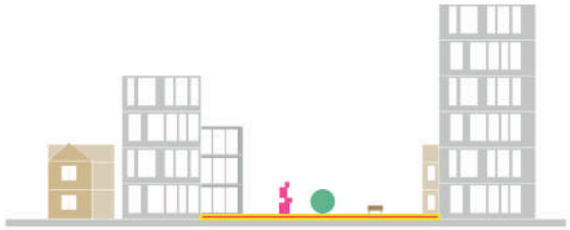


	Pros	Cons
People	- Preserve streetscape - Highly accessible inner neighbour-hood - Modern street with enough space	- Relatively poor accessibility of inner highrise
Profit	- FSI: 4.4, High level of FSI	- High cost for cutting old buildings
Planet	-	-

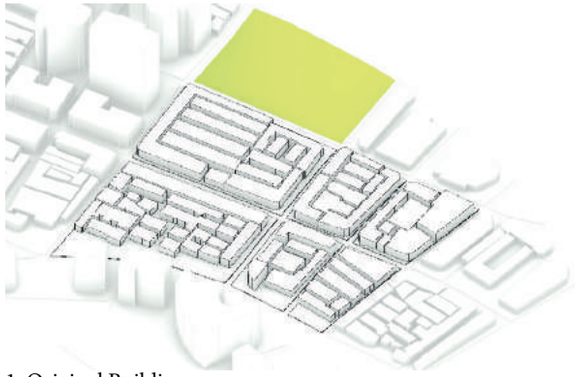
Design Test

Option 3: Collective Courtyard

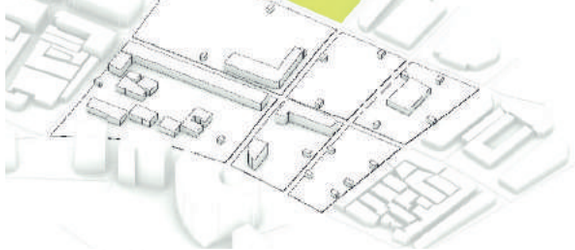
Lilong is also famous for its collective life. People put their tables and chairs in their nearby alleys, and the streetlife is vivid. In this option, multiple courtyards are created to celebrate the collective lifestyle. Each unique yard anchors the identity of that site. Historical valuable buildings are preserved to recall traditional memories. Highrise building with high FSI are weaved into the mixed pattern.



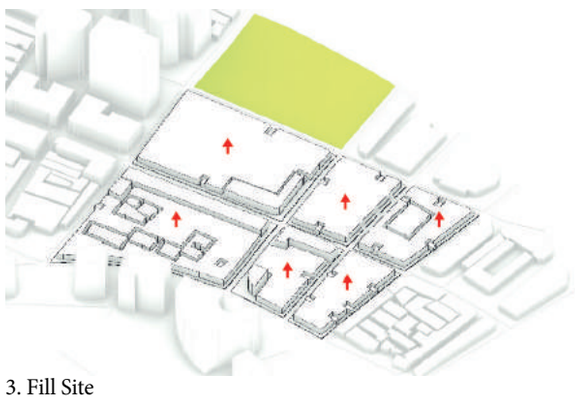
Step Story



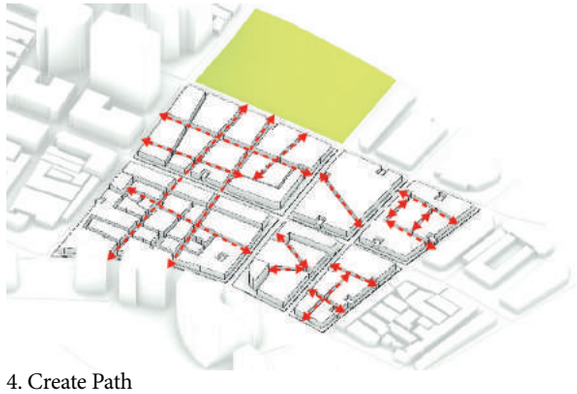
1. Original Buildings



2. Keep Valuable Buildings

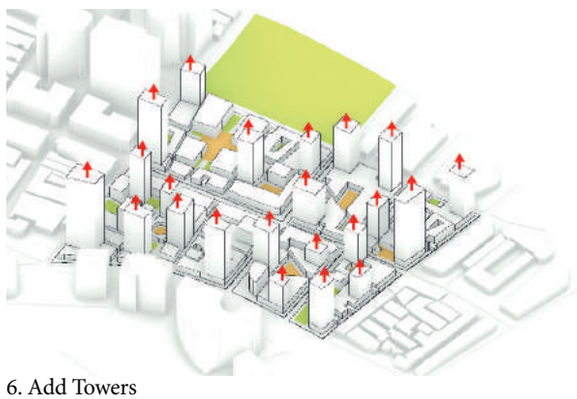


3. Fill Site



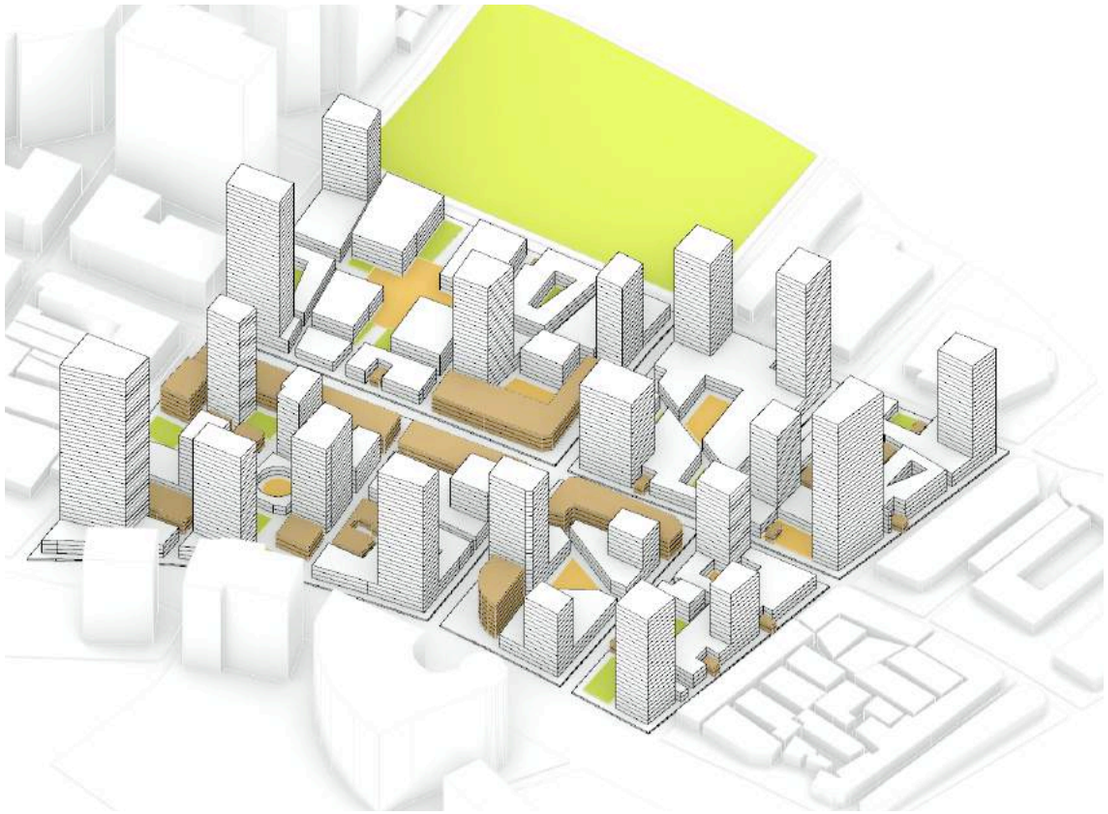
4. Create Path

5. Create Courtyards



6. Add Towers

Masterplan

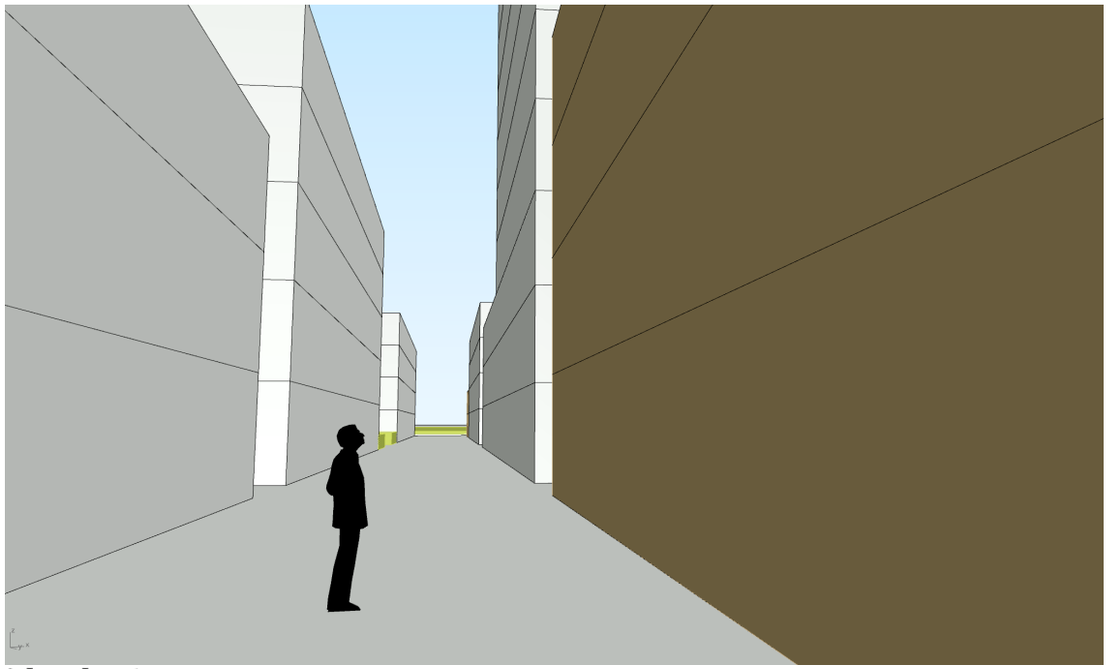


Plan

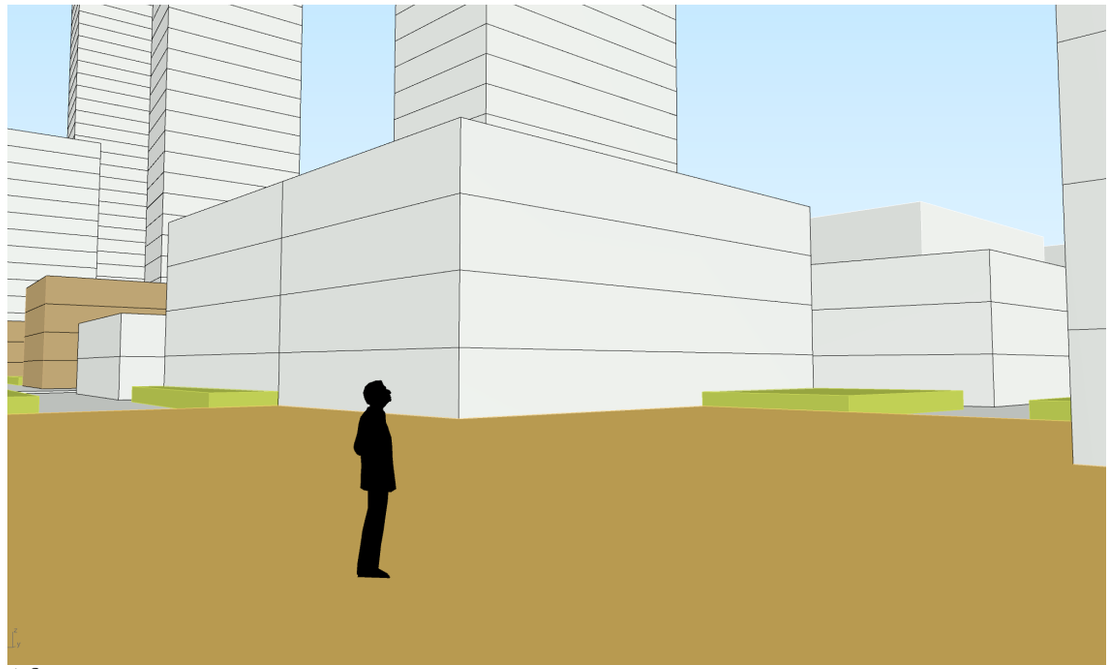
Eye View

1. Main Road

2. Inner lane 2

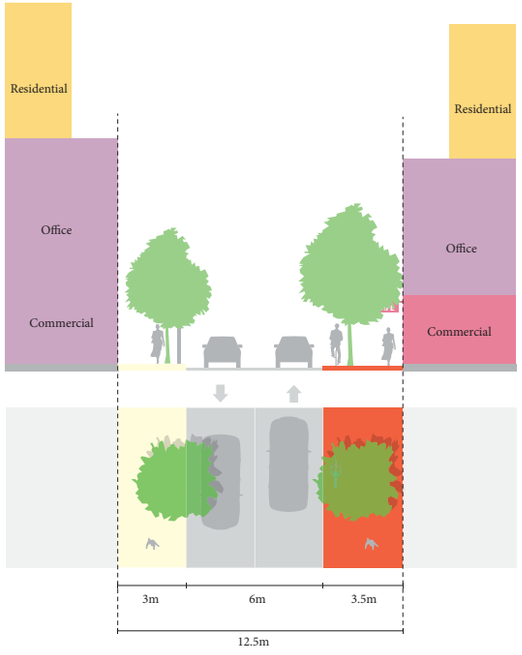


3. Inner Lane 1

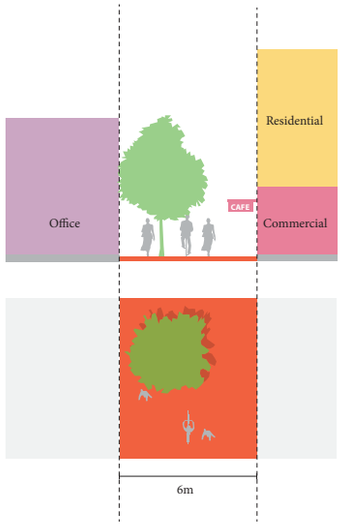


4. Square

Section

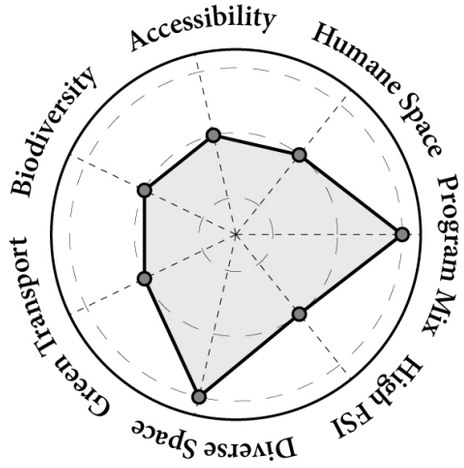


A-A Main Road



B-B Inner Lane

Assessment

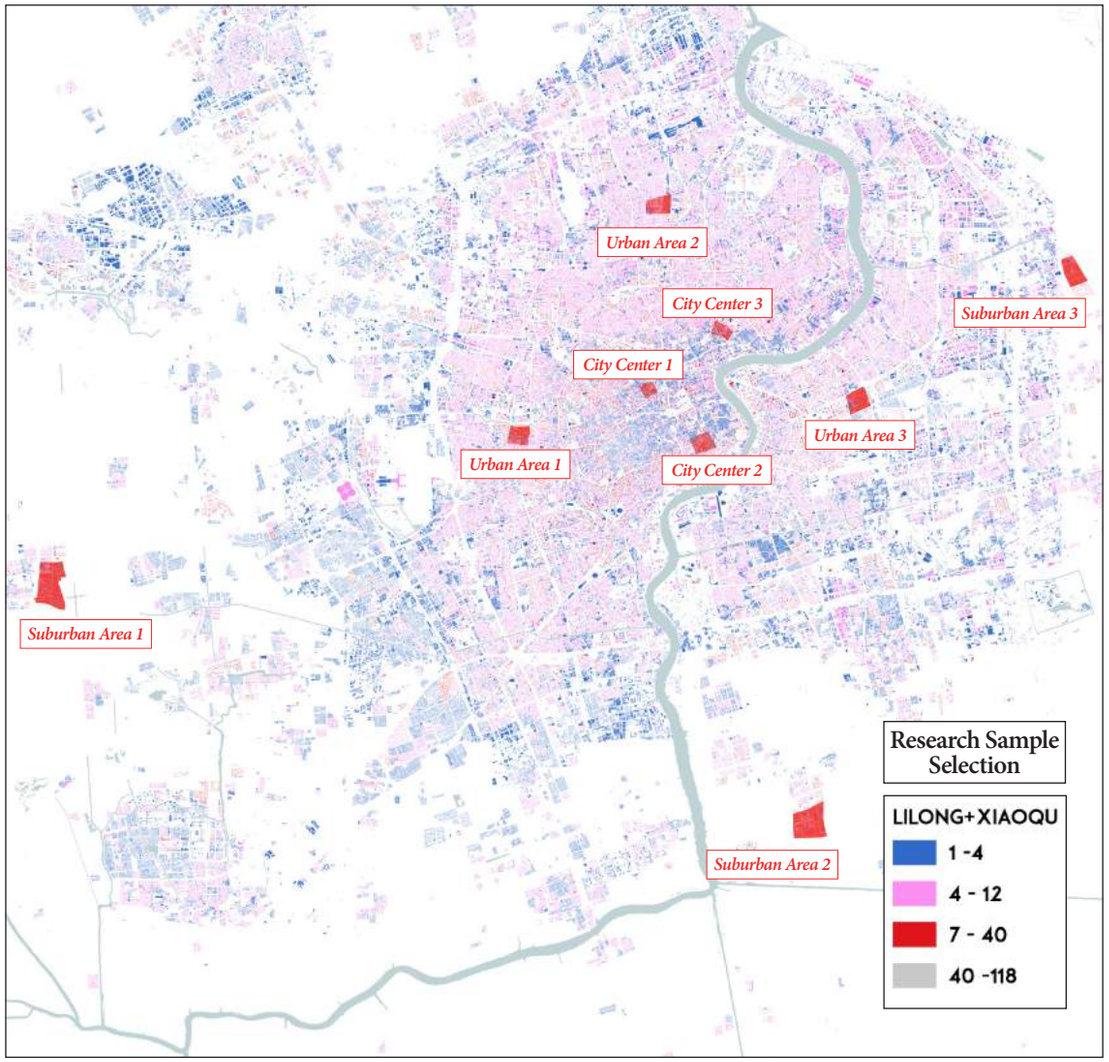


	Pros	Cons
People	- Preserve valuable buildings - Organic & identical urban pattern - Courtyard of collective culture - Modern street with enough space	- Acute angle buildings are not easy to use
Profit	-	- FSI: 4.1, Low level of FSI
Planet	-	-

Site Analysis

Zoom-in Research

Sample Fields Selection



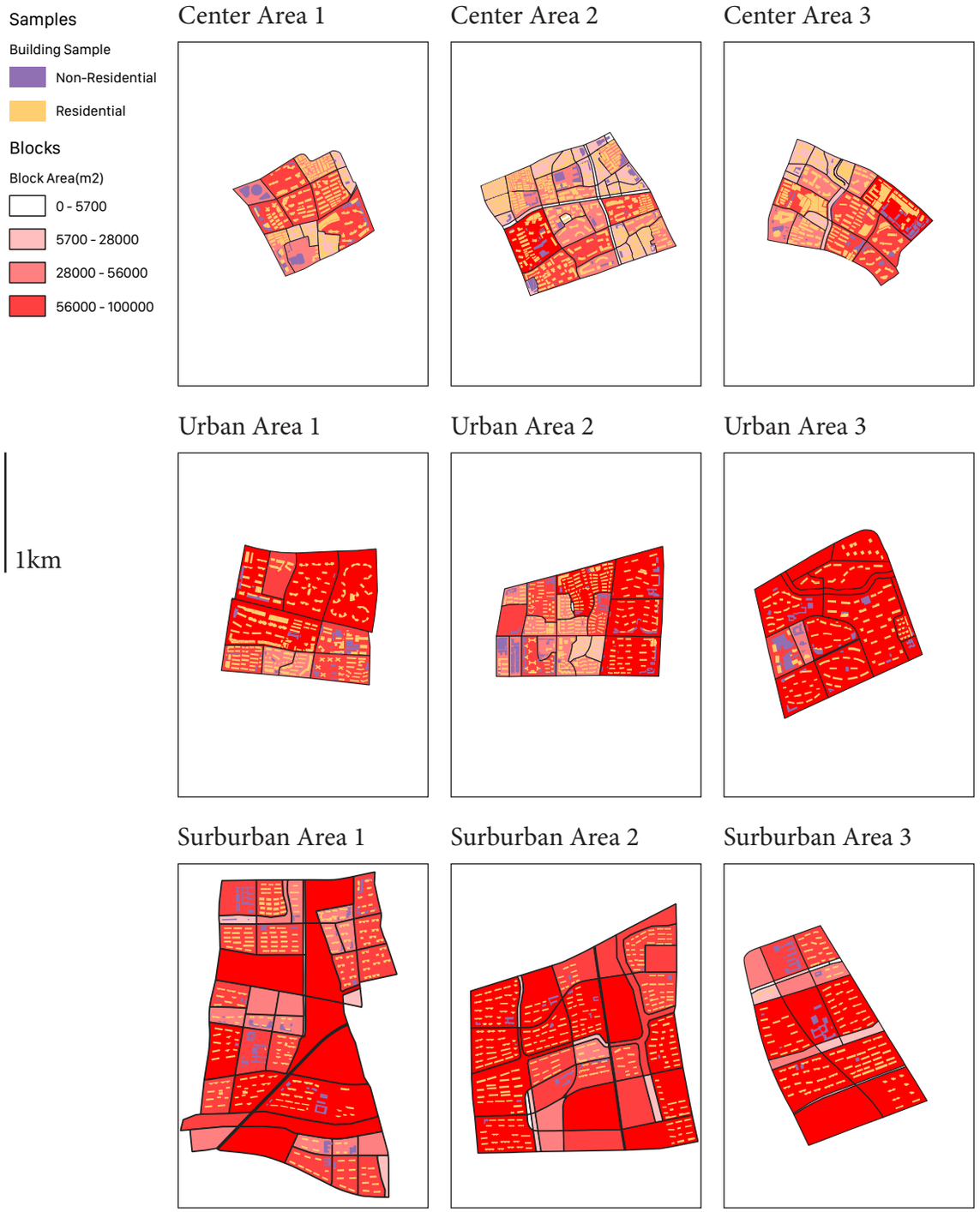
Through design tests in the chosen site, we could understand how we can improve qualities for people, for profit, and for the planet for former Lilong.

To gain a more comprehensive research in Shanghai, we can choose some sample fileds within the whole metropolitan area. In this case, the author picked up nine areas in three kinds of locations: three fields in city center, three in normal urban areas, and three in suburban areas for further research.

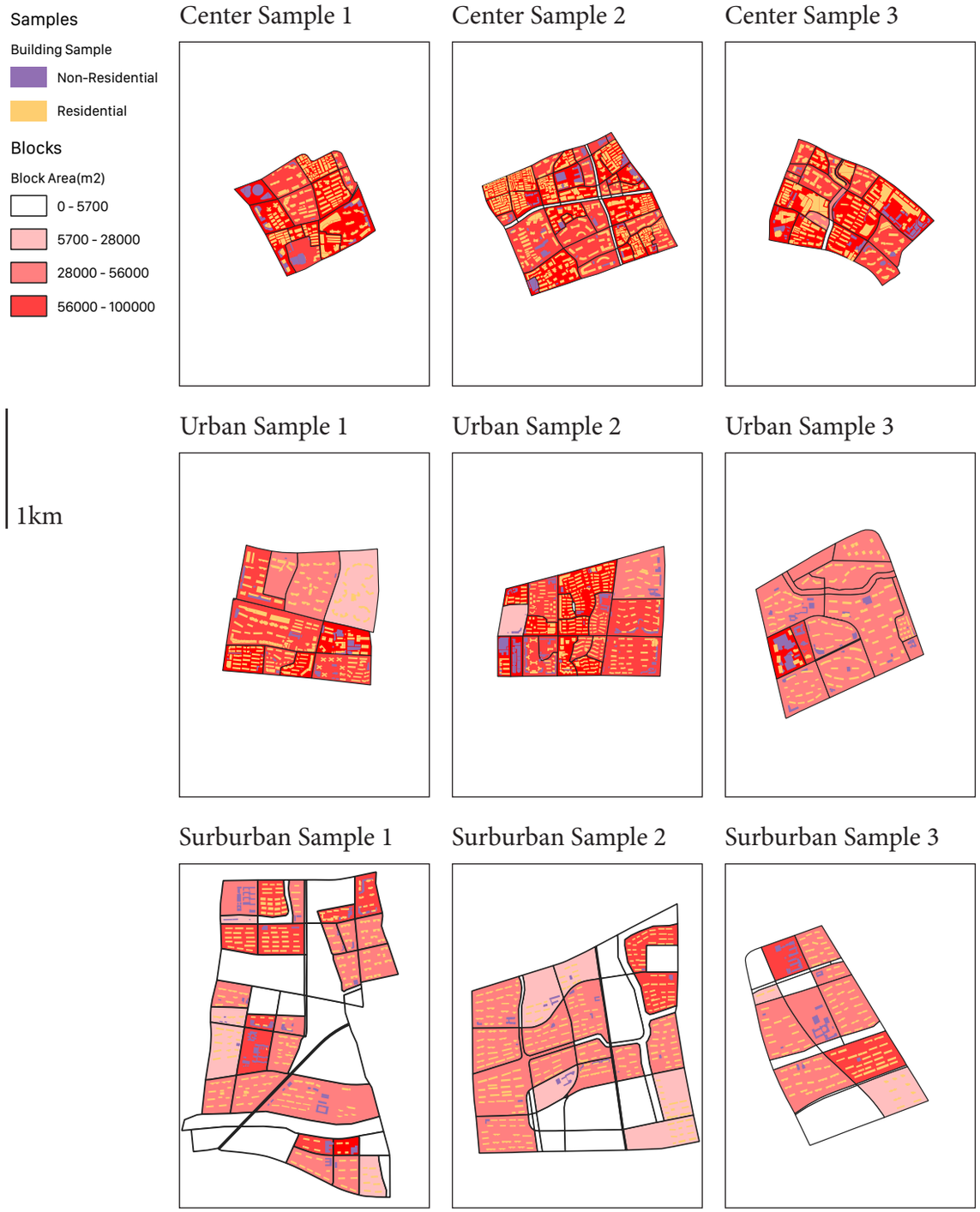
Mix Index Analysis

For those nice sites, the author first collect their GIS data and then draw the mapping according to its density index and program. From those maps, we can comprehend the spatial character of urban blocks in those sample areas.

Block Area Analysis



GSI Analysis



FSI Analysis

Samples

Building Sample

Non-Residential

Residential

Blocks

FSI

0

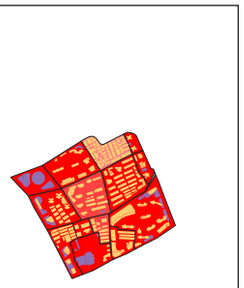
0.62 - 1.70

1.70 - 2.30

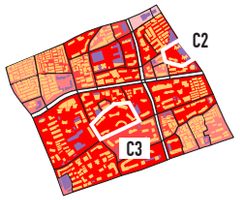
2.30 - 6.10

1km

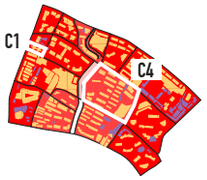
Center Area 1



Center Area 2

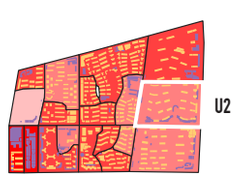


Center Area 3



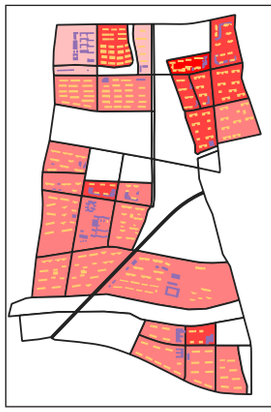
Urban Area 1

Urban Area 2

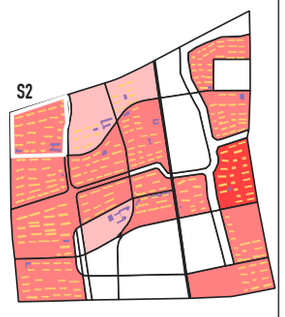


Urban Area 3

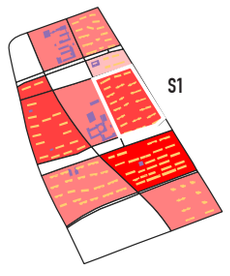
Surburban Area 1



Surburban Area 2



Surburban Area 3



Observation

From the above analysis on multiple areas in different locations in Shanghai, we can gain an understanding of the spatial character in residential communities. For example, blocks in urban areas show more mix-use program than city center and suburban areas. Besides, the suburban blocks have larger blocks than other areas in terms of block area. What's more, blocks in the urban area share a high level of FSI with city center blocks since it mainly consists of high towers instead of low rise lilong in the city center.

According to the above research of spatial properties. We can divide the types of various blocks inside the chosen sample, and they can be regarded as a block typology study of Shanghai's residential neighborhoods.

The type are as below:

City Center
- C1: Small Mix Open Block
- C2: Small Single (function) Open Block
- C3: Small Single Gated Block
- C4: Large Mix Open Block

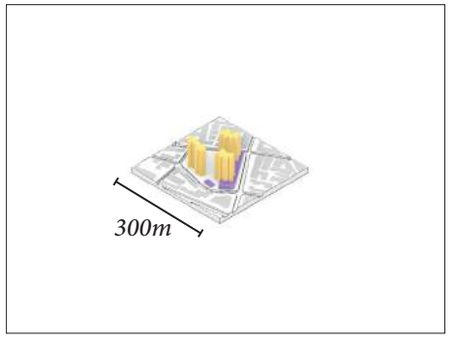
Urban Area
- U1: Large Singe Gated Block
- U2: Large Mix Gated Block.

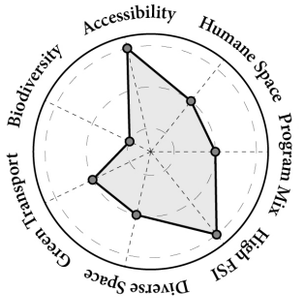
Suburban Area
- S1: Large Singe Gated Block
- S2: Large Mix Gated Block.

Block Typology: City Center

C1: Center Sample 1
Small Mix Open

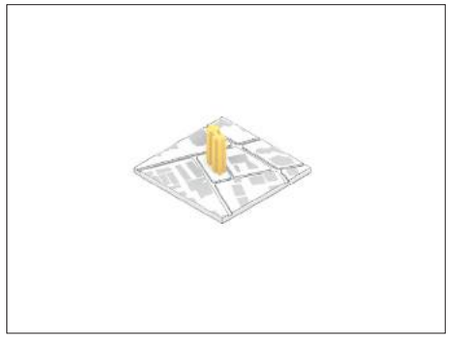
Area: 20,200 m2
FSI: 4.7

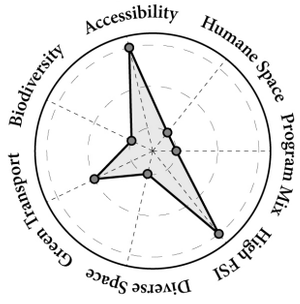




This kind of block is the ideal type in city center according to previous discussion, the program are mixed and accessibility is high. It does not need to be updated.

C2: Center Sample 2
Small Single Open

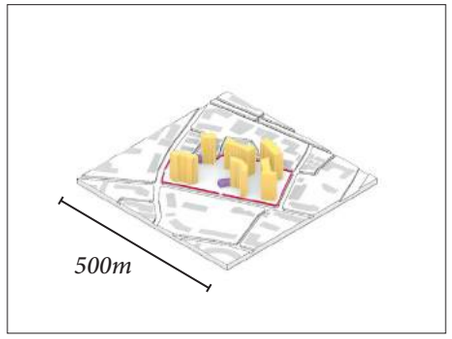


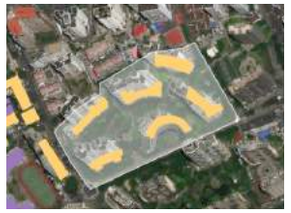


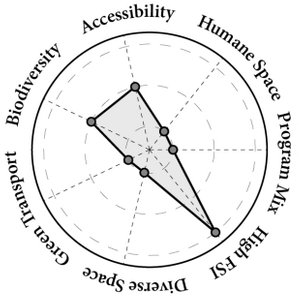
This type is rarely seen in cities, it is normally one or two highrise residential tower. It occupies little land and does not affect other urban activities.

C3: Center Sample 3
Small Single Gated

Area: 43,000 m2
FSI: 4.1



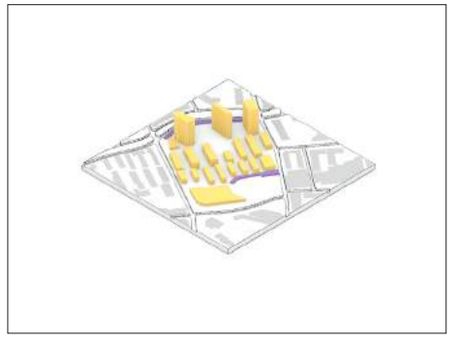


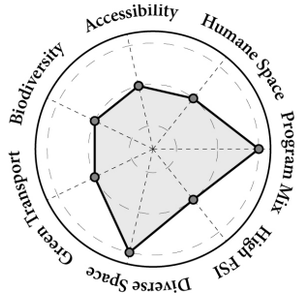


For this type, we can first remove the fence to open the block, then mix function inside.

C4: Center Sample4
Large Mix Open

Area: 88,000 m2
FSI: 2.2





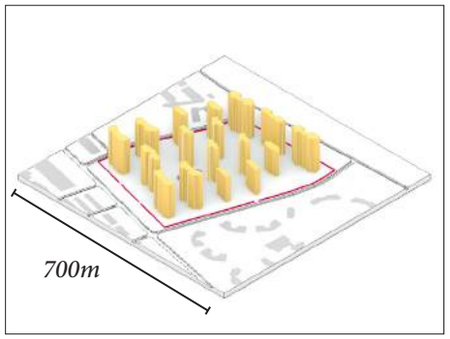
Since the block is already mixed and inclusive to citizens, we can create new roads to make the block smaller and more accessible.

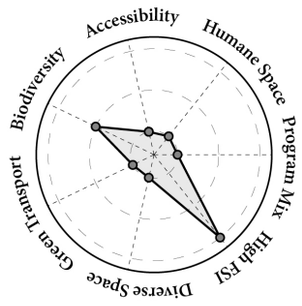
Block Typology: Urban Area

U1: Urban Sample 1

Large Single Gated

Area: 176,000 m2
FSI: 3.0



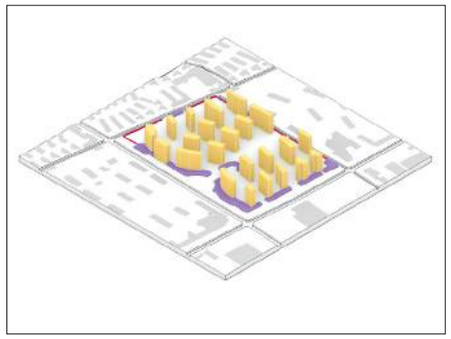


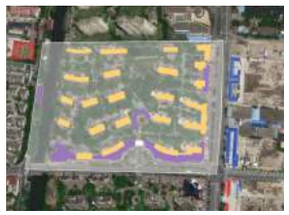
This type of residential Xiaoqu is maybe the most problematic block in the cities. It make the city separated and it is low efficient for commuting. We can update the block step by step: make it mix(like U2), then make it open, and probably make the block smaller.

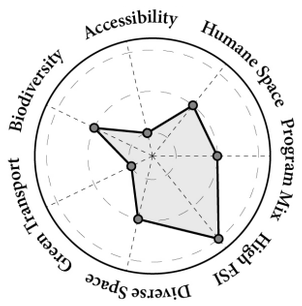
U2: Urban Sample 2

Large Mix Gated

Area: 146,000 m2
FSI: 1.8







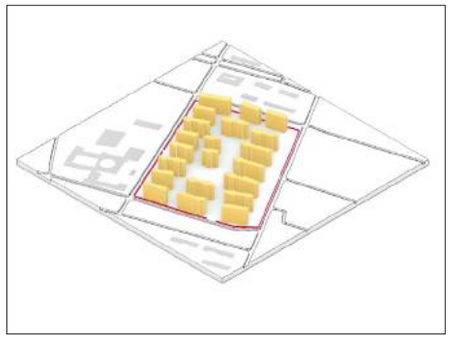
This block is closed and has mix function in its boundary area. Thus we can remove the fence to make it open, and maybe introduce new roads to make the block smaller.

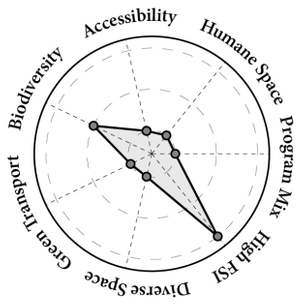
Block Typology: Suburban Area

S1: Suburban Sample 1

Large Single Gated

Area: 140,000 m2
FSI: 1.9



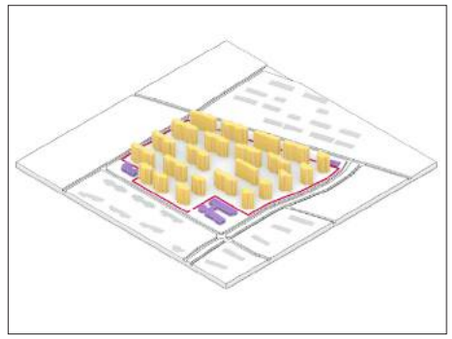


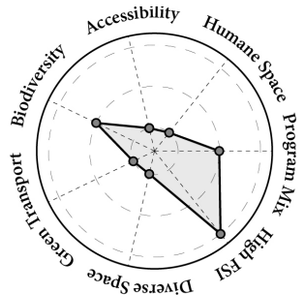
This Xiaoqu is suburban area is commanly seen, unlike high population density in urban area. The only downsides of this typology is exclusiveness for pedestrains, we can introduce more entrance to reduce detour for pedestrain.

S2: Suburban Sample 2

Large Mix Gated

Area: 144,000 m2
FSI: 1.8

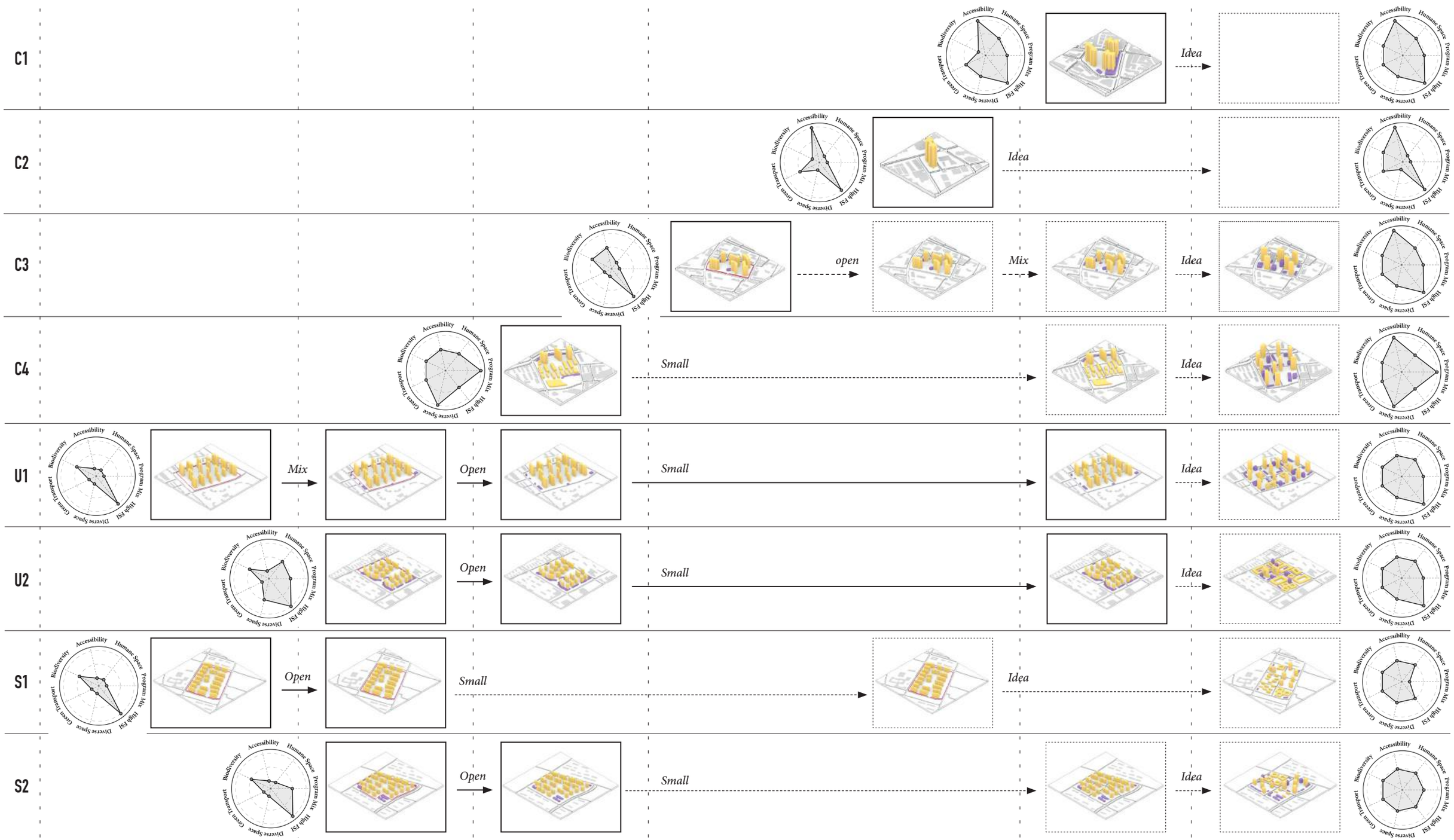




S2 type is similar with S1 type, we could make the block more inclusive and accessible for pedestrain.

Update Strategies to Different Blocks

For those eight types of urban block, the author concluded the evolving path for each to be updated as a “better” urban block according to their spatial character and update feasibility.



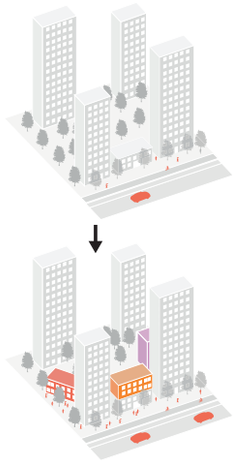
Design Actions to Strategies

After the strategic level of urban renewal, the author introduced many design actions at a smaller level as the toolbox for future design. Speaking of actions, he first explained how each action contributes to visions such as Open block or sustainability. Besides, he concluded the advantages and disadvantages of them. In addition, since the most disadvantages are related to money consumption, he suggested possible money sources for those design actions.

Actions	Type	Pros	Cons	Money Source
Remove some walls, updates some walls to plants	Open	more accessible and walkable	reduce safety	
Add smart monitor & monitoring room	Open	Improve safety	cost money	Government Tech Company
timing management: open at daytime, close at night	Open	make urban space more open and increase efficiency	a bit operation cost	Property company/Reseidents
Create Car Road	Small Sustainability	increase accessibility and walkability, create potential for profitable program	cost more money to build roads, increase management cost for government，斑马线?	Government +Profit
create bike/pedestrian path	Small Sustainability	increase accessibility, encourage green transporation	cost money, sacrifice a bit FSI	Government +Profit
new building with non-residetial function (complex funtion/flexible funtion)	Mix FSI	provide convenience for people, encourage local business	risk of more human flow?	+Profit
stack program: mix ground floor in existing building	Mix FSI	increase FSI and provide convenience	noise	+Profit
temporary function box	Mix Sustainability	satisfy temporary demands for people	-	+Profit
Move program to border	Open Mix	make urban space more open and increase efficiency	-	
diverse building form	Sustainability FSI Open	avoid faceless neighbourhood	reduce FSI and economic profit	Real Estate Developer
e bike charging hub/solar panel	Sustainability	green transportation	cost	Tech Company
densified block	FSI	Improve land use efficiency	less land for green	+Profit
biodiversity park	Sustainability	sustainable for planet	building and maintenance cost	Real Estate Developer Government
vertical green	Sustainability	reduce heat island and benefit for people's mental health	maintainance cost	Real Estate Developer Property company/Reseidents

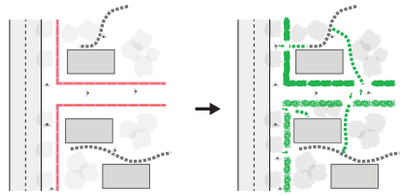
Design Action Diagrams

Densify Block

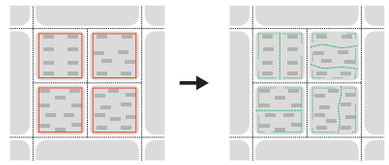


Bio Garden

Update Fence

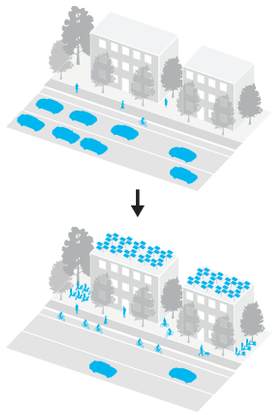


Create Public Walk/Bike Path

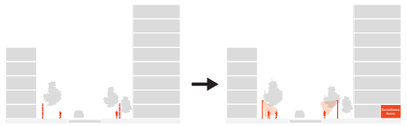


Vertical Green

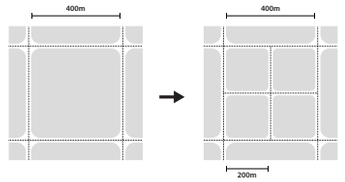
E-bike Hub & Solar Panel



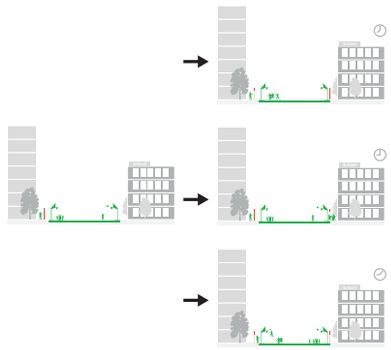
Monitor System



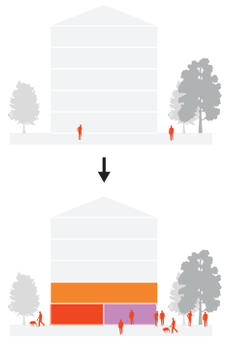
Create Car Roads



Flexible Time Place

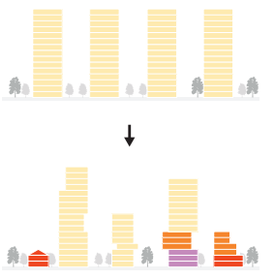


Add Program In Old Building

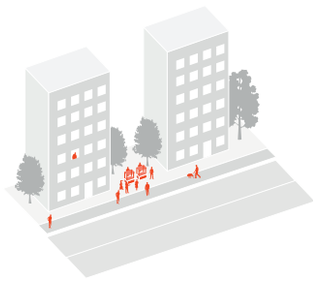


New Function Building

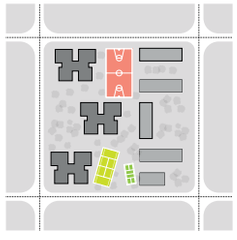
Diverse Building Form



Temporary Funtion Box



Place Public Funtion at Border



Progam Analysis: 3 Sample Site

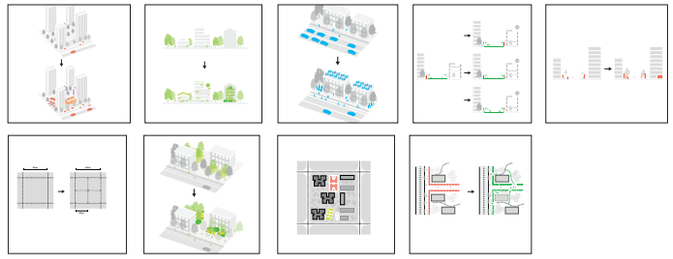
For specific block analysis, this project selects three urban blocks out of eight types of sample area. In the three blocks, the author shows the distribution of programs within the blocks and within a 1-kilometer circle around them. From which we can compare how the programs are mixed in those sites. Then, he introduced corresponding design actions to each site.

C4: Large Mix Open (City Center)

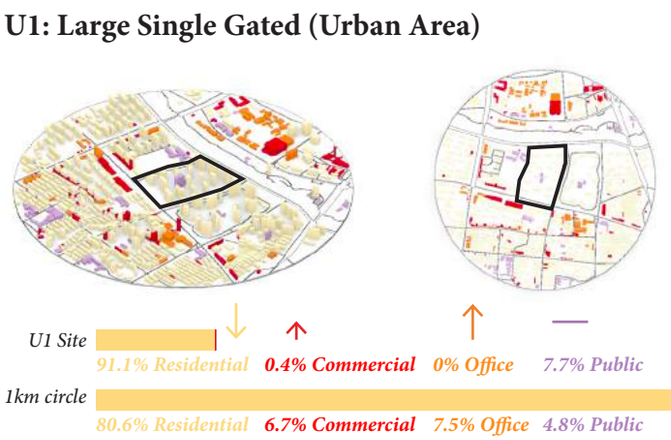
C4 Site
69.3% Residential ***9.7% Commercial*** *2.5% Office* *20.5% Public*

1km circle
61.7% Residential ***19.3% Commercial*** *15.4% Office* *8.5% Public*

Main Strategy: Small, Densify, Sustainble

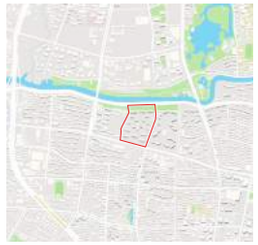


U1: Large Single Gated (Urban Area)

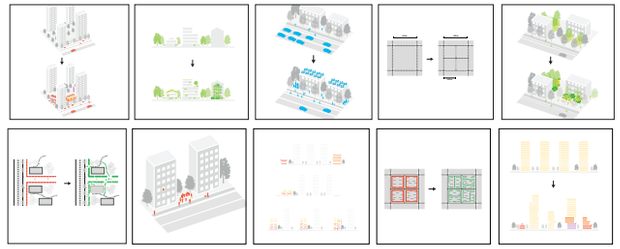


U1 Site
91.1% Residential ***0.4% Commercial*** *0% Office* *7.7% Public*

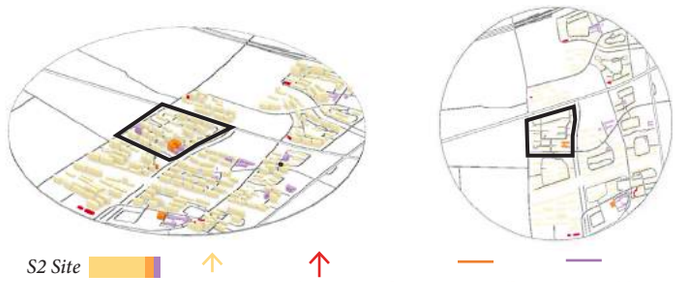
1km circle
80.6% Residential ***6.7% Commercial*** *7.5% Office* *4.8% Public*



Main Strategy: Small, Densify, Sustainble

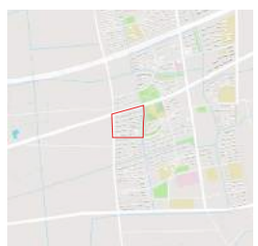


S2: Large Mix Gated (Surburban Area)

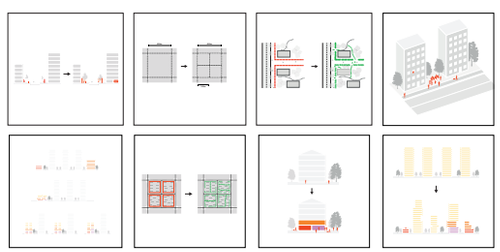


S2 Site
78.1% Residential ***0% Commercial*** *13.6% Office* *8.3% Public*

1km circle
91.7% Residential ***1.0% Commercial*** *2.6% Office* *4.7% Public*



Main Strategy: Small, Densify, Sustainble



Design Test: 3 Sample Site

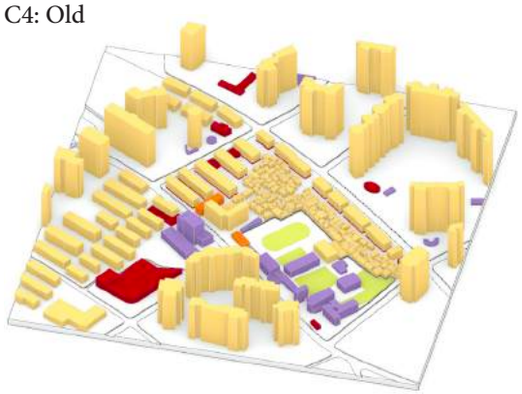
With the above analysis and design actions, the author did the design test for those three sites.

For the C4 site, the original block is filled with various building typology, including a large piece of dilapidated Lilong neighborhood. The new design turned down Lilong and introduced an office campus with an extra program like commercial and public service. Besides, other actions like vertical green and new car roads are integrated into the area. In this way, the C4 site is improved in many aspects.

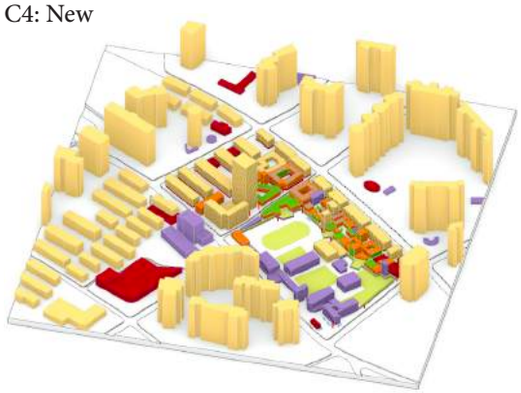
For U1, the original block is faceless in terms of form and it is isolated with other blocks for its fence. The newly updated blocks have various building forms and it become more inclusive and accessible by removing the fence and creating new roads. Other sustainable actions like bio garden and bicycle path are also introduced.

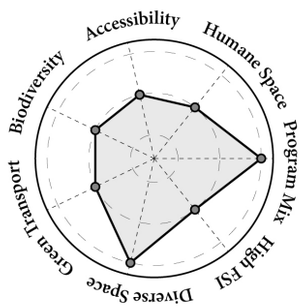
Speaking of S2 Site, part of the buildings are updated to different form typology, the block are divided and fences are removed.

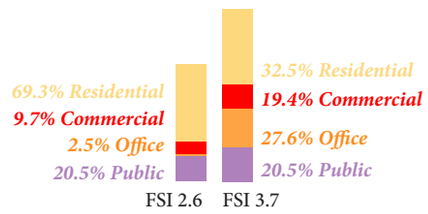
C4: Old

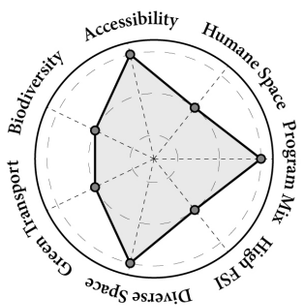


C4: New









For People

More Quality Green
Shared Facilities

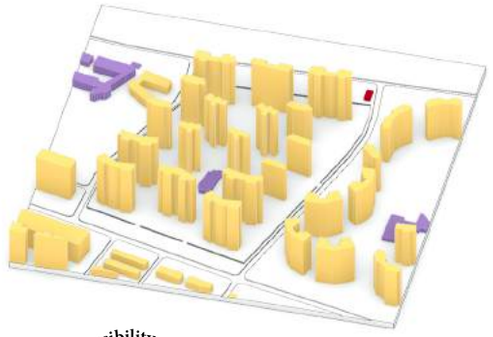
For Profit

More Commercial Program
More efficient circulation
Tax income from more offices

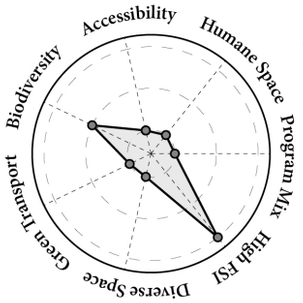
For Planet

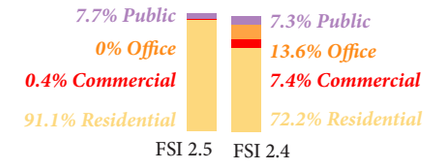
Less pollution with green transportation
Biodiversity Encouragement
Green energy

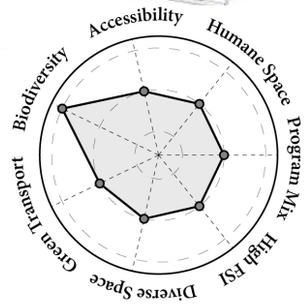
U1: Old



U1: New







For People

Diversed Living Neighbouhood
Accessible Open Block

For Profit

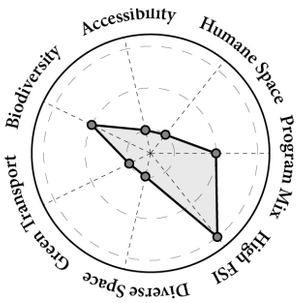
More efficient Circulation
Tax from Commercial/Office
Sacrifice a bit housing FSI

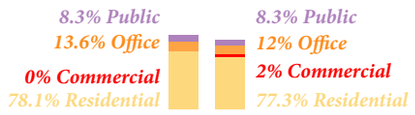
For Planet

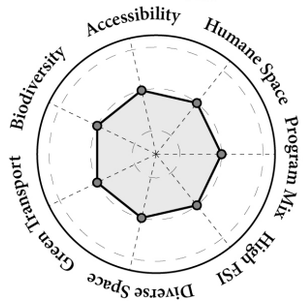
Green Energy
Biodiversity
Green Transport

S2: Old

S2: New







For People

Diversed Living Neighbouhood
Accessible Open Block
Enclosed humane public space

For Profit

More efficient Circulation
A bit more profitable program

For Planet

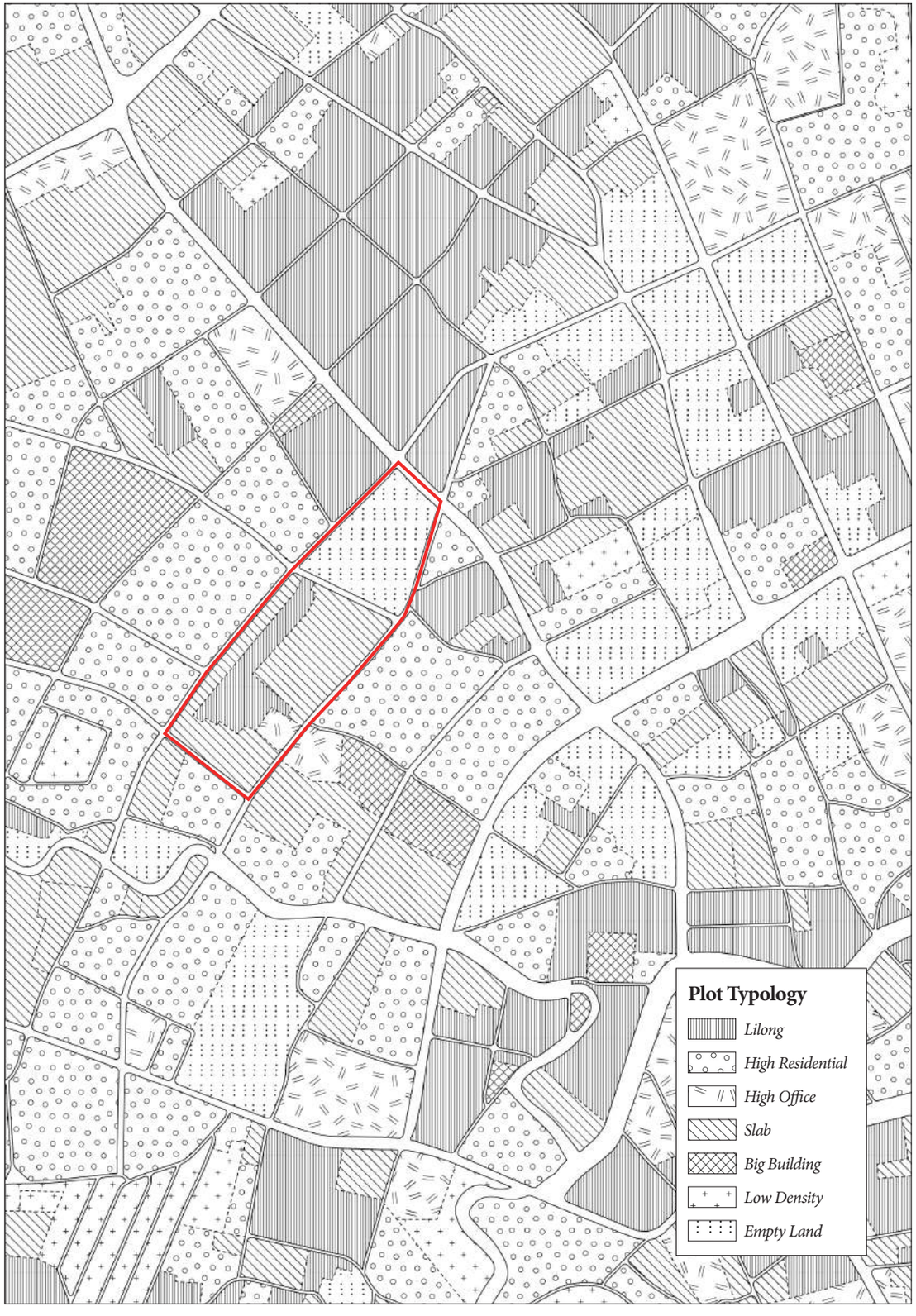
Less pollution with less car use

3rd Design Test

"Design by Research."

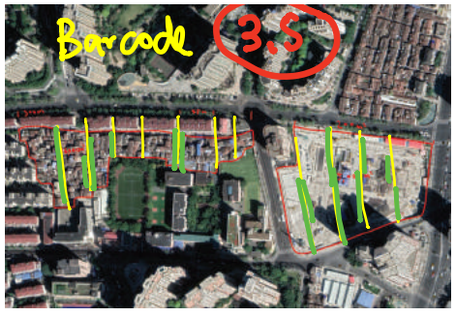
Besides focusing on three sites. C4 site are picked up for further detail design for its complexity and high density. There are different kinds of urban fabrics within the C4 site, including Lilong, slab buildings, high-rise office, and a piece of empty land.

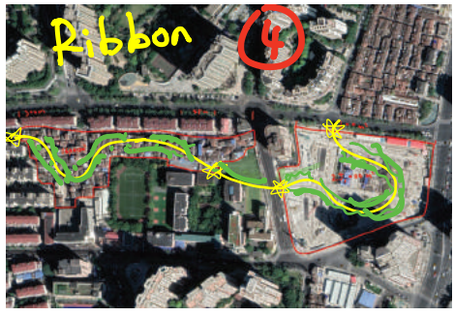
Urban Fabrics of C4

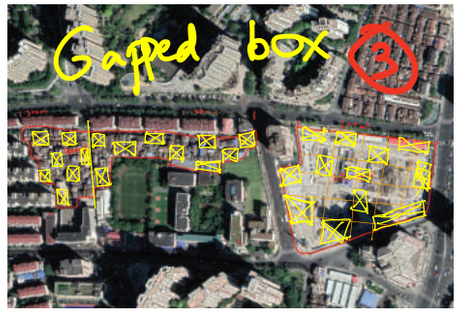


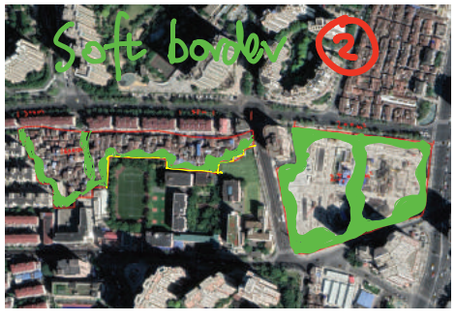
Brainstorming Ideas

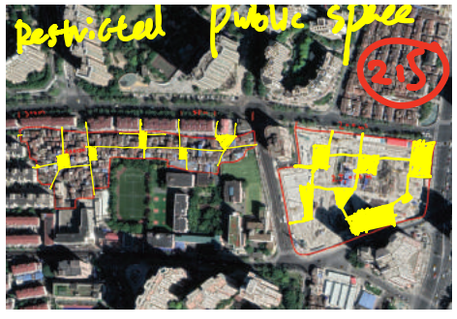
For Urban design, the author first draws multiple ideas through brainstorming; within those ideas, we can select a few of them for detailed design options.

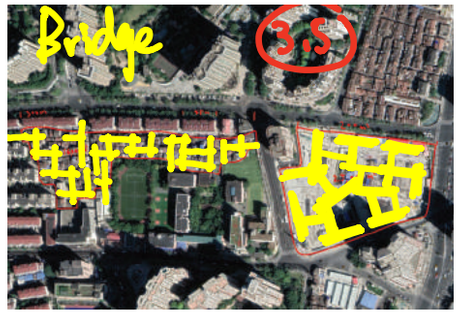


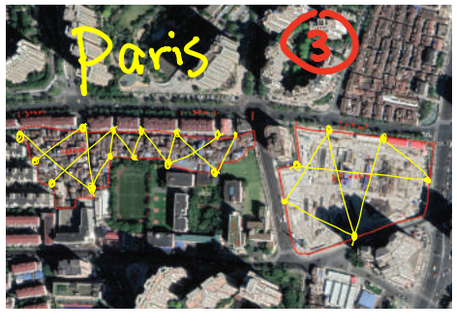


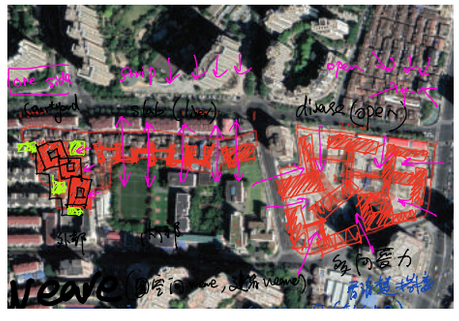










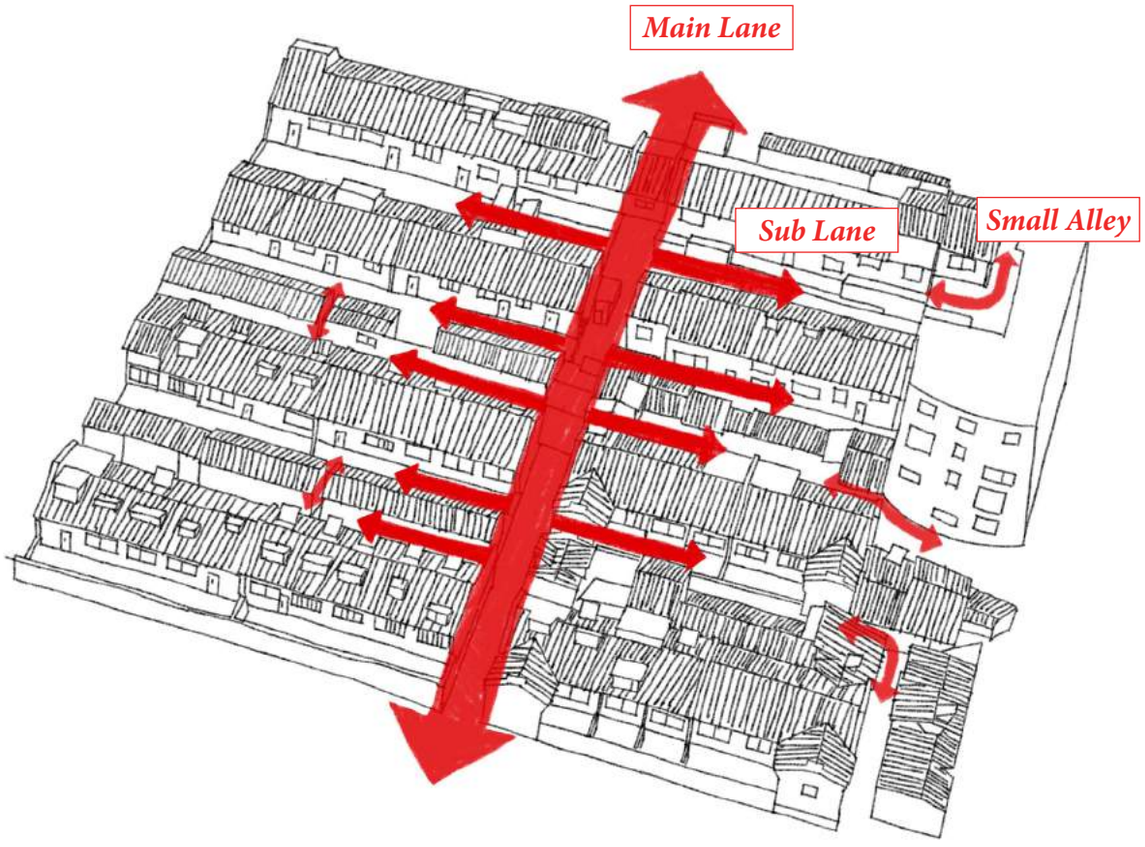


Option 1:
Hierarchic Path

Lilong Path Analysis

Lane Structure in Lilong

For the option of the Hierarchic path, we can learn from the existing spatial hierarchy of the path system in Lilong. For most Lilongs, there are main lanes, sub lanes, and small alleys as a structured system. In the future design, we can borrow this idea and apply it to a modern urban block .



Lane Structure

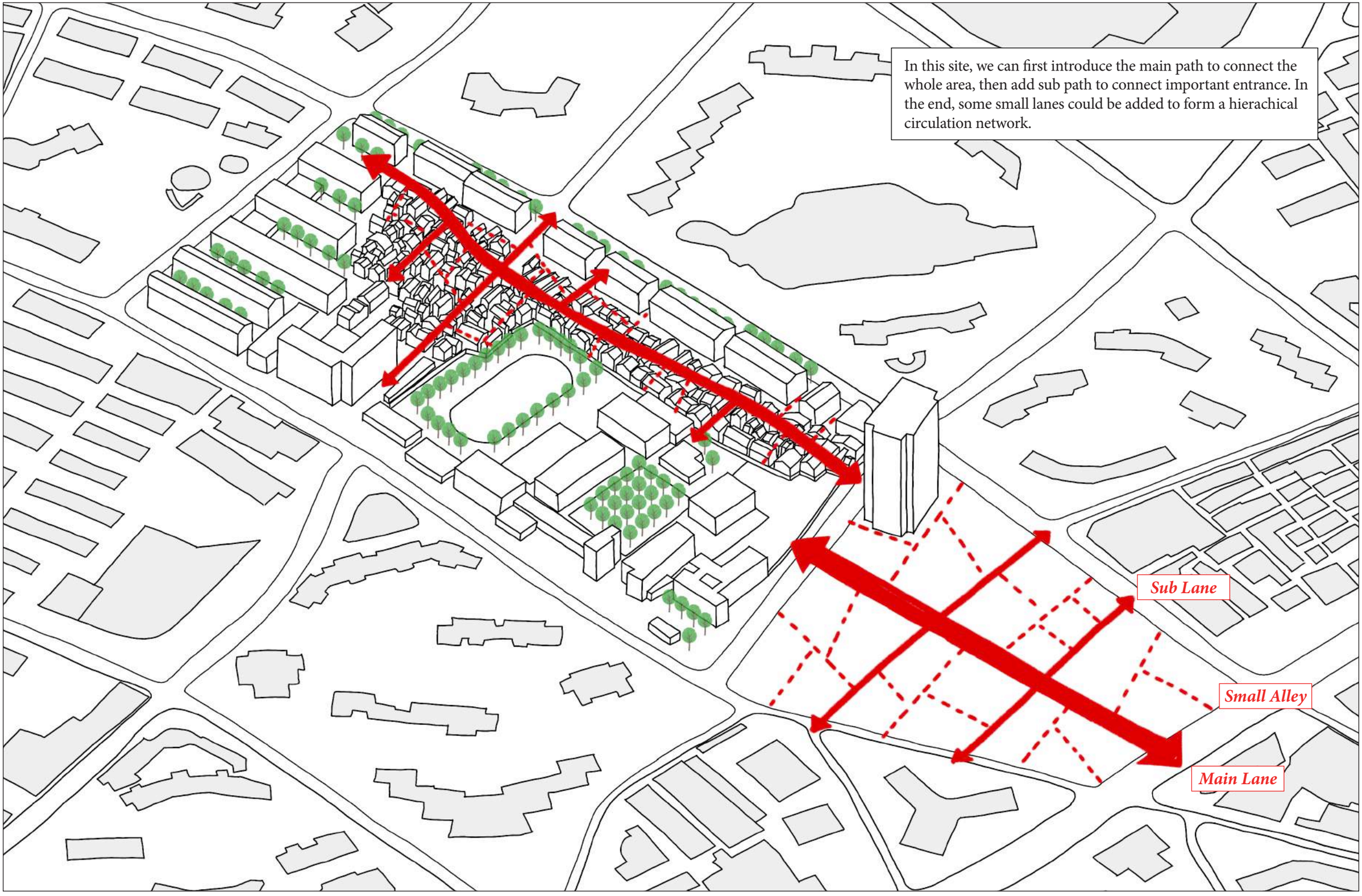
Main Lane

Sub Lane

Small Alley

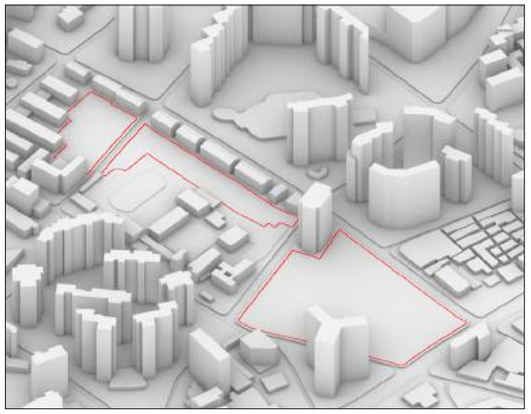
Source: 500px.com

Idea for Design

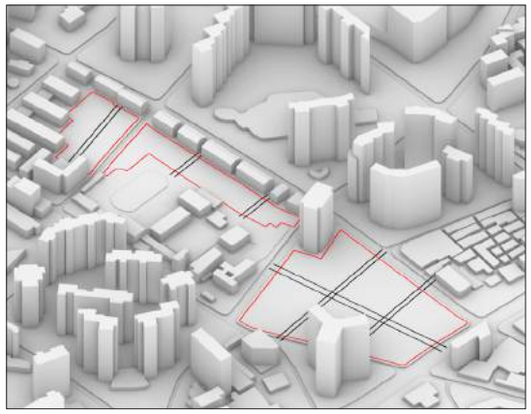


Step Story

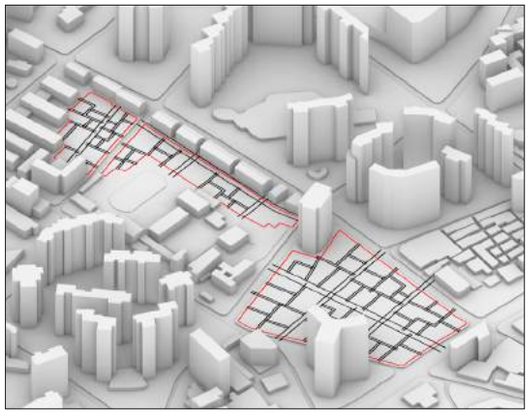
1. Workable Site



2. Add Main & Sub Lanes



3. Add Small Alley

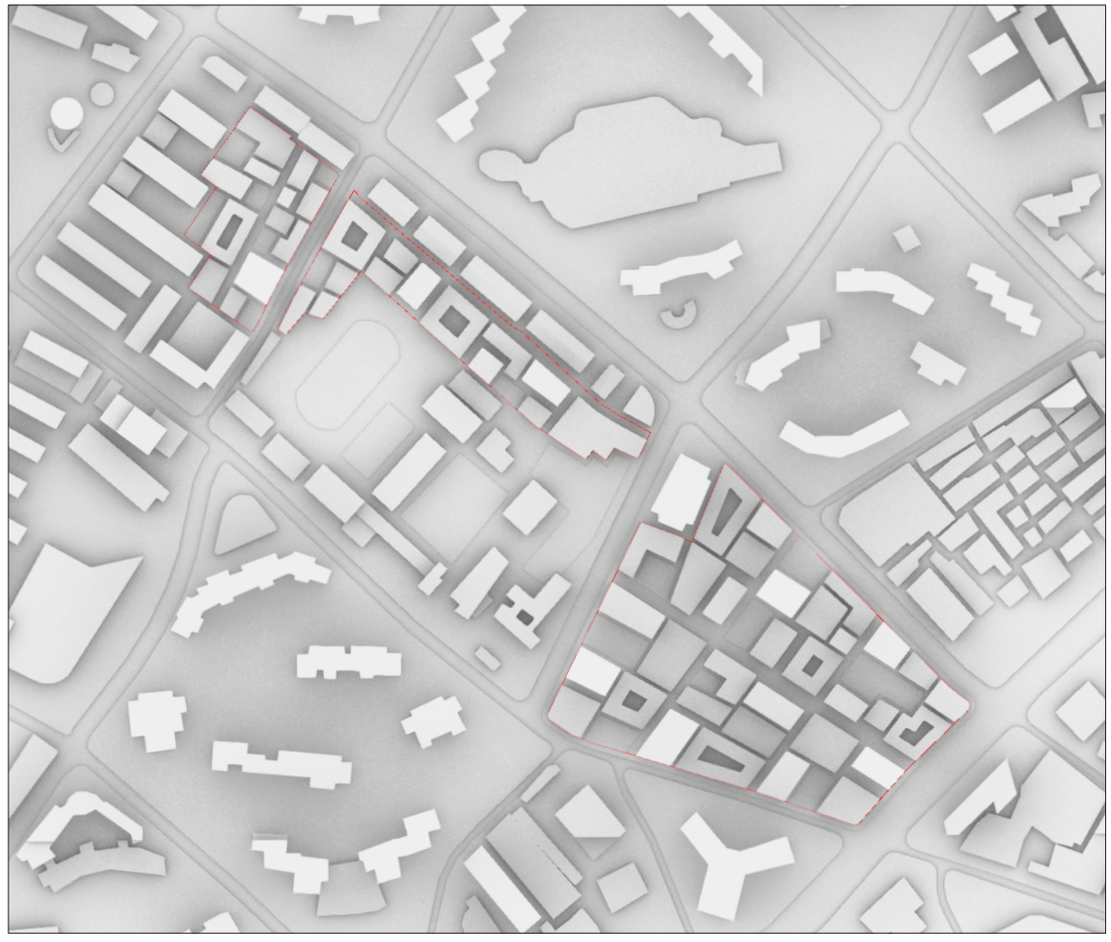


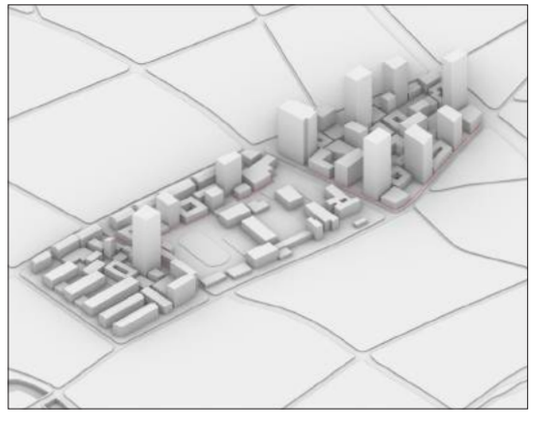
4. Building Lines

5. Buildings

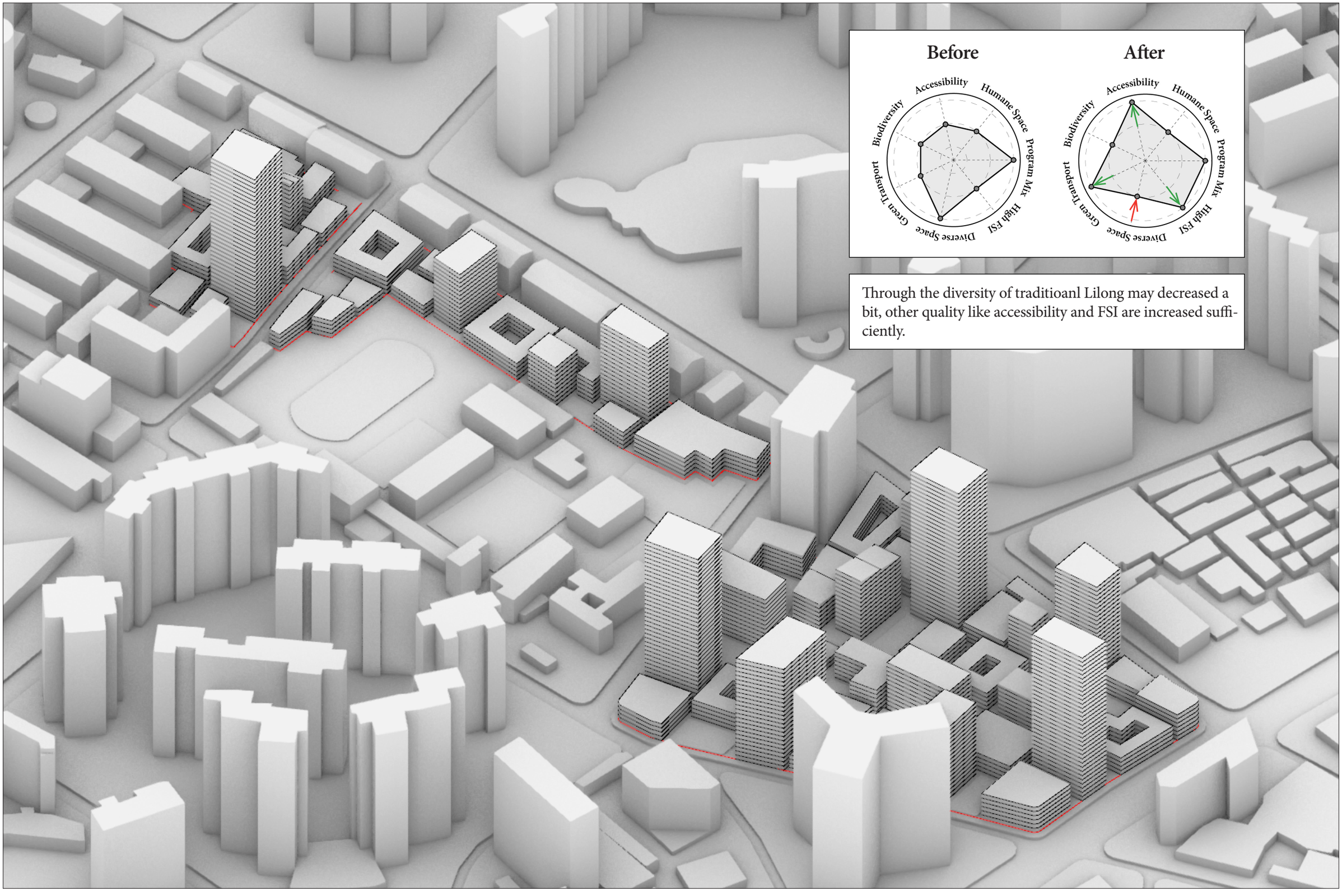
6. Adjust Heights and Parks

Plan & Birds View





Birds View



Through the diversity of traditioanl Lilong may decreased a bit, other quality like accessibility and FSI are increased sufficiently.

Eye Level Perspective

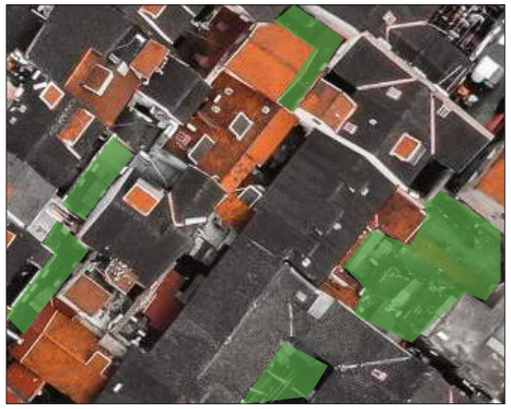
Option 2:
Squeezed Voids

Lilong Voids Analysis

Voids in Lilong

In the original Lilong neighborhood, we can see there are many spatial voids that squeezed by buildings. Those leftover empty spaces are Yin to contrast with buildings as Yang in Chinese philosophy. In the site, this idea is embedded into the design, and distinguished green voids are generated out by parallel lines of site boundary.

Voids Pattern



Voids Space

Voids Space

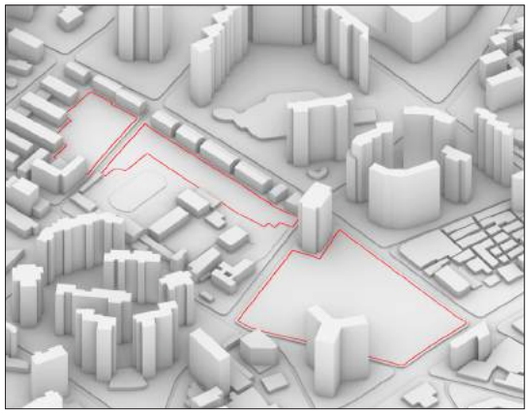
Voids Space

Source: 500px.com

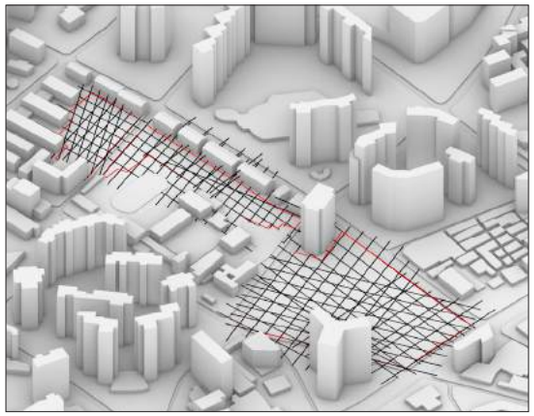
Idea for Design

Step Story

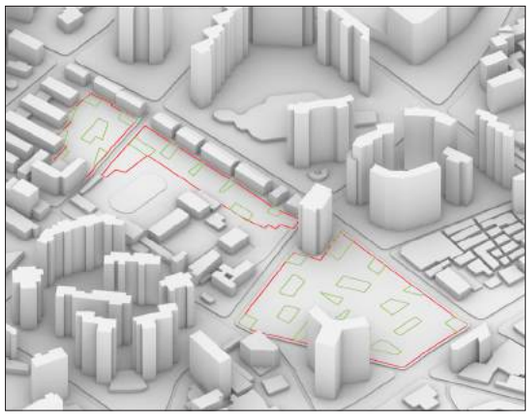
1. Workable Site



2. Axis from Site Boundary



3. Select Voids

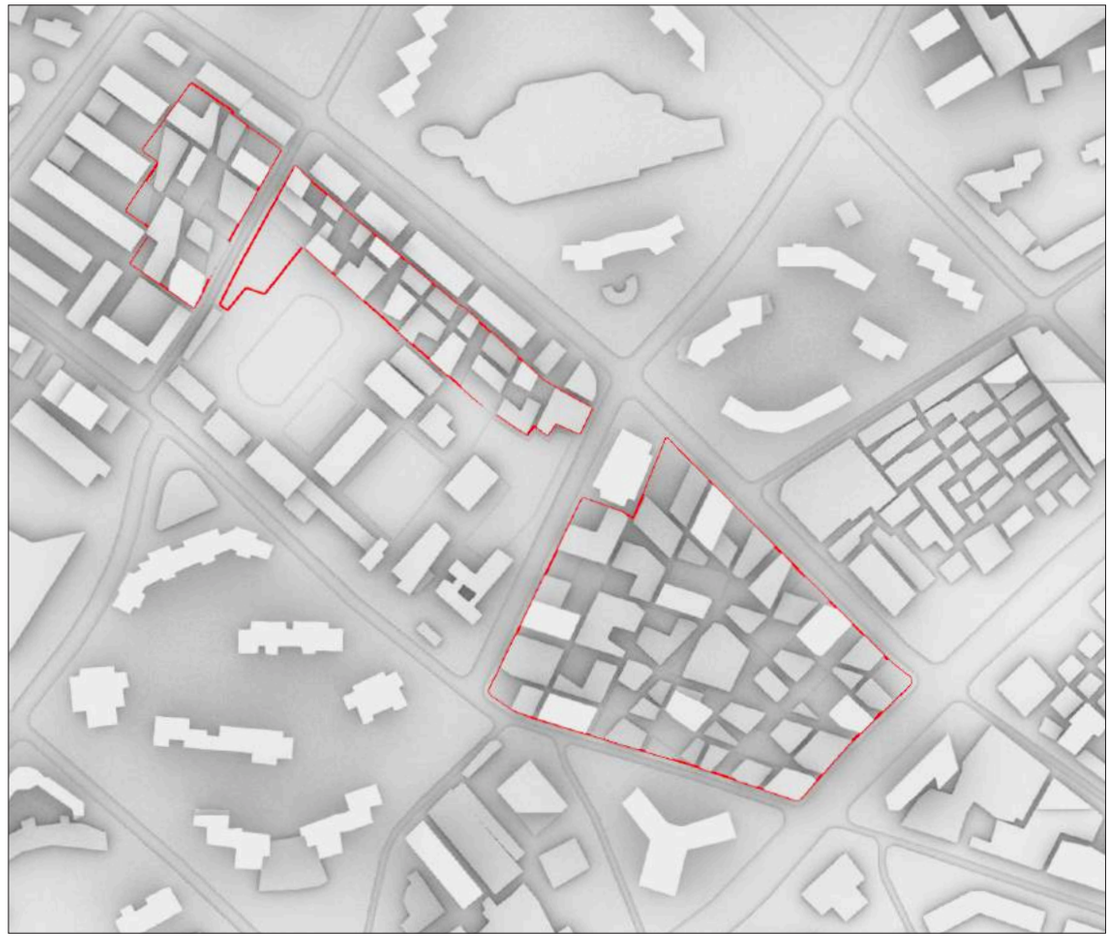


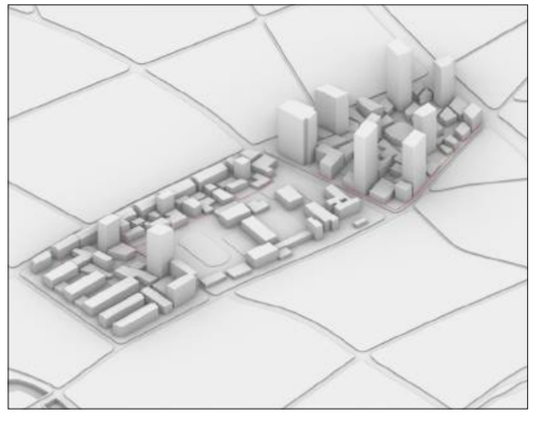
4. Draw Building Lines

5. Buildings

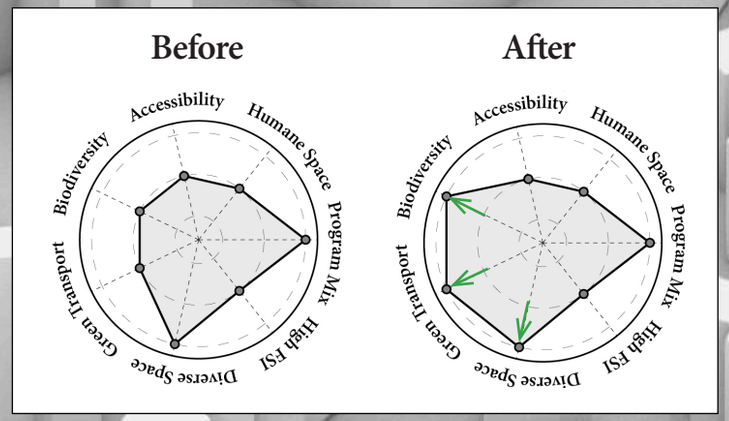
6. Adjust Heights and Parks

Plan & Birds View





Birds View



Thanks to the organic grid that created from site boundary, the later design show diverse spaces but in a order that efficient to circulation. And it is also beneficial for cycling.

Eye Level Perspective

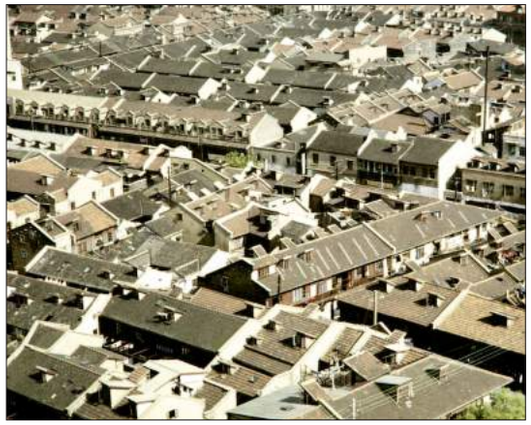
Option 3:
Weaved Fabrics

Fabrics Weave Analysis

Weaved Fabrics

To look at the Lilongs, we could find that the urban fabrics are weaved as an organic system. Some blocks are closed by buildings that front-facing the streets, sometimes there are parallel entrances that cut in Lilongs, and there may be entrances from all directions for irregular sites. Meanwhile, the buildings are also twisted together to contribute the weaved urban fabrics. In urban design, this option learned this idea and applied it to the C4 site.

Weaved Buildings



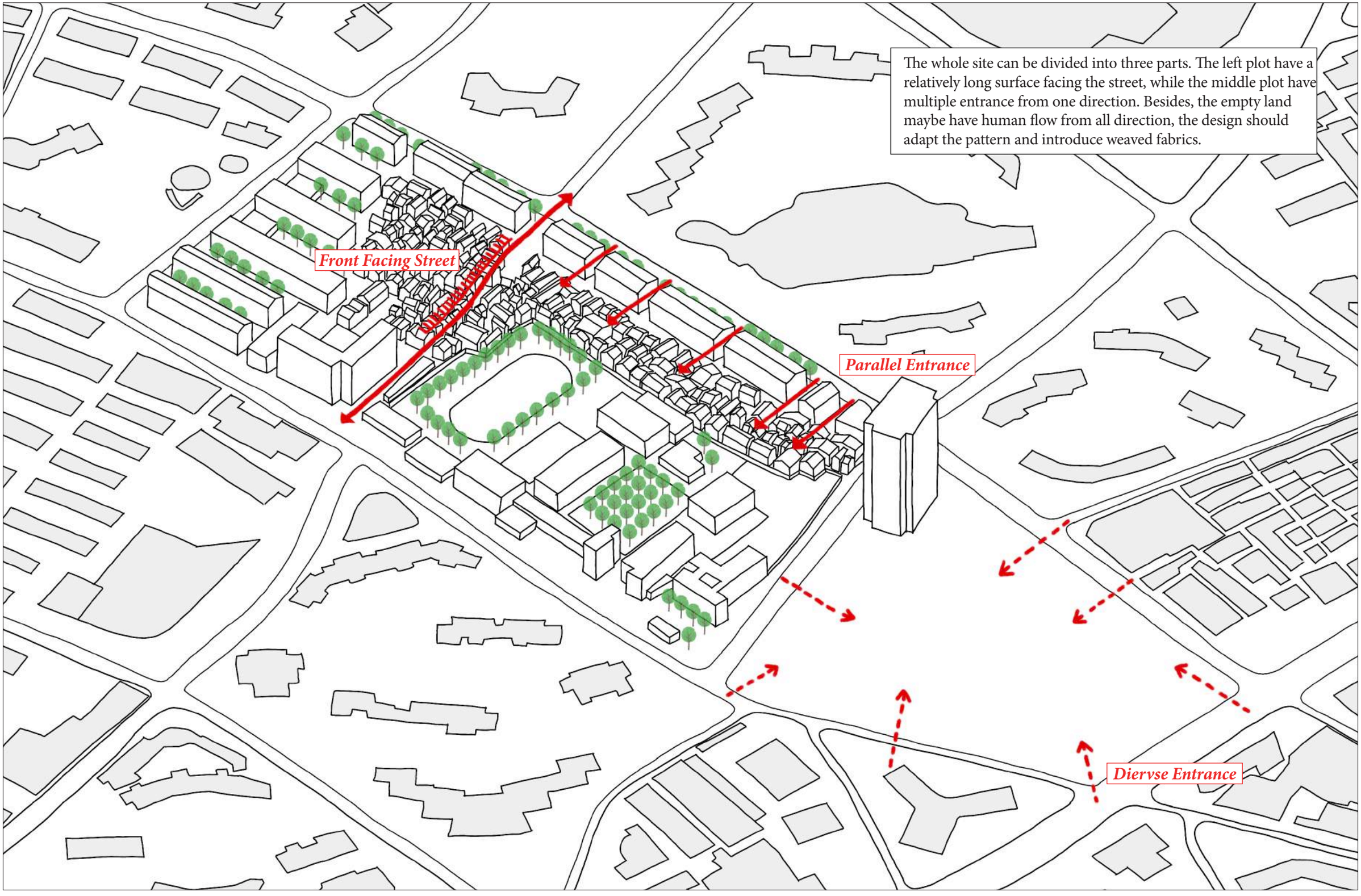
Bridge

Weaved Buildings

Bridge

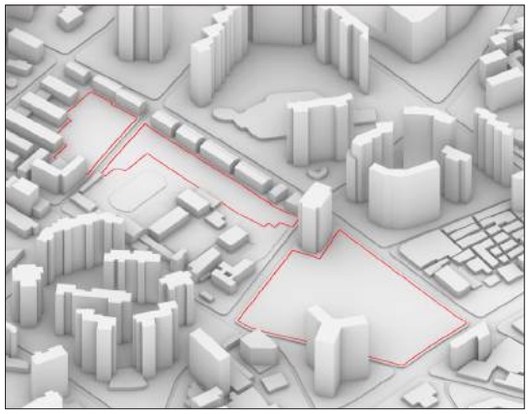
Source: 500px.com

Idea for Design



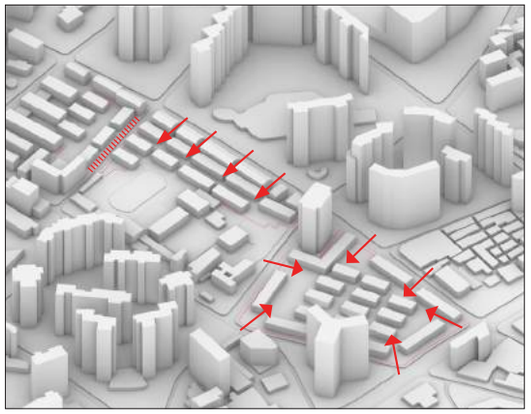
Step Story

1. Workable Site



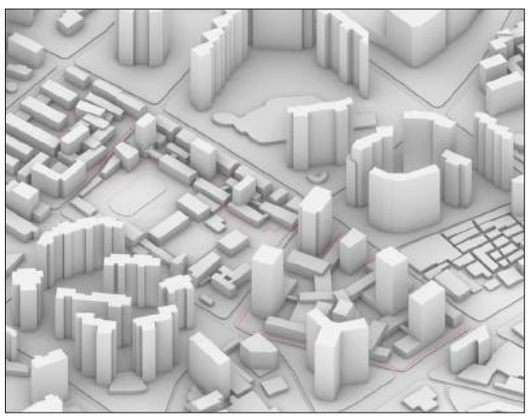
2. Add Slab Buildings

3. Adjust to Entrances

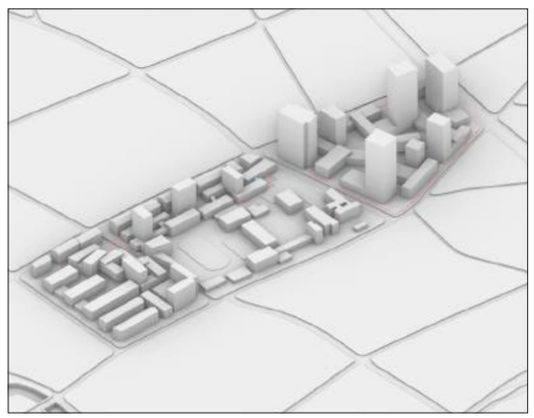


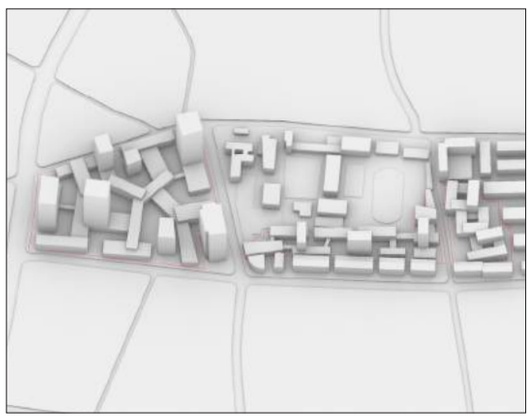
4. Trasform Buildings

5. Adjust Heights and Parks



Plan & Birds View





Birds View

The most essential change to this design option is that it increased the accessibility of the site and also reflect weaved space that from Lilong.

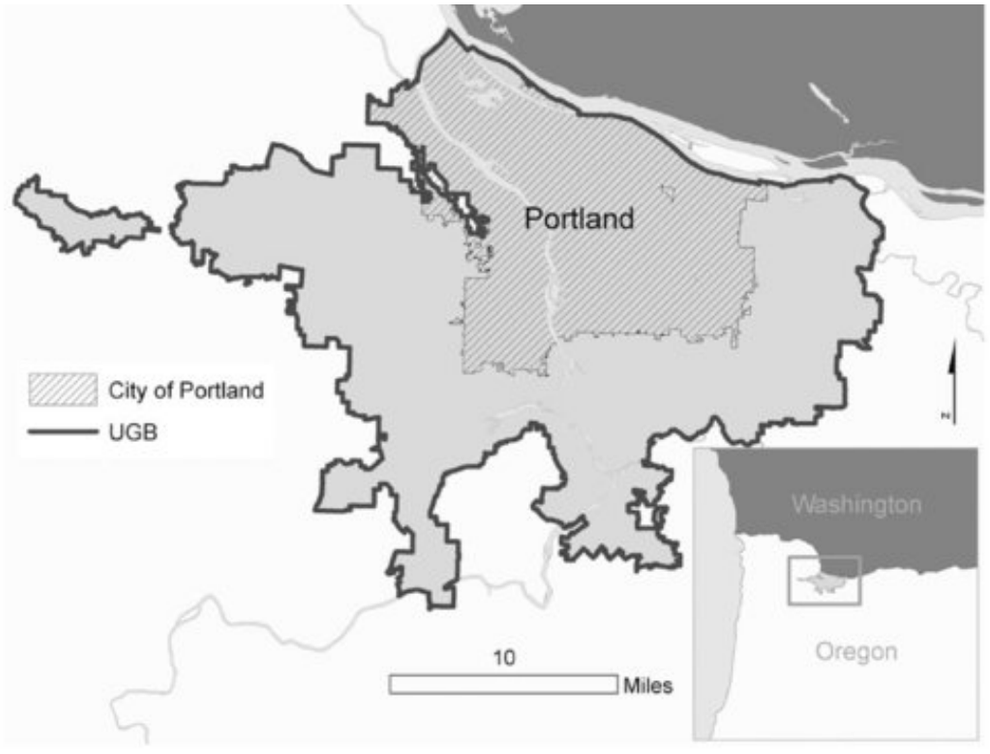
Eye Level Perspective

“Xiaoqu” Case Study

“Evidence” of Unsustainable Xiaoqu

Through above design tests showed potential benefits of introducing new typology that mixed the form and program of urban space, they fail to explain the real threats of Xiaoqu. Following chapter unflod the potential threats to monofuntional highrise sprawl by introduding similar cases in the urban design history.

Portland: Densification Without Mix



Portland, Oregon's metropolitan urban growth boundary UGB (Andrea L Sparks-Ibanga)

Since the end of the Second World War, most cities in the United States start urban sprawl with the popularity of private cars. Portland, as one of the cities, suffers from sprawl, adopted the "Smart Growth" principal to avoid further sprawl. The government drew an urban growth boundary (UGB, above picture) to limit the size of portland, aiming to increase population density in compact areas to reduce traffic congestion, air pollution, and other urban issues. In contrast, a report shows that "most citizens are upset by the unaffordable housing, traffic congestion, increasing taxes, declining urban services, and disappearing jobs that have resulted from the plans. " (Randal, 2007)

Traffic Congestion in Portland (Randal, 2001)

Accoring to the smart growth plan, actions like increased residential densities, rail transit, transit-oriented developments, and pedestrian-friendly design are all supposed to reduce the need for driving. However, "these actions are prescribed by LCDC to achieve its target of reducing per capita driving by 10 percent. No such reduction is in sight to date. From 1990 to 2000, per capita driving in the Portland area increased by 35 percent, from 17.4 miles per day to 23.6 miles per day." (Randal, 2004)

Randal point out the problem of smart growth in portland is due to lacking of mix. "densification of population and employment via the UGB had no direct impact on a reduction in automobile dependence, while additional mixed land use in the place of residence would be an effective smart growth tool for reducing single occupant commuter vehicles."(Randal, 2004)

Fail Factor:

- *Monofunctional Densification*
- *Increasing Cars*

Similar Problem to Chinese Xiaoqu:

- *Lack of Mix Program*
- *Excess Commuting*
- *Unaffordable Housing*
- *Urban Heat Island*
- *Air Pollution*

Pruitt Igoe: Enlarging Gap

Pruitt Igoe 1965 (Nihan, 2016)

Pruitt Igoe was a social housing project in the city of St. Louis, US. The residential neighborhood was complete in 1954, initially imagined as two isolated segments (Pruitt for blacks and Igoe for Whites). After the clearance of urban slums, the introduction of the new community was aiming to provide homes for low and middle-income groups. However, after the completion of two years, the community quickly suffered a decline, including facility vandalism, savagery, and financial flimsiness. “Within twenty years, it was razed on the grounds of increasing vandalism, sexual assaults, and muggings.” (Nihan, 2016)

There are many reasons of Pruitt Igoe’s failure. The first design proposal for the scheme consists of “high-rise, mid-rise and low-rise buildings, and the dwelling units were placed in between playgrounds and open public spaces.” To gain a better profit income, however, the developer chose this homogenous slabs. “when the nine 14-storey cross-plan buildings and fourteen 11-story slab-type buildings both of which had the same room capacities, were compared to each other, the slab-type buildings drove 16% profit of the total.” (Nihan, 2016)

Vacant lands in between slabs 1965, demolition of Pruitt Igoe 1972 (Nihan, 2016)

Besides, the construction’s quality has issues. According to Nihan, “Many technical details were missing, including landscaping, painting the concrete walls of the galleries and stairwells, insulation of steam pipes and screening on the gallery windows.”

But maybe most importantly, the Pruitt Igoe did not provide humane quality for residents who live in. In these massive concrete jungles, “people have lost their defined place in a defined structure under unarguable rules and regulations. This freedom has thrown the rule book at people and devolves the responsibility of people positioning themselves in the world.” (Nihan, 2016)

The faceless tower kills a diverse lifestyle and social relationship. It is reasonable to see those top-down designed buildings that deprived of social, political, and economic grounds cannot represent the bond between humans and society.

Fail Factor:

- Lack program, amenities
- Opposition of class
- Remove diversities
- Lack Maintainance

Similar Problem to Chinese Xiaoqu:

- Profit-driven Urbanism
- Faceless Neighbourhood
- Poor Walkability
- Lack of Mix Program
- Social Segregation

Bijlmer: Unsuccessful Utopia


Original Plan (1968) and Construction of Bijlmer (Leeming, 2003)


Updates of Bijlmer (2004 & 2020, Satillite Image from Google Earth)


Dutch Queen Juliana on balcony of Bijlmer in 1971 and Bijlmer now (Mingle, 2018)

After the Second World War, architects and planners around the world learned the modernist idea from CIAM (the International Congresses of Modern Architecture) and Le Corbusier. They want to envision future cities by building highrises with sufficient sunlight. Planners in Amsterdam test the idea on a grand scale in Bijlmer as the blueprint of modernism. Planners introduced the hexagonal grid slabs that would allow each apartment to get some sunlight every day.

Their ideas were great, but the reality did not go that way. "A metro line was supposed to connect the new area with Amsterdam, but construction was delayed. For a while, there was only one dirt road leading out to the area. The designers had planned for a shopping area, but the shops didn't come right away either, which meant there was nowhere to buy groceries. (Mingle, 2018) Besides, the faceless concrete building and common outdoor space made people confused with surrounding and easily get lost.

Gradually, people start moving out of this neighborhood, and the decline of Bijlmer attracts low-income people, such as immigrants from Suriname. Then people from Turkey, Morocco, and Ghana who came to the Netherlands for work also come to Bijlmer since they can not afford housing anywhere else.

After a plane crash accident caused death in Bijlmer, the government finally start to demolish the huge buildings gradually. In recent years, the buildings were removed one by one, and small row houses are introduced in the neighborhoods. Former local residents are relocated, and the elevated roads were eliminated. For Bijlmer, the goal now was to mix functions instead of separating them.

The top-down paternalistic approach proved the huge scale residential block does not work.

Fail Factor:

- Lack program, amenities
- Unhuman scale

Similar Problem to Chinese Xiaoqu:

- Faceless Neighbourhood
- Poor Walkability
- Lack of Mix Program
- Social Segregation

Red Road Flats: Rise & Fall

Red Road Flats in Glasgow, UK, 1969, tumblr.com

Replacing “slums” by New Towers, 1967, Getty

A room inside red road flats, 2015, Chris Leslie

The Red Road Flats was built in the 1960s on Glasgow suburban area. It was intended to accommodate 5000 people and remove crowing and combat slum conditions.

But the towers did not make the situation better. It becomes “new kinds of slums” in the sky. “You had people using drugs and urinating in the lifts, And people would throw things out of windows.” (Leislie, 2015)

Demolition of Red Road Flats, 2016, Youtube.com

An old resident in Flats said, “At first it was great, but over time there were people with drug and alcohol problems moving in. The buildings started to fall into disrepair.”

People thought their old crowded house is the place that “defined by aspiration and community spirit, where you could leave your doors open, and families looked out for one another.”(Leislie, 2015) With the disappearance of the sense of nearby. The social isolation in high rise towers is harmful to mental health and provides a hidden place for criminals.

In time, with the long-term low economic growth in Glasgow city. Deindustrialization in the 1960s and 70s had left the area in ruins. The highrise towers become truly urban slubs. At the end of 2015, Glasgow Housing Association demolished all the towers in Red Road Flats.

Fail Factor:

- Lack public space
- Social Isolation
- Lack Maintainance

Similar Problem to Chinese Xiaoqu:

- Faceless Neighbourhood
- Poor Walkability
- Lack of Mix Program
- Social Segregation

Castlemilk

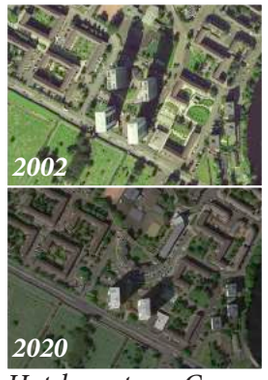
Dalmarnock

Whitevale Towers

Germiston

Govan

Laurieston



Hutchesontown C

Gorbals

Ibrox

Pollokshaws

Pollokshaws

Red Road Flats

Sighthill

Sighthill South

Toryglen

Yoker

Glasgow: The Solution Becomes Problem

Like many other UK cities, there are lots of high-rise towers being built in the 1960s. The towers are introduced as the solution to provide homes for the increasing population who live in “problematic” slums. The demolition of crowded slums provided lands for new towers. However, the solution becomes a new problem. Towers become new slums, and they will also end up with demolition the same as 60 years ago.

Since 2003, The Glasgow Housing Association began a £96 million program to clear and demolish many of the high-rise flats and refurbish others. (Wikipedia, 2006) From 2006 to 2015, the Glasgow government had turned town one-quarter of around 200 towers of all in the city (Leislie, 2015). And they will continue the urban regeneration.

Radical start leads to radical ends.

Lesson for Chinese Xiaoqu

According to the above cases, we could find out that there are times in history. Planners choose to design large scale residential neighborhood to accommodate the increasing population and improve the living quality. The idea itself is ok, but when it comes to huge monofunctional residential towers, the problems may come. The inhumane space loses walkability compare to small scale streets; monofunction causes unnecessary commuting. Most importantly, the residents suffer from social segregation, and social issues may appear.

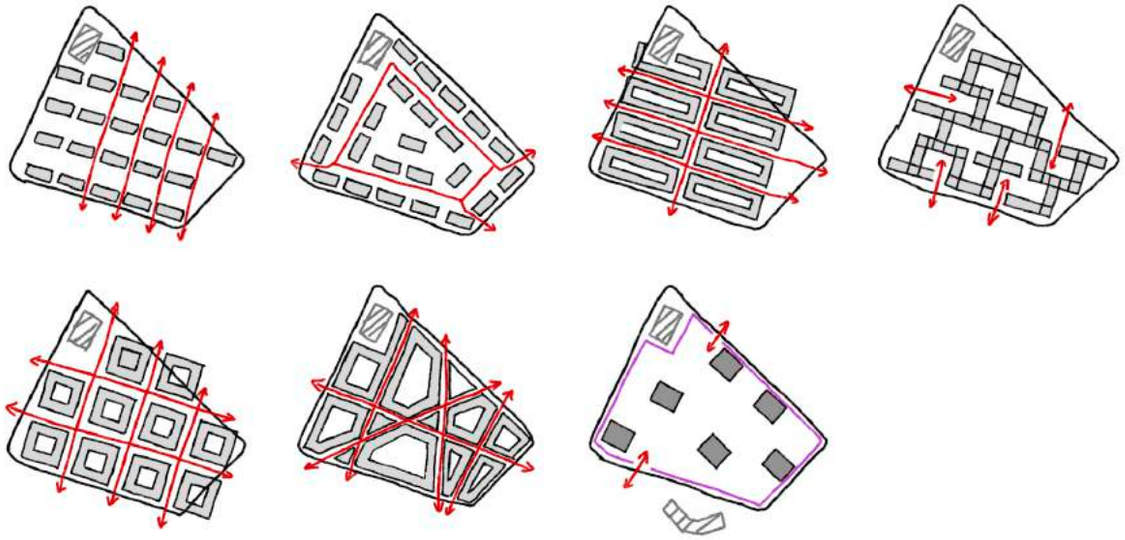
Back in the Chinese context, the current Xiaoqu model has the same problem, such as social isolation and poor walkability, yet it works well in general. It is true that maybe the essential reason of Pruitt Igoe and Red Road Flats in economic factors other than urban spatial planning. However, the large scale residential model shows the vulnerability when facing economic decline. It may works in economic growth time, such as Chinese Xiaoqu now. It is not resilient in possible future economic change.

Since Chinese cities have relied on this model for about 20 years, hundreds of millions of people are moving into Xiaoqu. It is urgent for urban designers to blow the whistle and provide an alternative solution. China need towers to increase FSI, to accommodate the increasing population. Yet the monofunctional mega block may not be sustainable in future decades. In rapid urbanization, it is almost impossible to predict future possible iusses of paradigm shift on living environment. But we can adopt a less radical way by learning experience from others than top-down arbitrary planning. As this project suggests, urban designers can encourage government and developers be allowed to remove some of the fences in Xiaoqu, add roads to make the block smaller, mix function to reduce congestion, and, most importantly, provide quality and sustainable living environment for the People.

Wall itself is not the essential problem, the above cases proved that large residential communities might decline without fences, yet the wall is a barrier of urban communication. It encourages social segregation and prevent intervention from the cities.

Design Evolution

Design Evolution for 7 Options

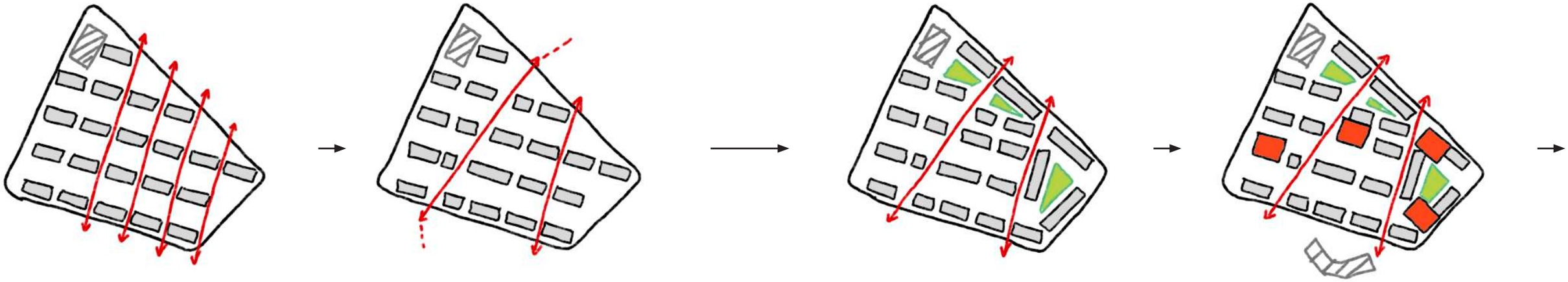


According to the above chapters, we can gain some essential qualities that new design should achieve, including good accessibility, human-scale spaces, mixed program neighborhoods, sufficient FSI, diverse spaces, green transportation, and encouragement of biodiversity.

Instead of applying all those qualities as one, the author took an evolutionary design approach. A workflow of criteira-judgement-actions-evolutionary design is introduced.

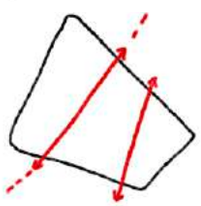
In the following pages, the author illustrated how seven options of design are evolved, and he evaluated the outputs of options by assessment diagram he introduced in early chapters.

1. Grid Slab



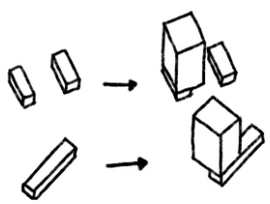
1. Introduce grid residential slabs

2. Adjust the circulation to connect surrounding streets.

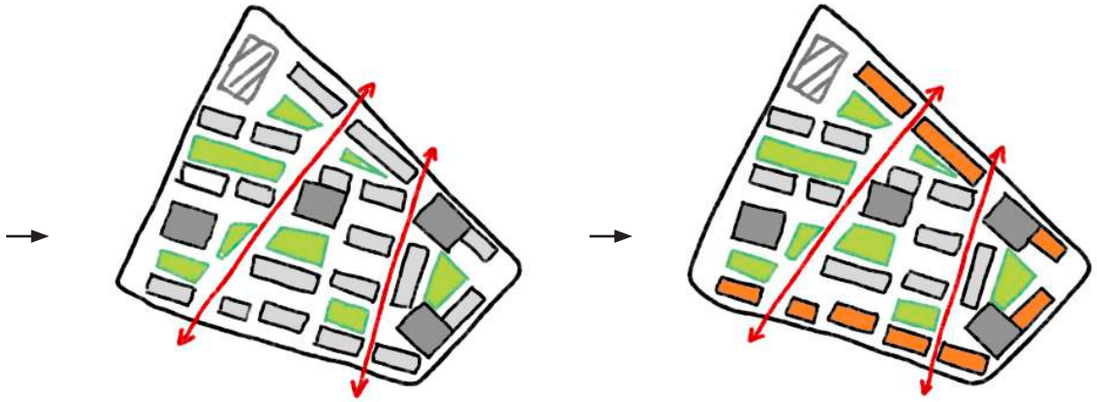


3. Adjust the surronding building to create more walkable streets.

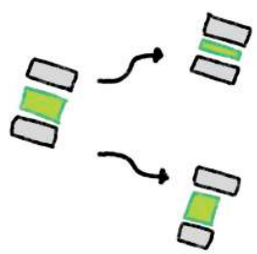
4. Add towers on top of slabs to increase FSI



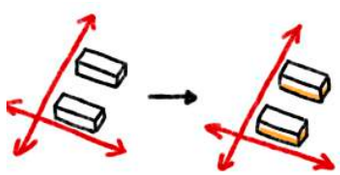
Criteria	Judgement
Accessibility Step 2	Quite good grid streets, need to connect surrounding roads.
Human Scale Step 3	Trangular space near streets can be nosiy.
Mix Step 6	Poor function mix, can mix function slong streets, like public service or commercial
FSI Step 4	Low FSI level, need to add towers to increase total area. (GSI is already quite high)
+ Others Step 5	- Space is too homogenous - Sunlight condition is great



5. Diversify public space to increase homogeneity (avoid faceless).



6. Mix function in low level of buildings that along streets.



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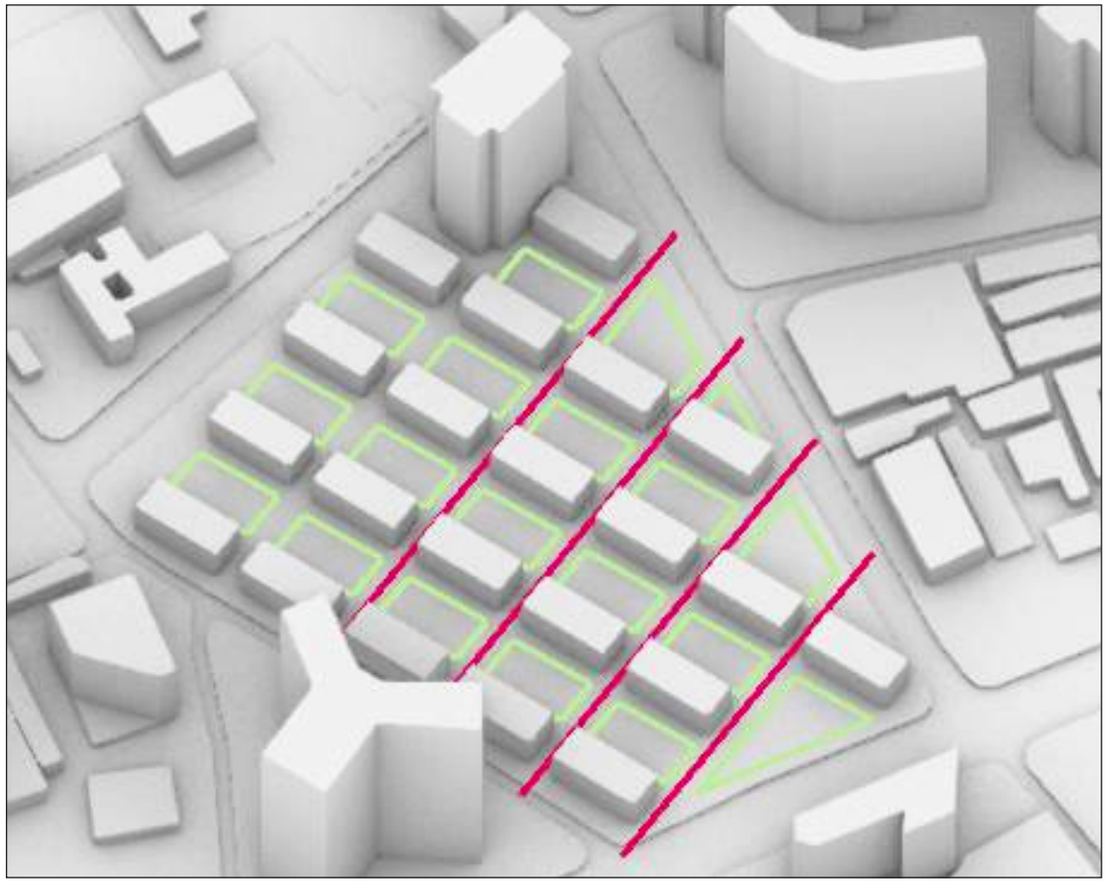
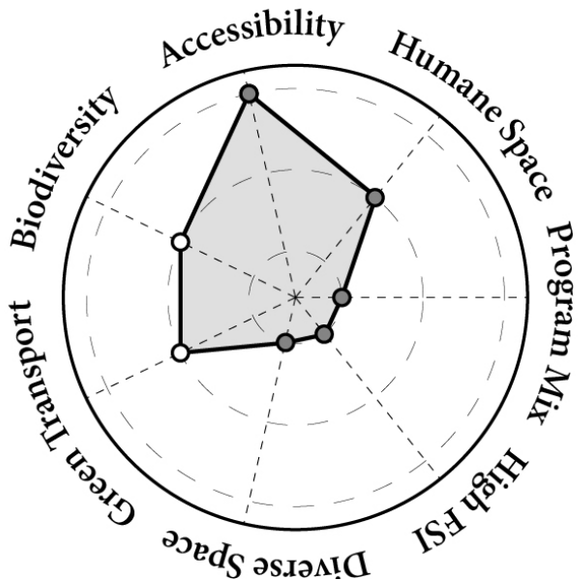
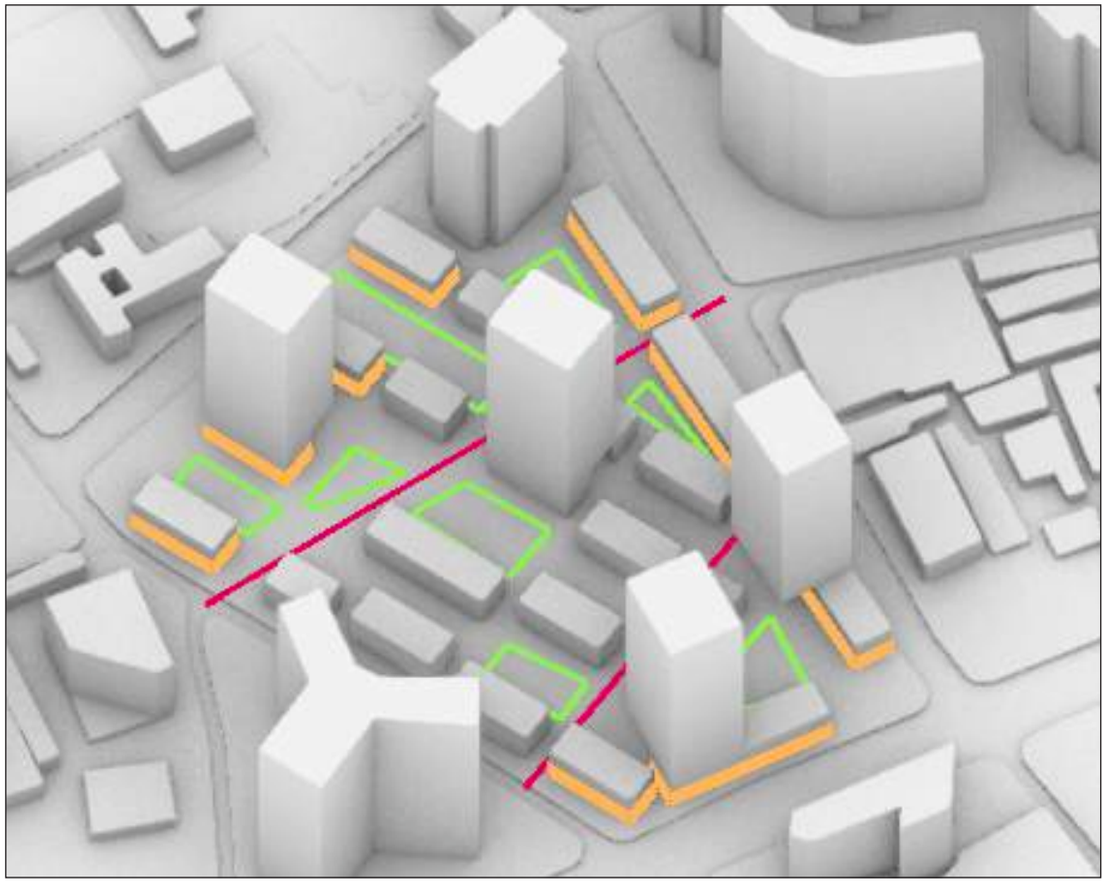


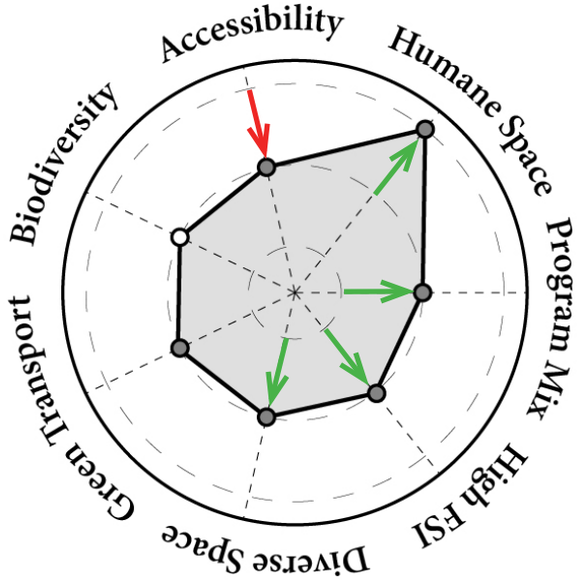
FSI: 1.15



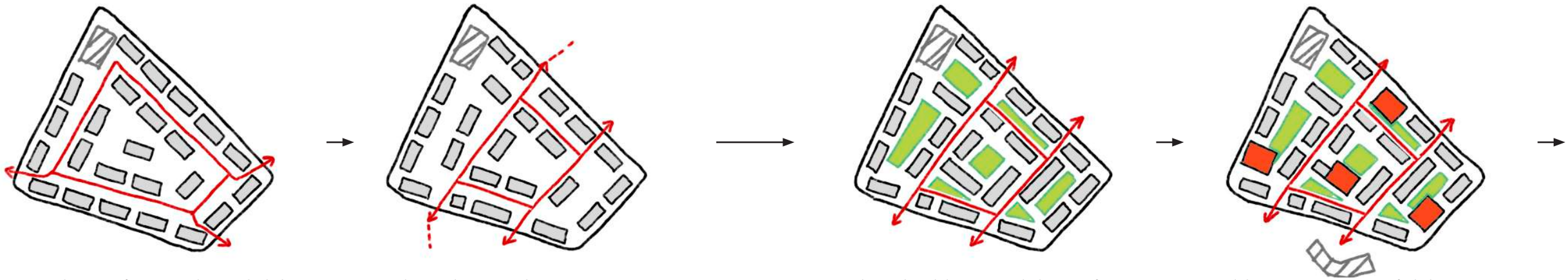
Improved



FSI: 3.64



2. Offset Slab



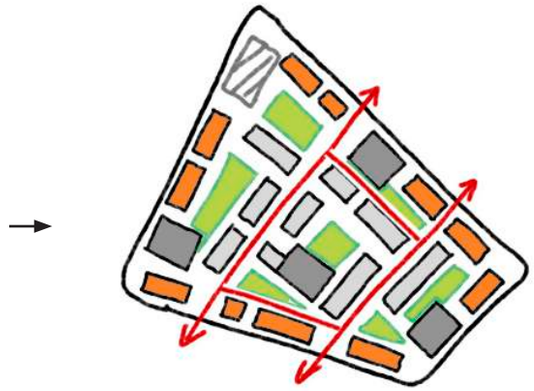
1. Introduce offset residential slabs

2. Adjust the circulation to connect surrounding streets.

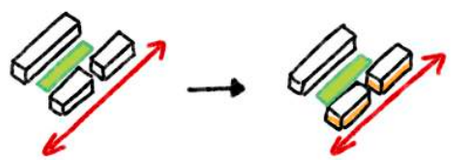
3. Adjust buildings and diversify public space.

4. Add towers on top of slabs to increase FSI

Criteria	Judgement
Accessibility Step 2	Open and accessible, but not efficient for pass by citizens
Human Scale Step 3	Buildings and outdoor space inside neighbourhood is quite chaotic.
Mix Step 5	Poor functional mix.
FSI Step 4	Low FSI level, need to add towers to increase total area. (GSI is already quite high)
+ Others	Sunlight condition is not satisfied.

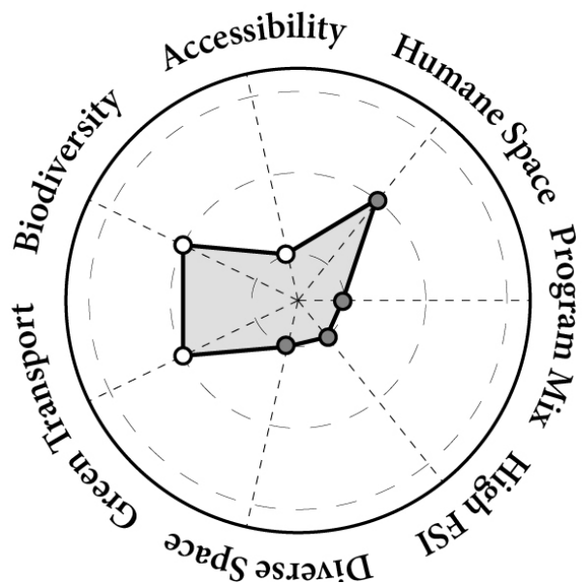


5. Mix function in low level story along streets

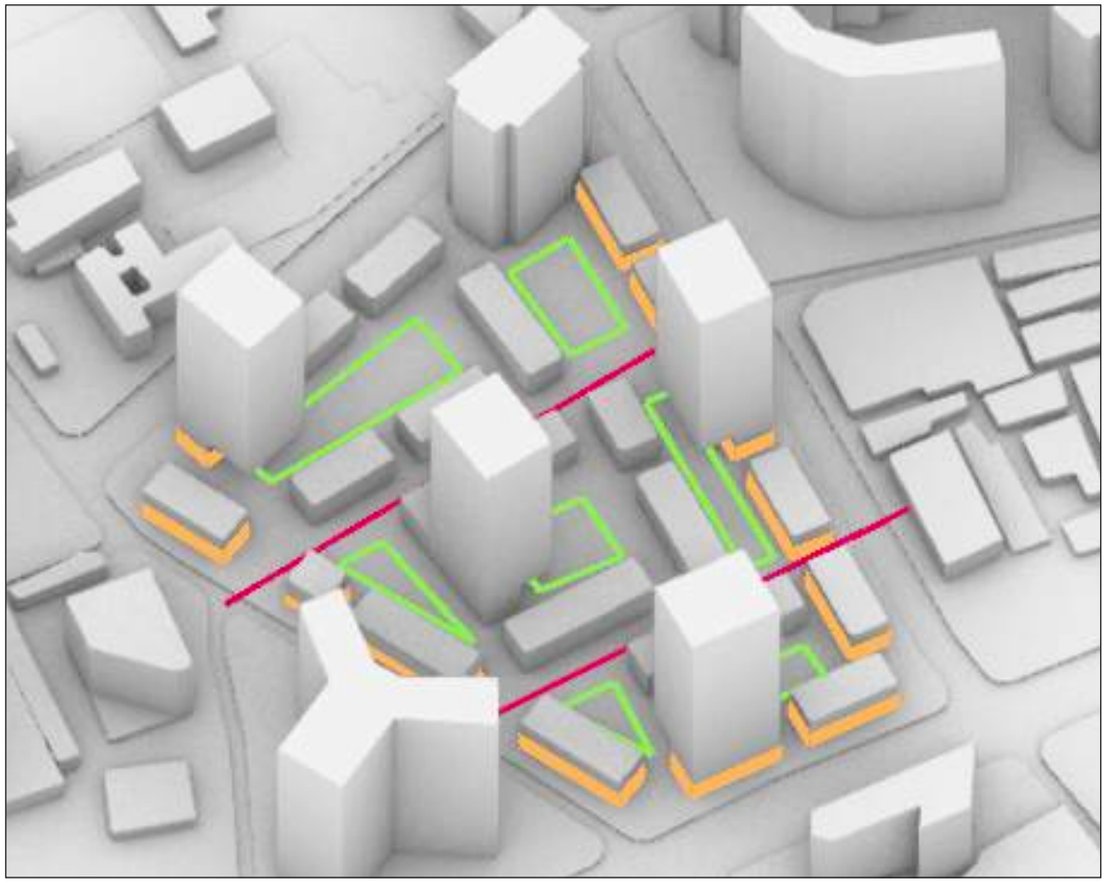


Original

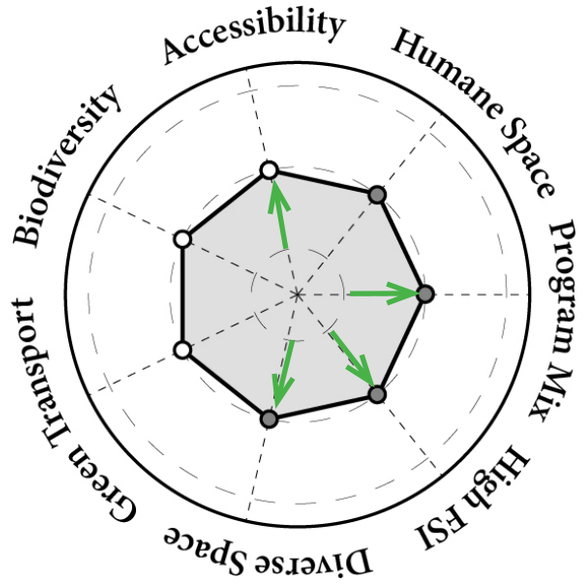
FSI: 1.31



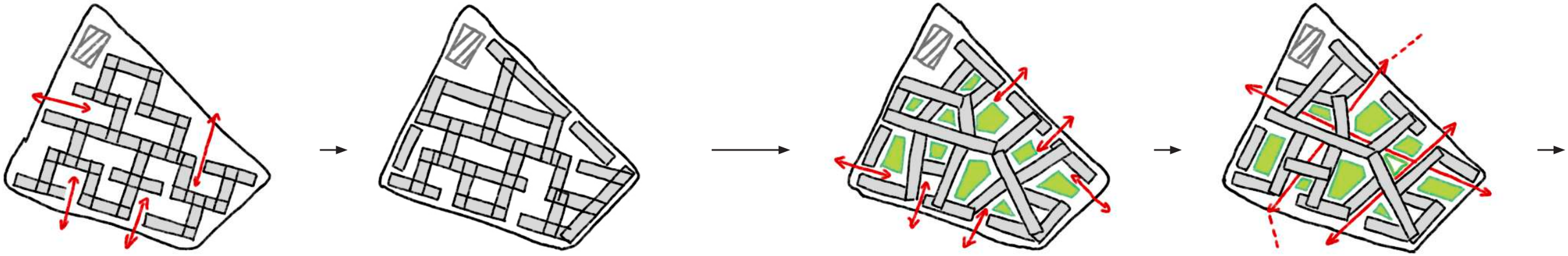
Improved



FSI: 3.69

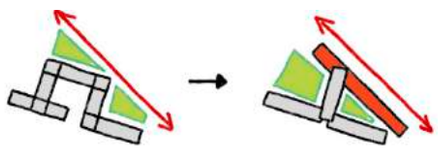


3. Weaved Slab

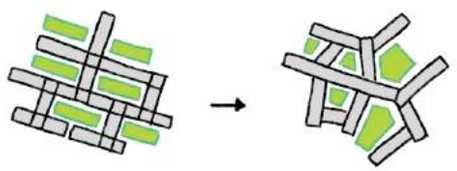


1. Introduce weaved residential slabs

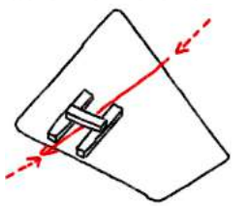
2. Adjust the circulation to connect surrounding streets.



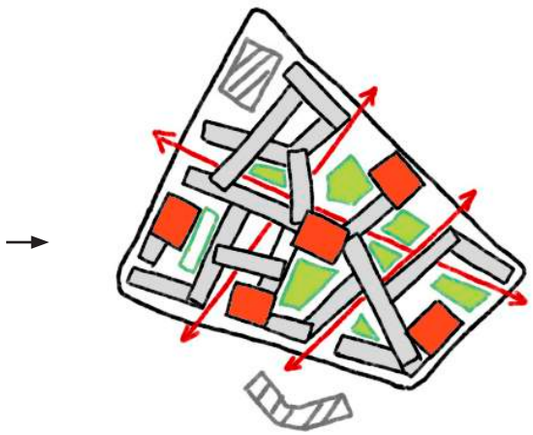
3. Diversify outdoor space by rotate slabs



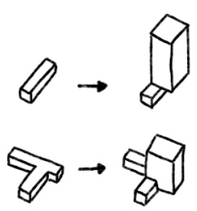
4. Adjust building angle, lift slabs to make circulation efficient

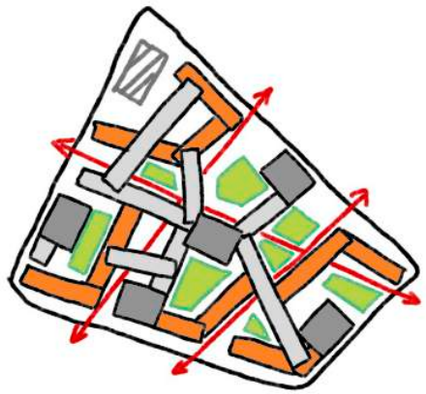


Criteria	Judgement
Accessibility Step 4	Open but not accessible in terms of public circulation.
Human Scale Step 2	Human scale, trangular space near streets can be nosiy.
Mix Step 6	Poor function mix, can mix function along streets, can mix function in weaved slabs.
FSI Step 5	Low FSI level, need to add towers to increase total area.
+ Others Step 3	- Outdoor space is mainly triangular, can be diversified - Sunlight condition is not satisfied



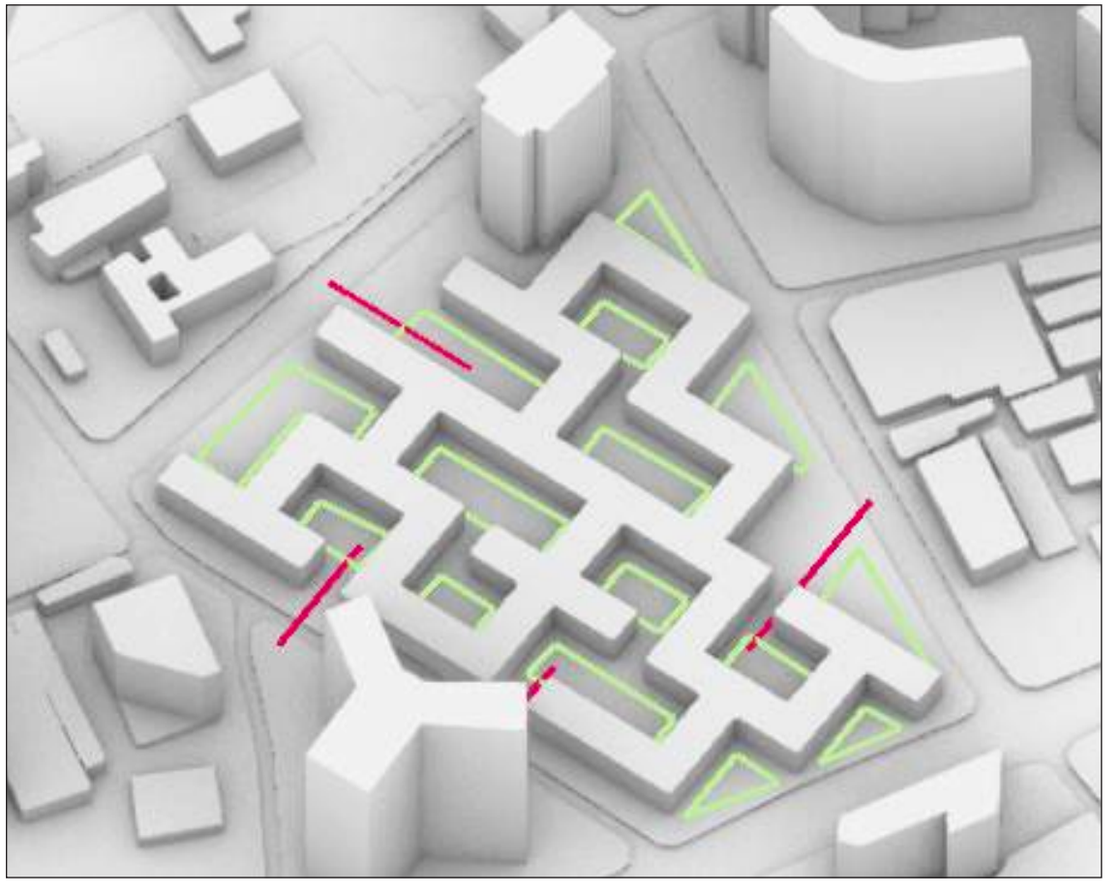
5. Add towers to increase FSI



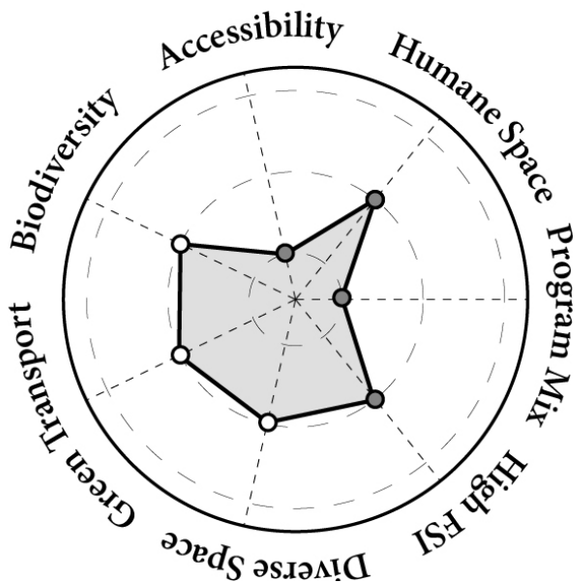


6. Mix function in streets buildings and weaved buildings.

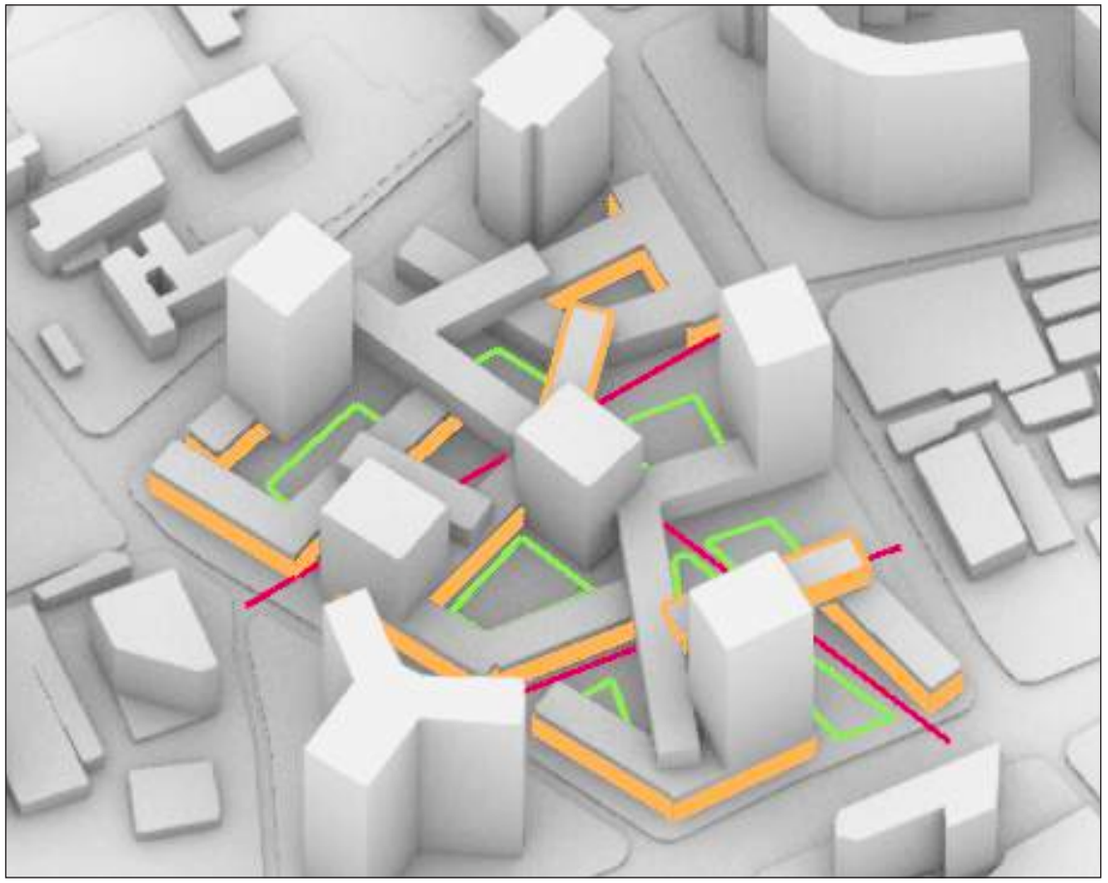
Original



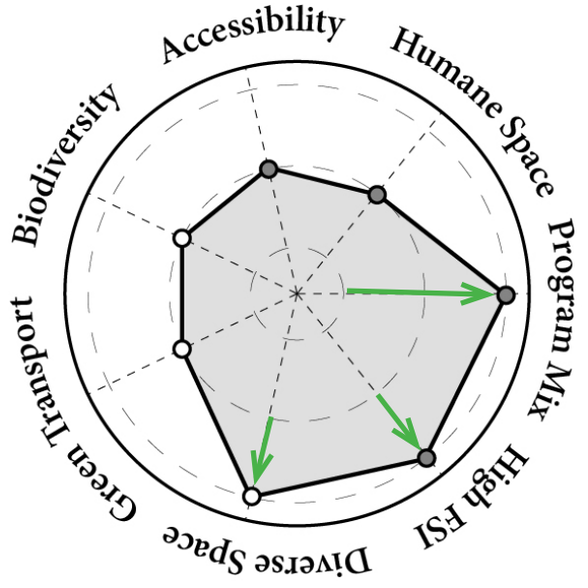
FSI: 2.30



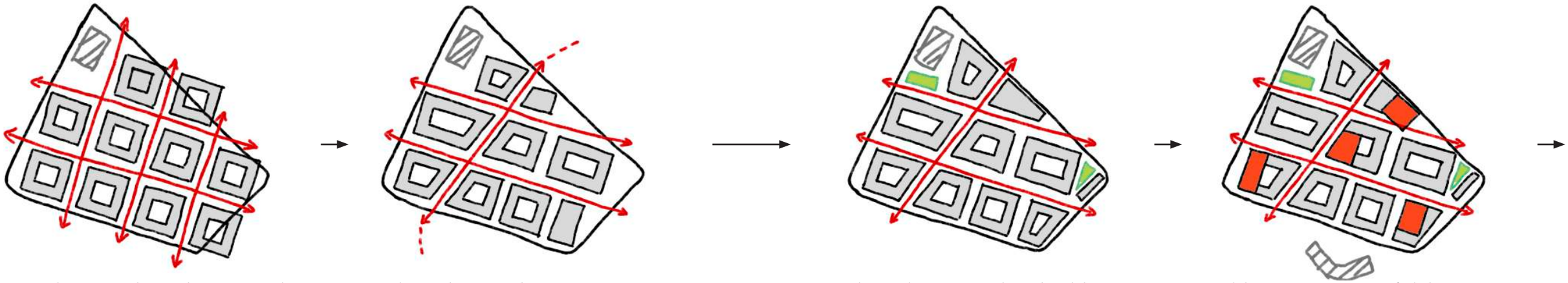
Improved



FSI: 4.75



4. Courtyard



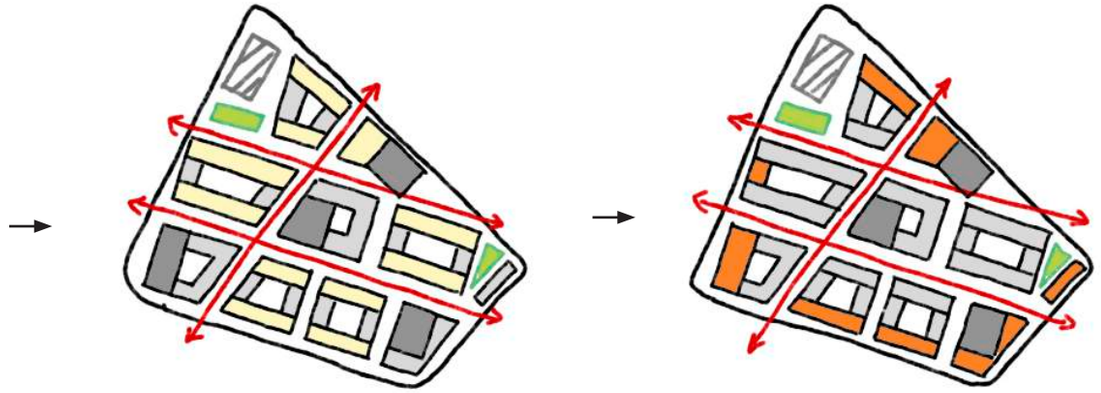
1. Introduce residential courtyards

2. Adjust the circulation to connect surrounding streets.

3. Adjust the surronding building to create more walkable streets.

4. Add towers on top of slabs to increase FSI

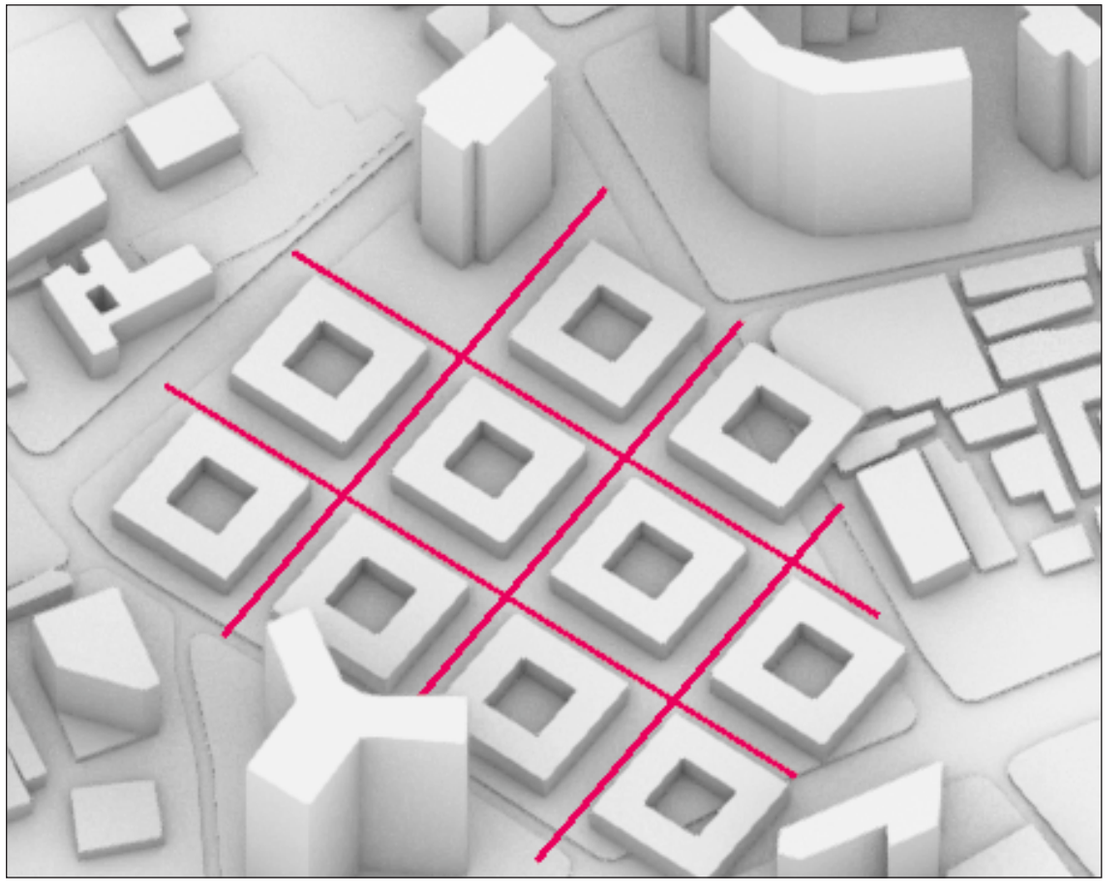
Criteria	Judgement
Accessibility Step 2	Quite good grid streets, need to connect surrounding roads.
Human Scale Step 3	Trangular space near streets can be nosiy.
Mix Step 6	Poor function mix, can mix function slong streets, like public service or commercial
FSI Step 4	Low FSI level, need to add towers to increase total area. (GSI is already quite high)
+ Others Step 5	- Sunlight condition is not good



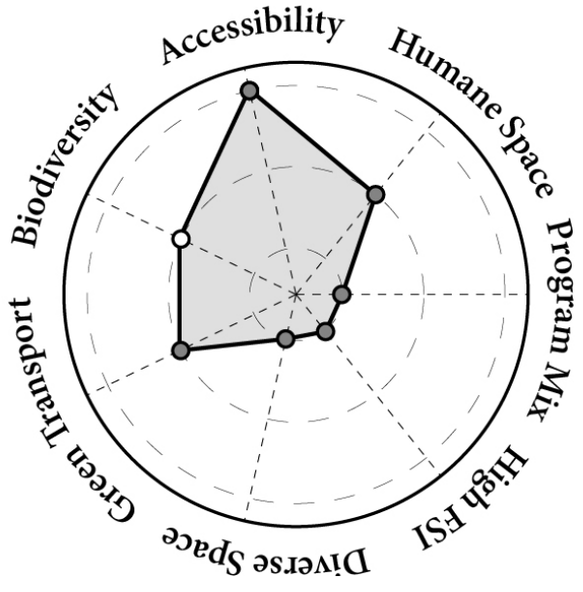
5. Increase height in north-south slabs and decrease in east-west to gain more sunlight.

6. Mix function in low level of buildings that along streets.

Original

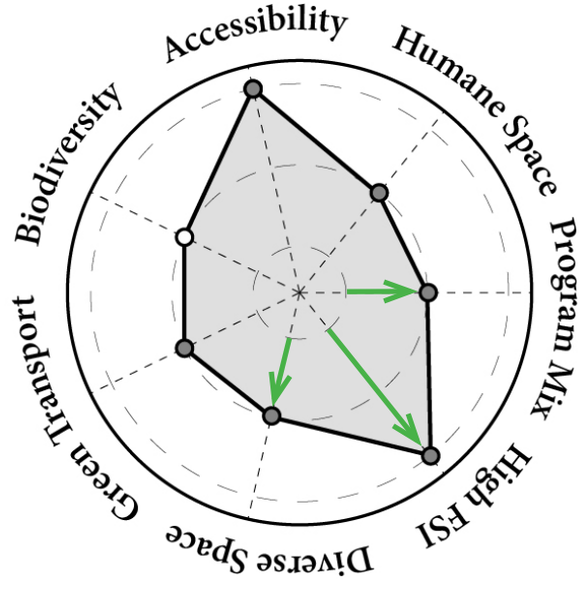


FSI: 1.47

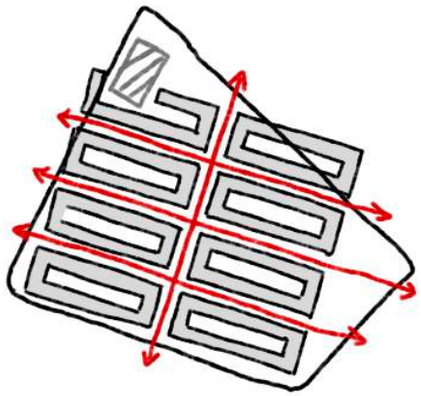


Improved

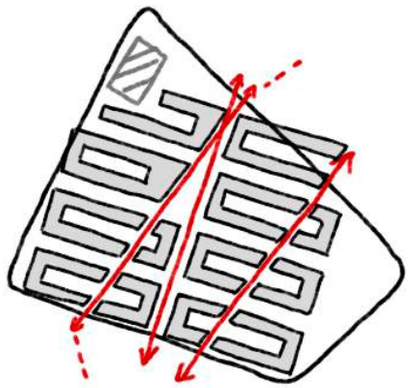
FSI: 4.06



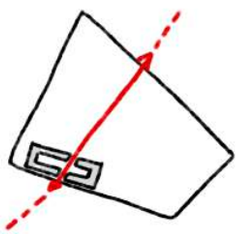
5. Dutch Courtyard

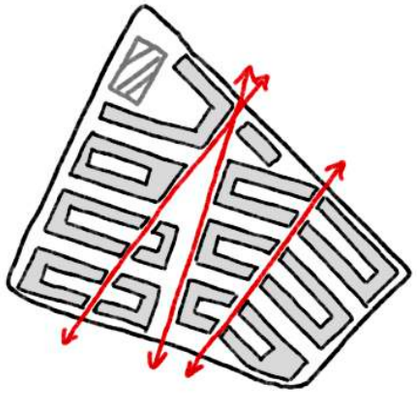


1. Introduce long courtyards

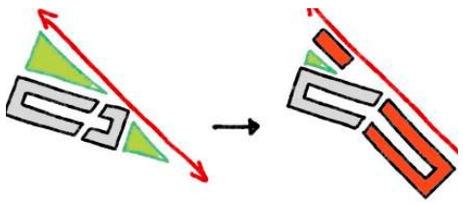


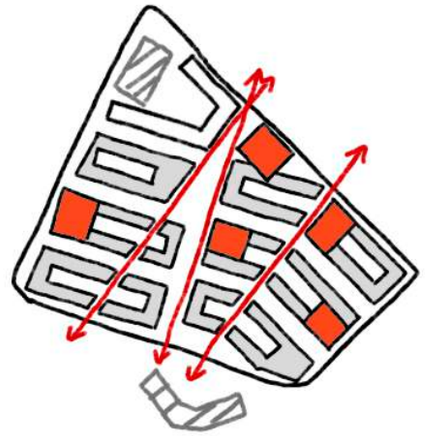
2. Adjust the circulation to connect surrounding streets.



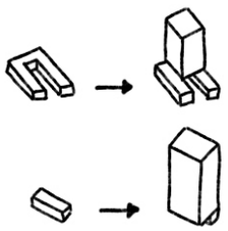


3. Adjust the surronding building to create more walkable streets.

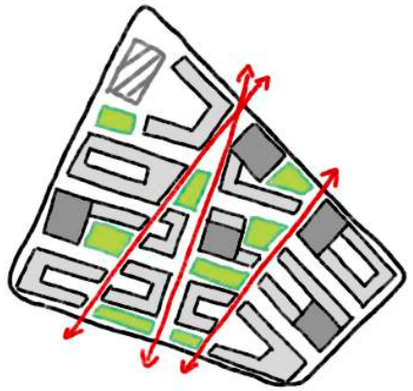


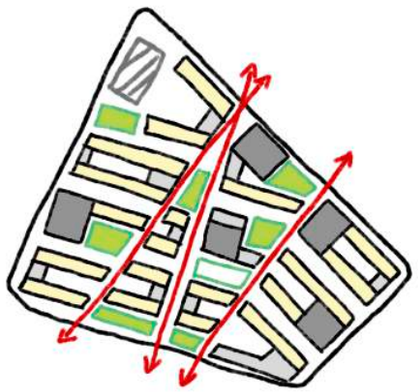


4. Add towers on top of slabs to increase FSI



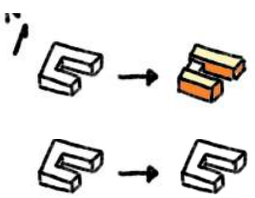
Criteria	Judgement
Accessibility Step 2	Good grid streets, better to connect surrounding roads.
Human Scale Step 3	Trangular space near streets can be nosiy.
Mix Step 6	Poor function mix, can mix function slong streets, like public service or commercial
FSI Step 4	Low FSI level, need to add towers to increase total area. (GSI is already high)
+ Others Step 5 Step 6	- Space is homogenous - Sunlight condition is good, increase height in south and north slabs



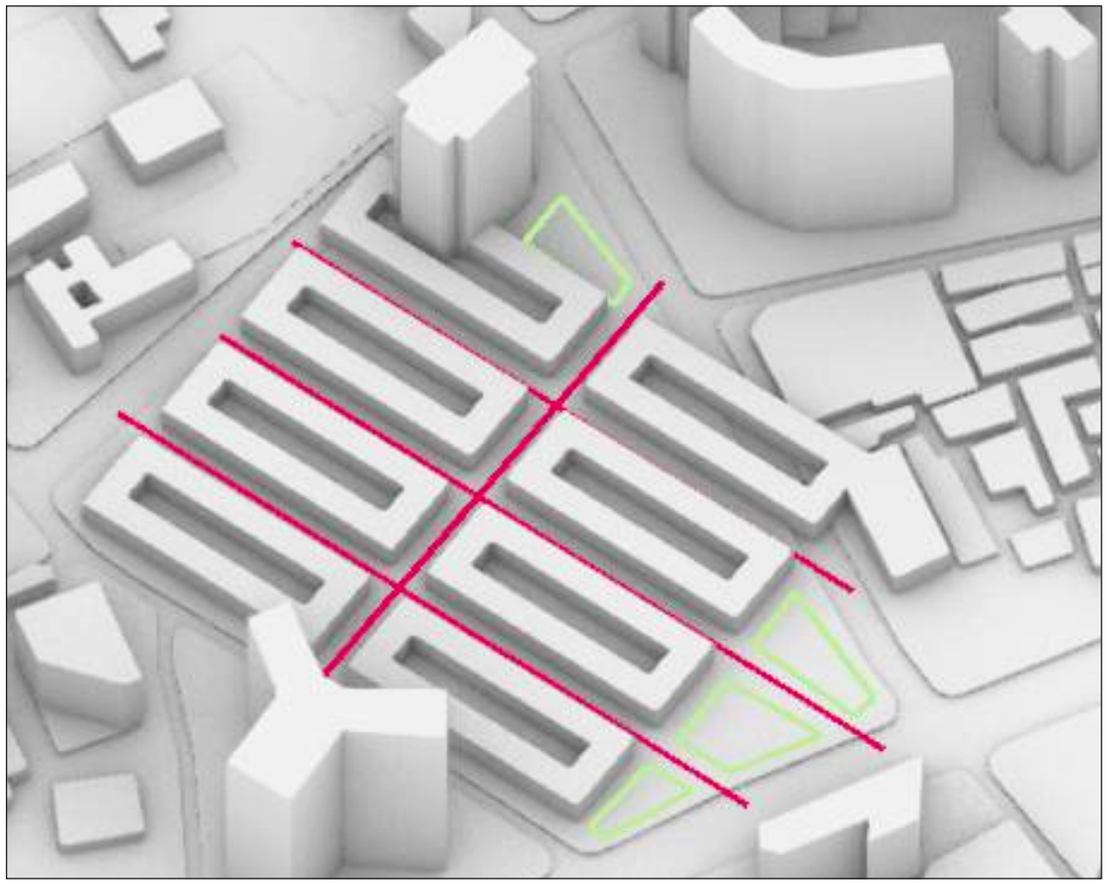


5. Diversify public space to increase homogeneity (avoid faceless).

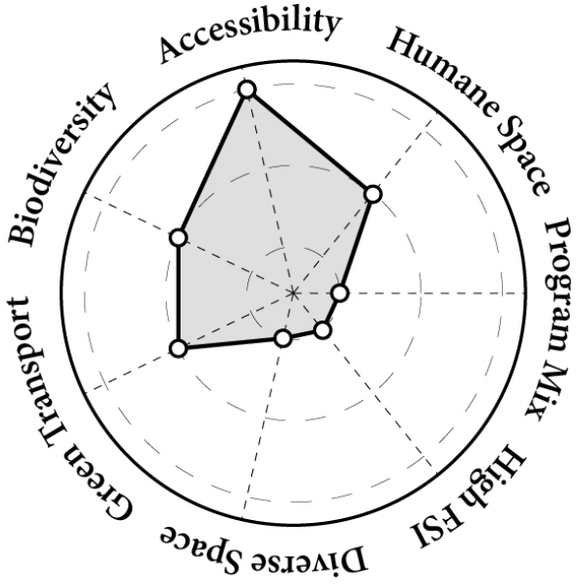
6. Mix function in low level of buildings that along streets.



Original

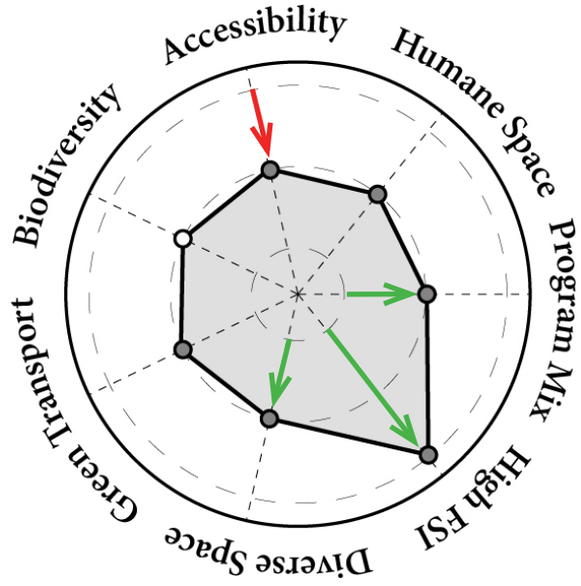


FSI: 1.66

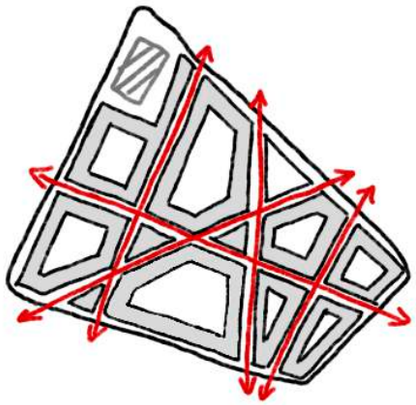


Improved

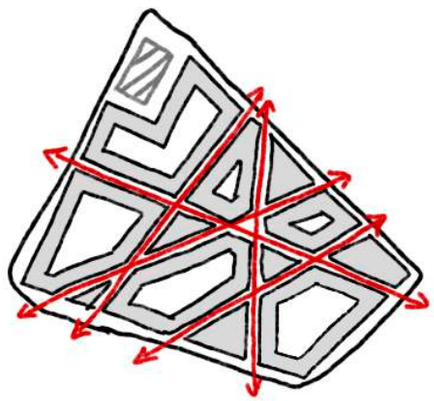
FSI: 3.97



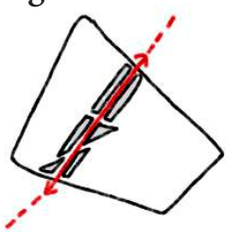
6. Paris Courtyard

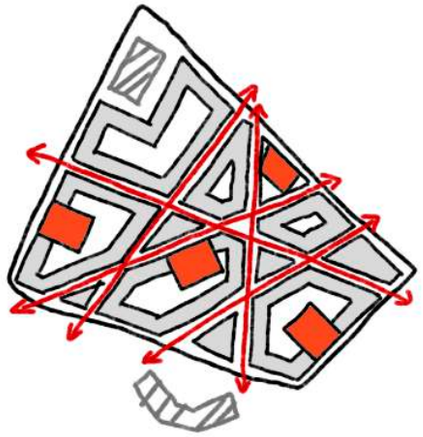


1. Introduce paris pattern Courtyard

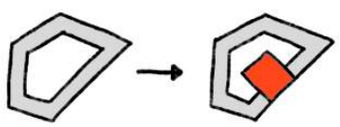


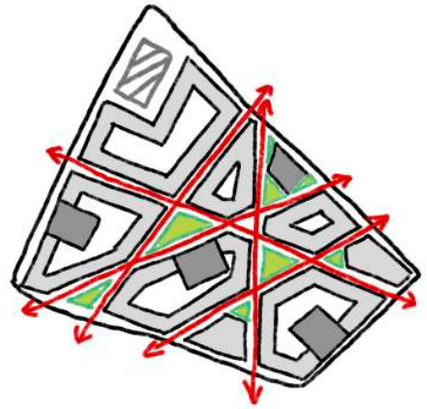
2. Updtae the circulation to connect surrounding streets.





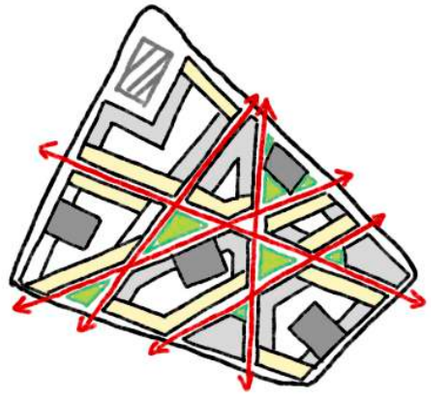
3. Add towers on top of slabs to increase FSI

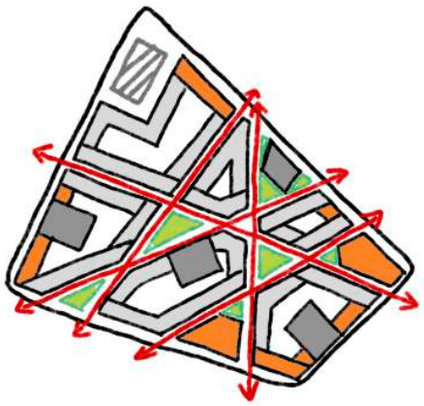




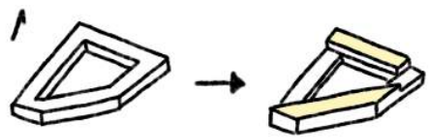
4. update acute buildings

Criteria	Judgement
Accessibility Step 2	Quite good grid streets, need to connect surrounding roads.
Human Scale Step 4	quite human open scale, but acute angle building can be improved.
Mix Step 6	Poor function mix, can mix function slong streets, like public service or commercial
FSI Step 3	Low FSI level, need to add towers to increase total area.
+ Others Step 5	- Sunlight condition is bad, update to gain more sunlight

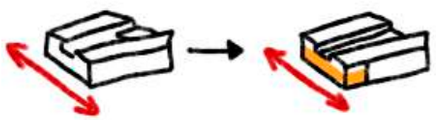




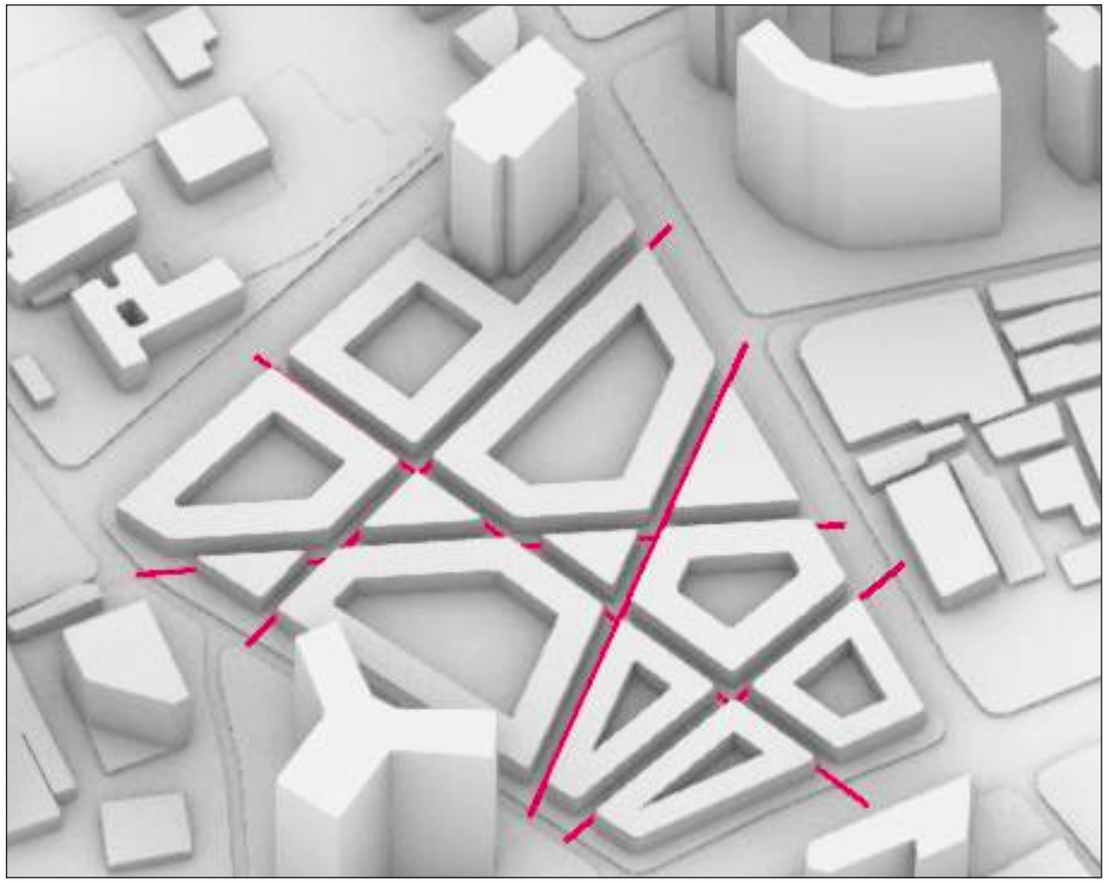
5. Increase south-north building and decrease east-west to gain more sun



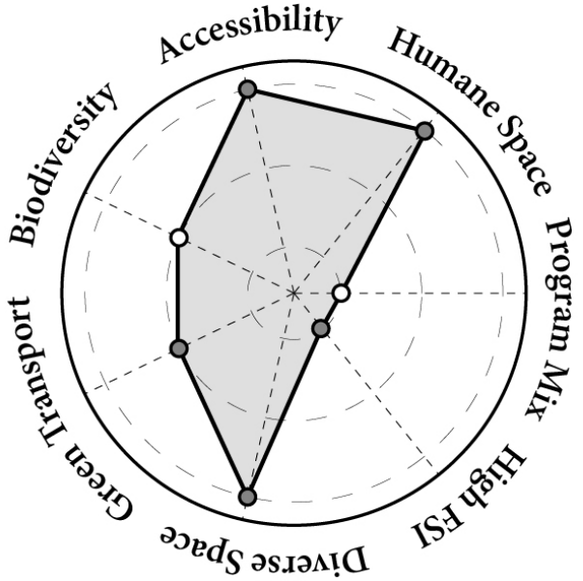
6. Mix function in low level of buildings that along streets.



Original

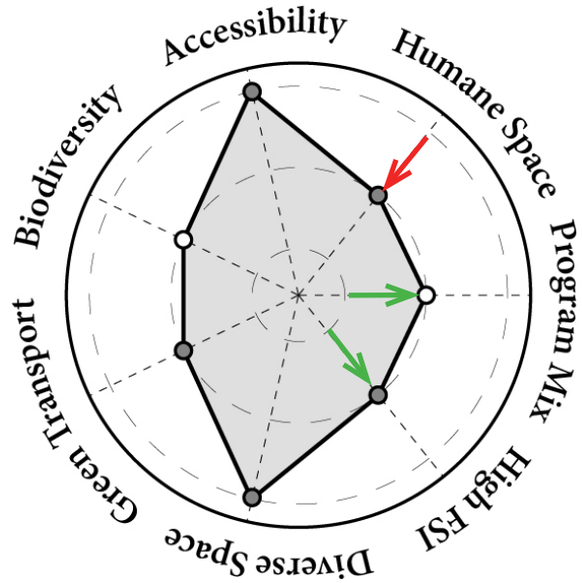


FSI: 1.82

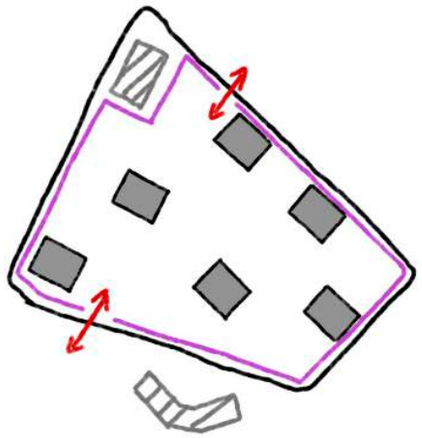


Improved

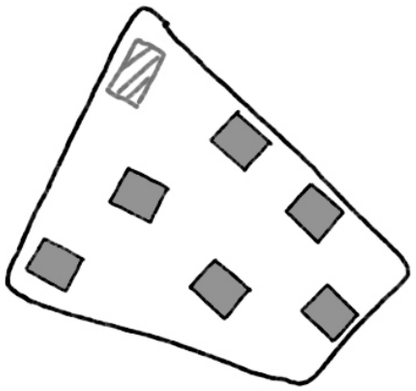
FSI: 3.83



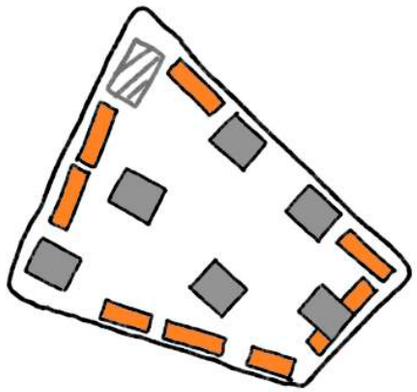
7. Xiaoqu



1. Introduce Xiaoqu Towers



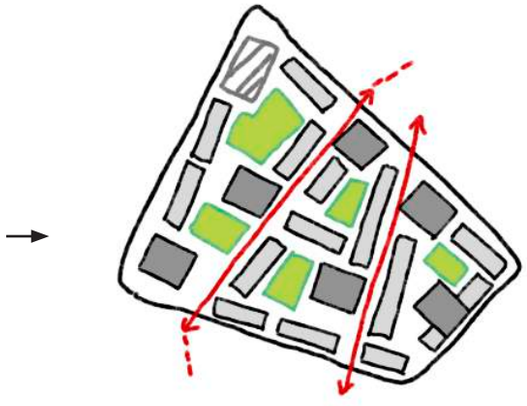
2. Remove the fence to make neighbourhood accessible



3. densify streets side with mix function to increase vitality on streets

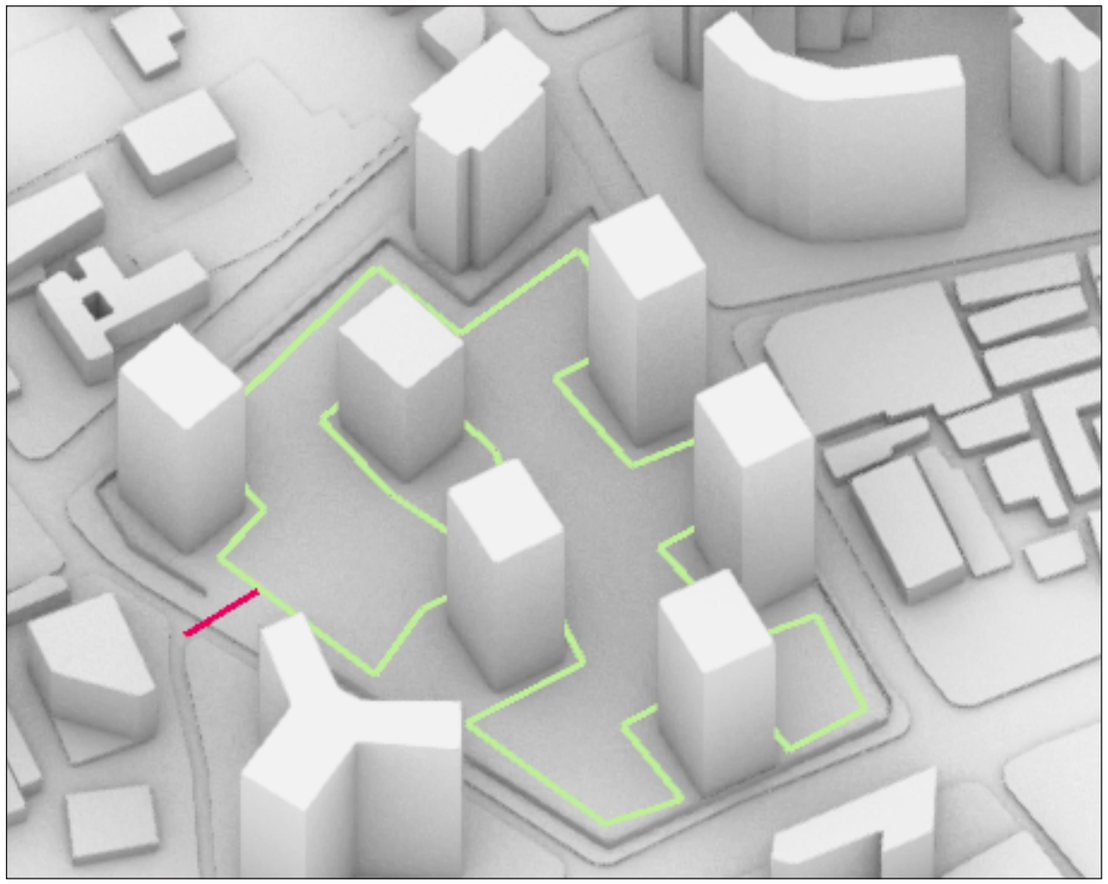
4. Densify blocks to diversify space and make it human scale

Criteria	Judgement
Accessibility Step 2 Step 5	Closed with fences, not accessible.
Human Scale Step 4 Step 3	Space is too spacious, streets is not walkable, need to make it more human friendly.
Mix Step 3	Poor function mix, can mix function slong streets, like public service or commercial
FSI	Maximum FSI, can be sacrified a bit to improve quality
+ Others Step 4	- building is too homogenous - Sunlight condition is great

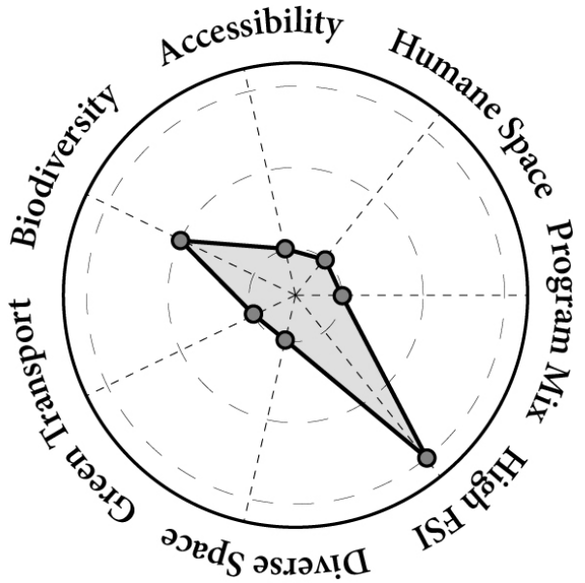


5. Update path to connect surrounding roads.

Original

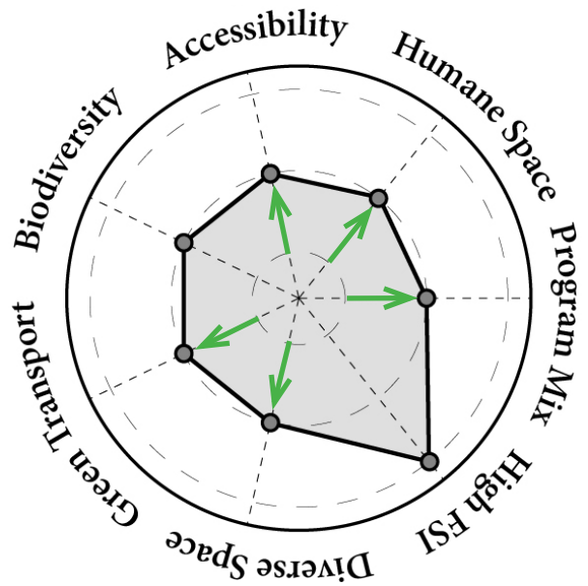


FSI: 3.90



Improved

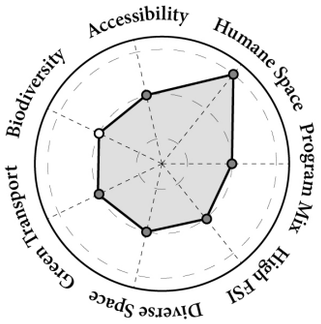
FSI: 4.68



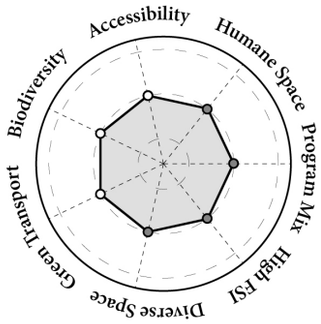
Comparison

By comparing seven design options of evolution product, the Wevead Slabs is chosen as the one for future refined design.

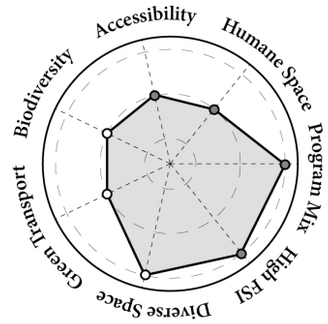
Grid Slab



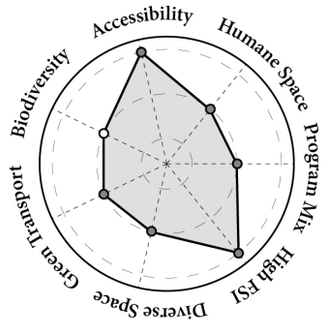
Offset Slab



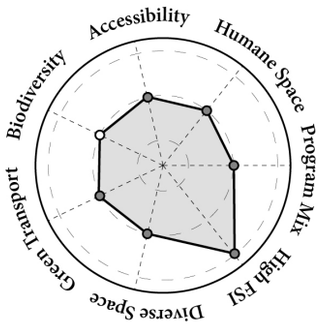
Weaved Slabs



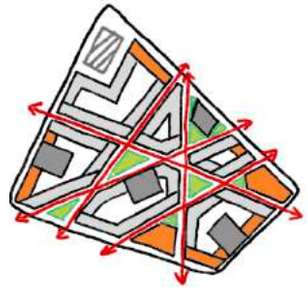
Courtyard

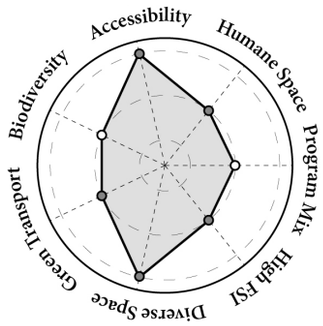


Dutch Coutyard

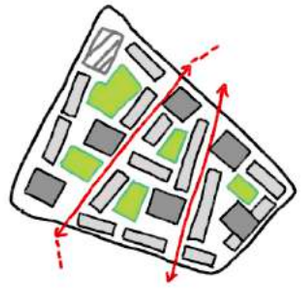


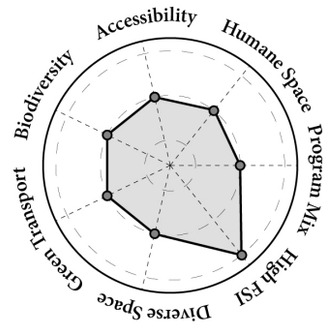
Pairs Courtyard





Xiaoqu+





Refined Design Evolution

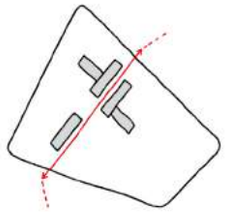
Design Action *for Weaved Slabs*

Apply Design Action with Quality to Later Design Evolution

✕ May not suitable

Accessibility

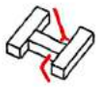
Building along Main Path



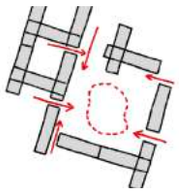
Lift Building

Open Door

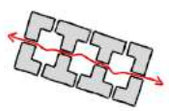
Add Sky Path



Centralised Accessible Space

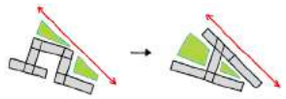


Series Courtyards



Human Scale

Intimate Street



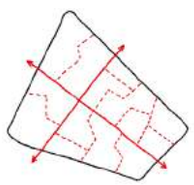
Postive Courtyard Garden

Secondary Level Public Space

Highrise Collective Space

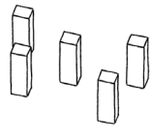
Step Back Slabs

Bike/Walk First Path

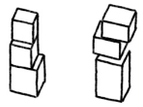


FSI (sunlight)

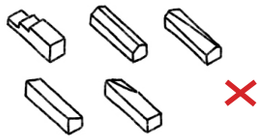
Add Towers



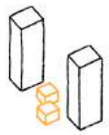
Stepped Towers



Sunlight Friendly Roofs

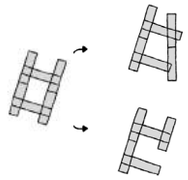


Non-Residential Densification

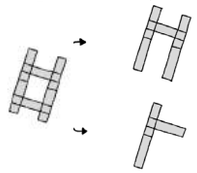


Diversity

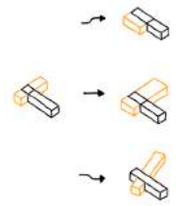
Rotate & Split Courtyard



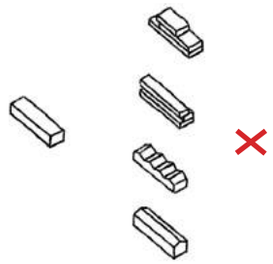
Open Courtyard



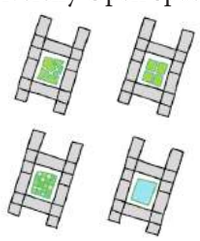
Transform Slabs



Diversify Slab Roofs



Diversify Open Space



Mix

Mix Low Level along Streets

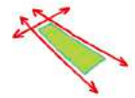
Mix in Weaved Slabs

Flexible Program Space

Sustainability

Various Green

Public Bio Forest

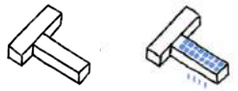


Open Greenland

Collective Bio Garden

"Private" Sky Garden

Solar Panel + E Bike Charger



Possible Evolution Direction

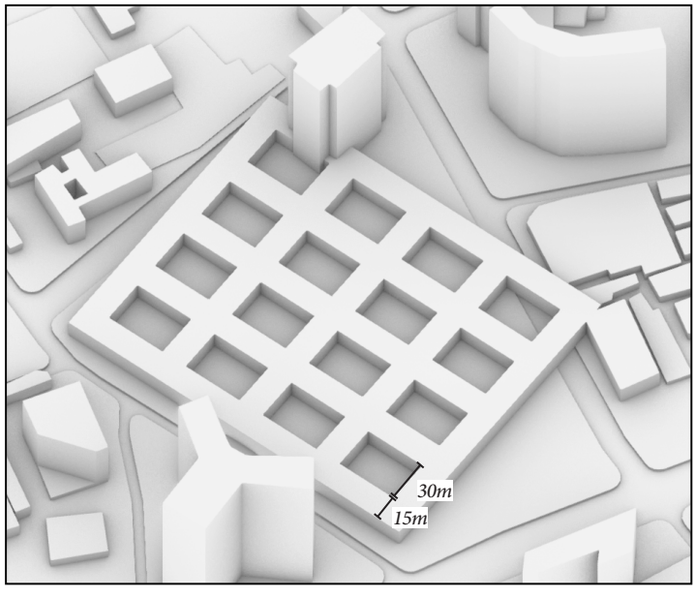
In the process of design evolution, there may be more than direction that has potential to become future design. In this case, the author developed multiple directions and chose the "better one" for design. For instance, as we can see from the below steps, the step 1.1.1 shows more dynamic space and sufficient space for adding towers than the step 1.2.1. Therefore, path 1-1.1-1.1.1 was chosen for future design.

1 Weaved Slabs

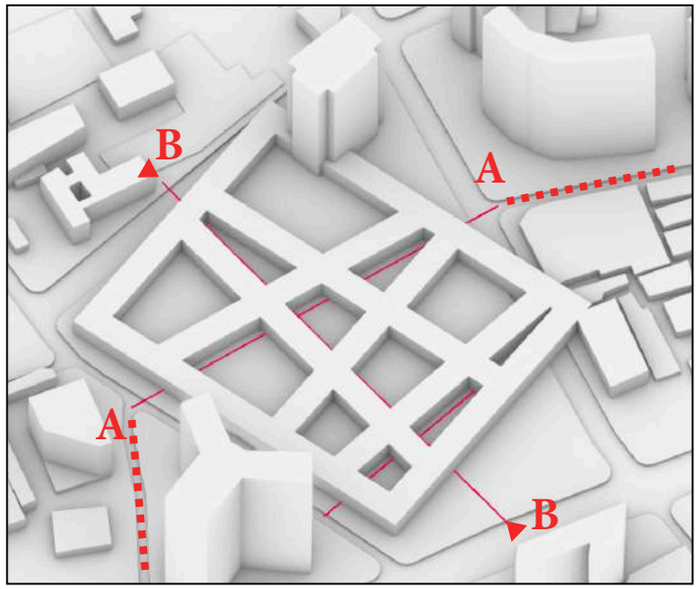
2 Connect City Roads

3 Adapt Site

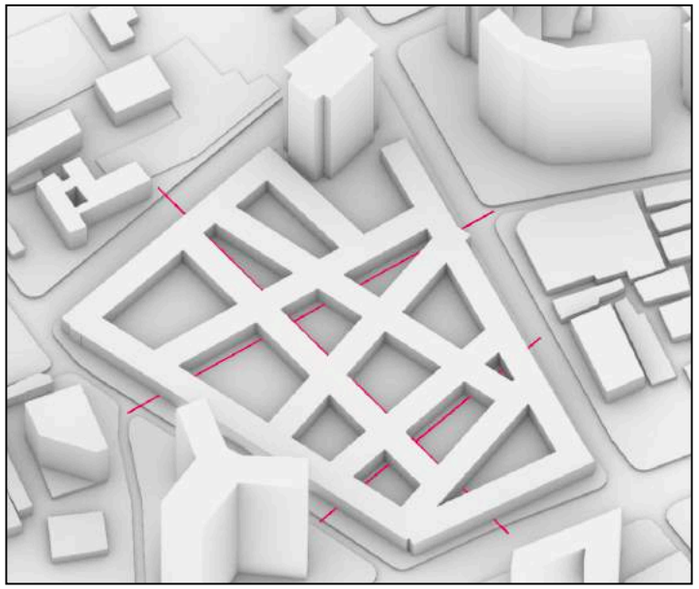
1



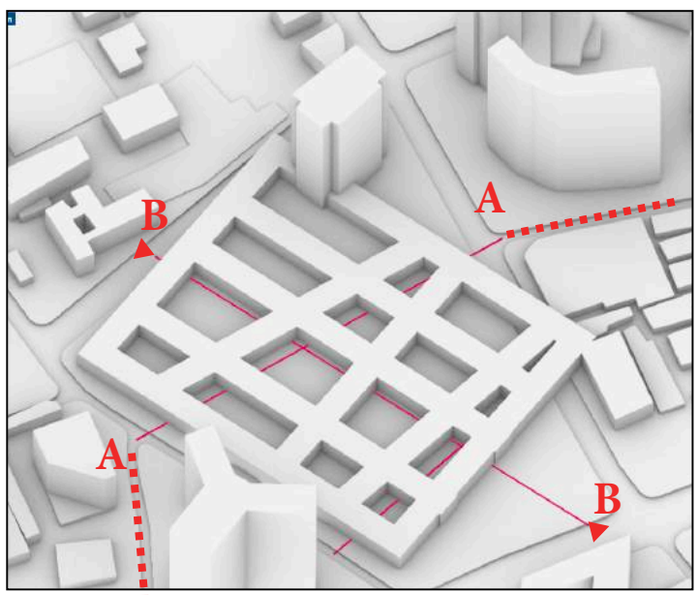
1.1



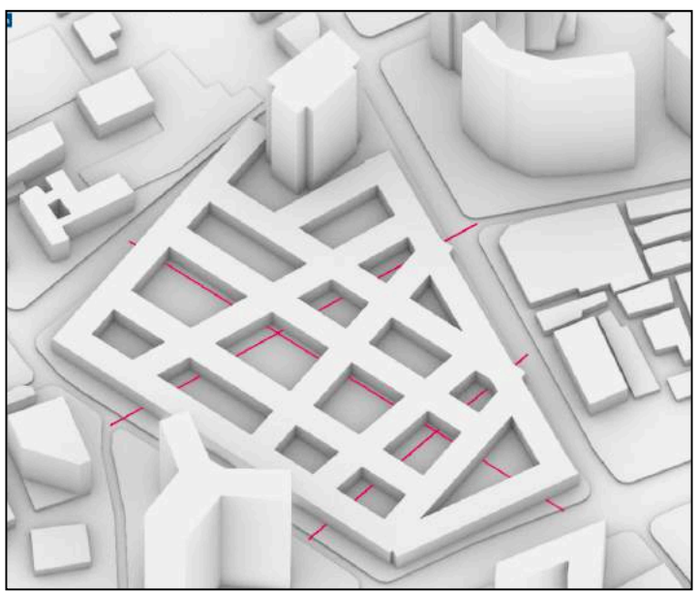
1.1.1



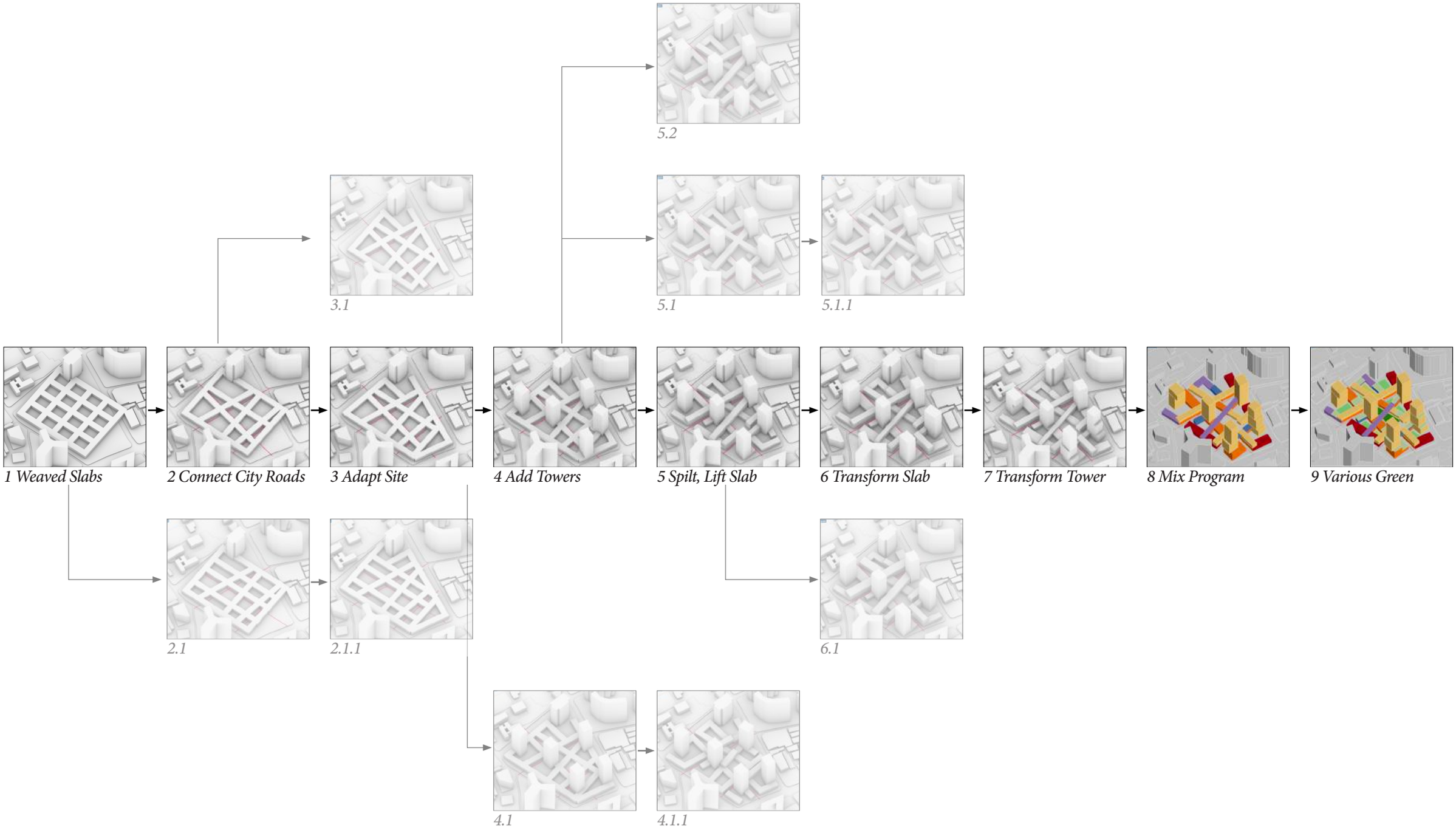
1.2



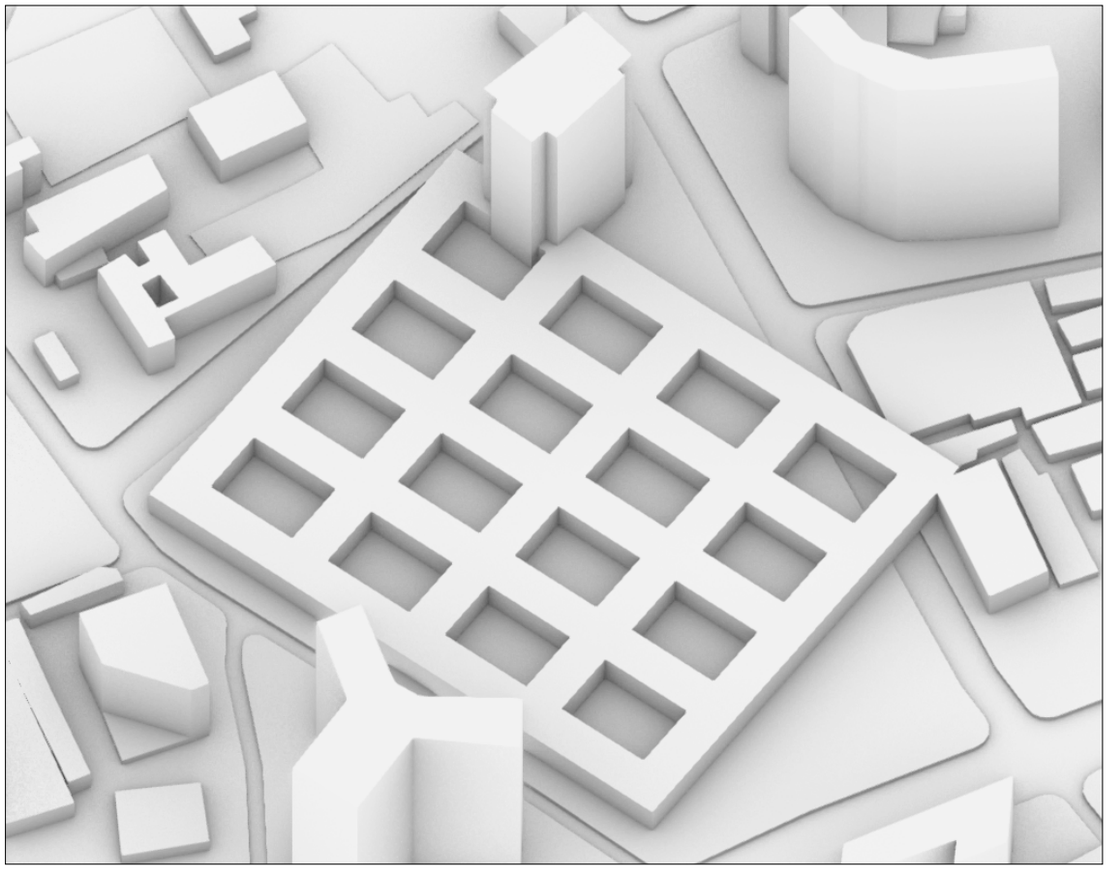
1.2.1



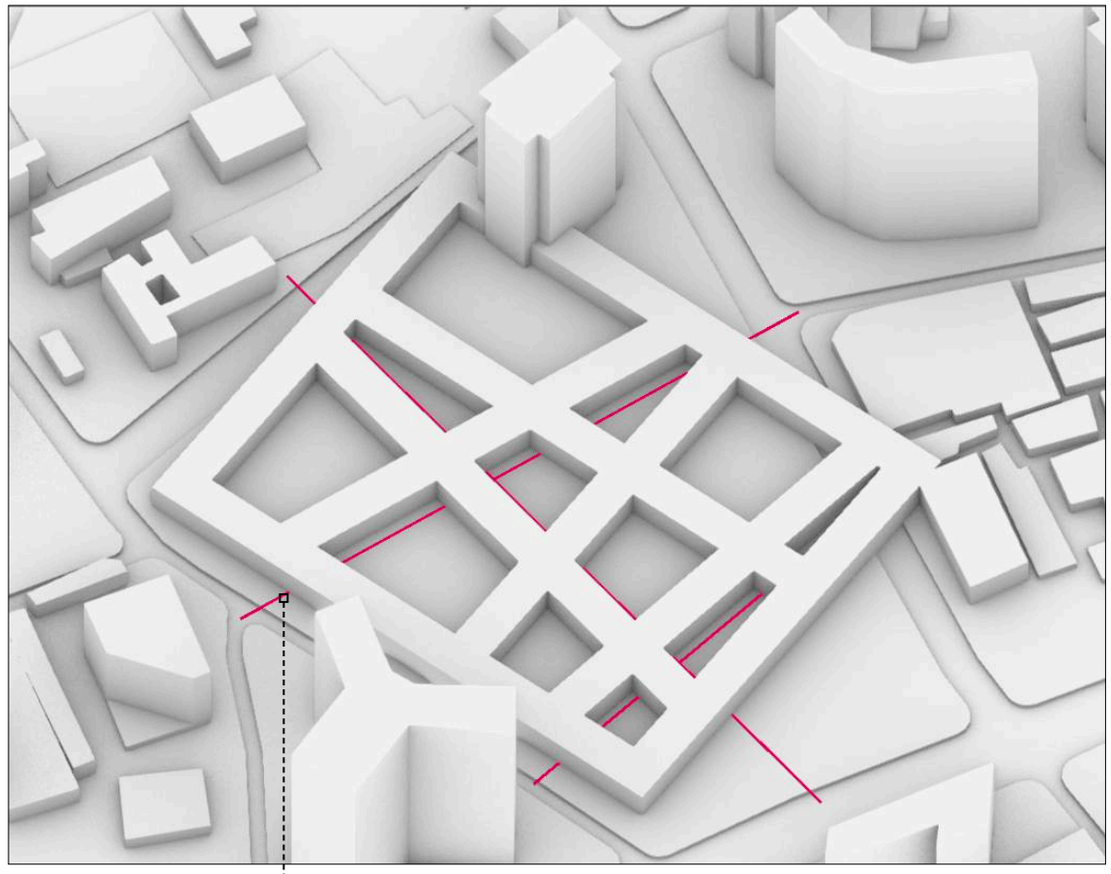
Evolution Path Flowchart



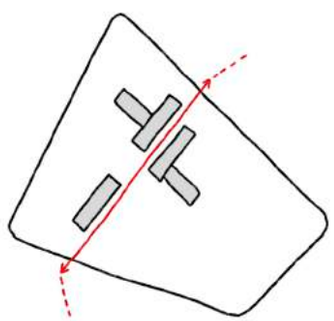
1 Weaved Slabs



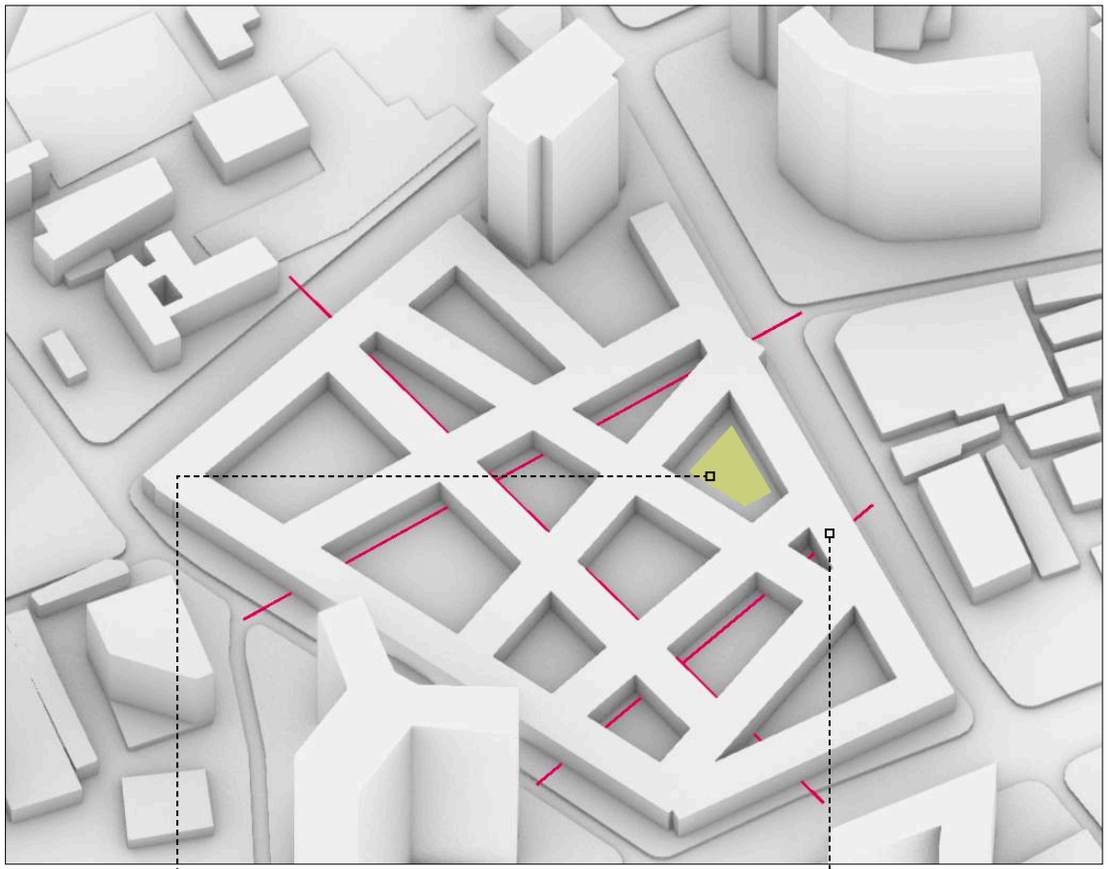
2 Connect City Roads



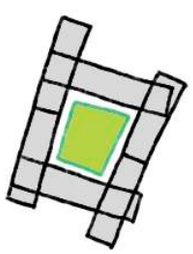
Building along Main Path



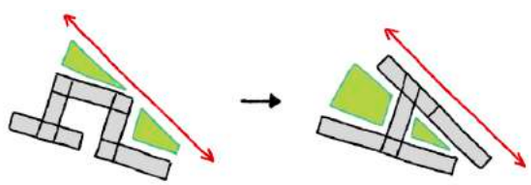
3 Adapt Site



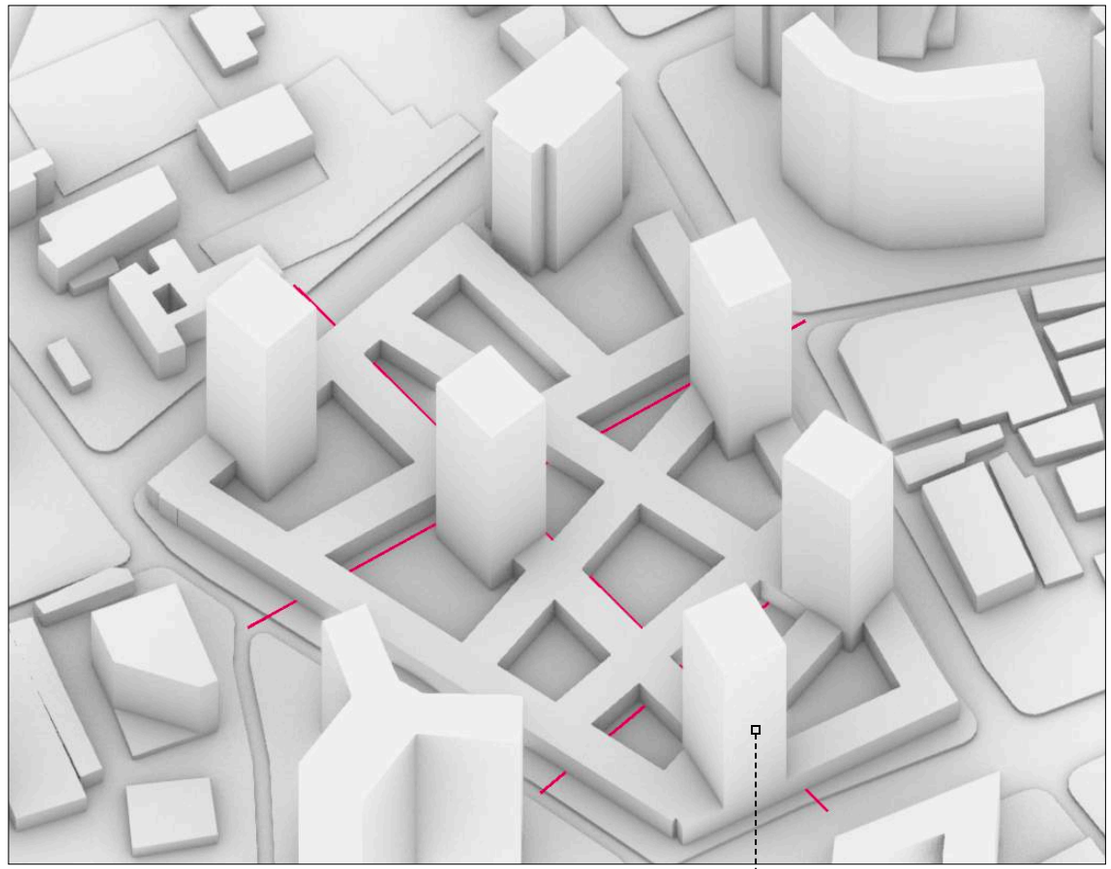
Postive Courtyard Garden



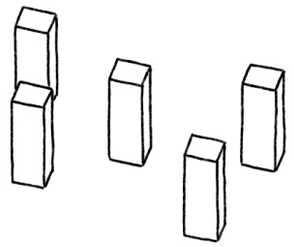
Intimate Street



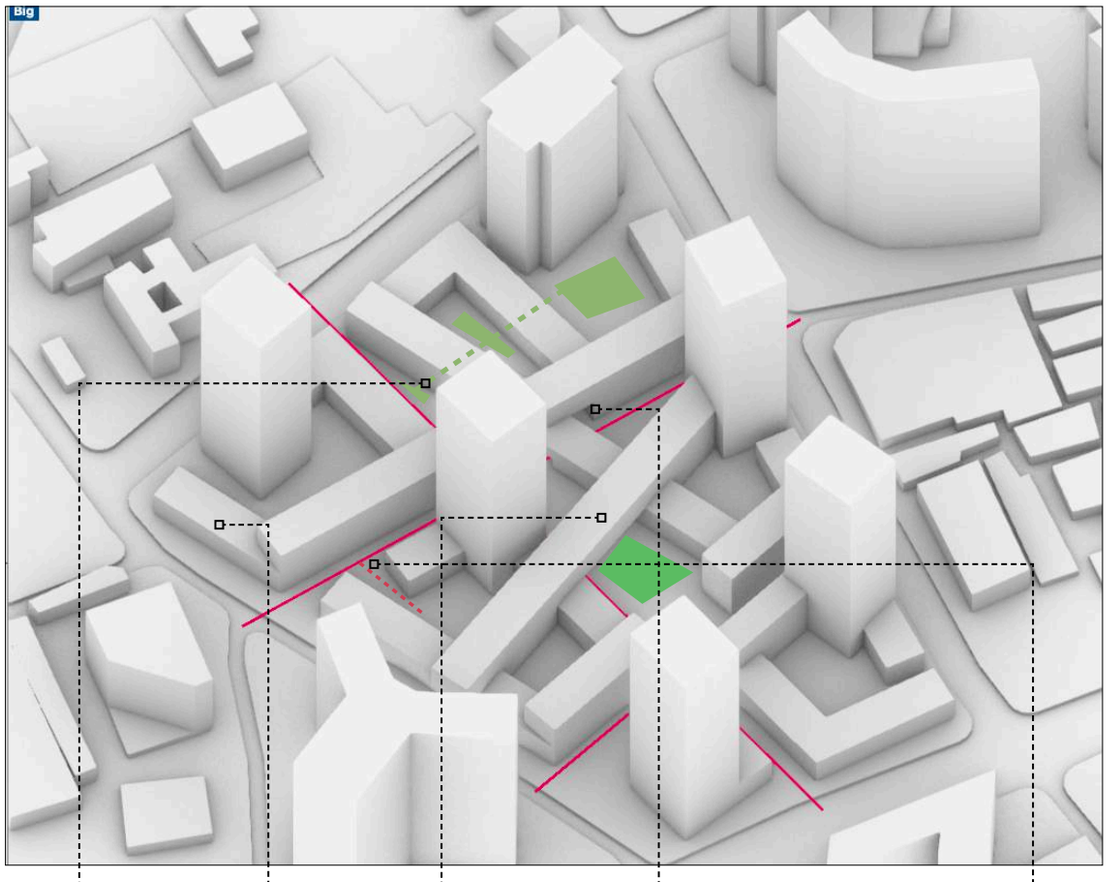
4 Add Towers



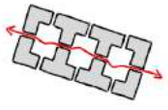
Add Towers



5 Spilt, Lift Slab

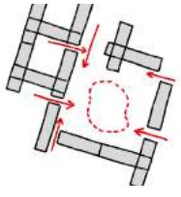


Series Courtyards

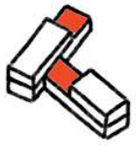


Lift Building

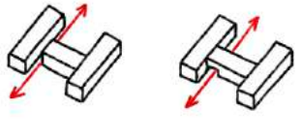
Centralised Accessible Space



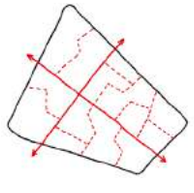
Secondary Level Public Space



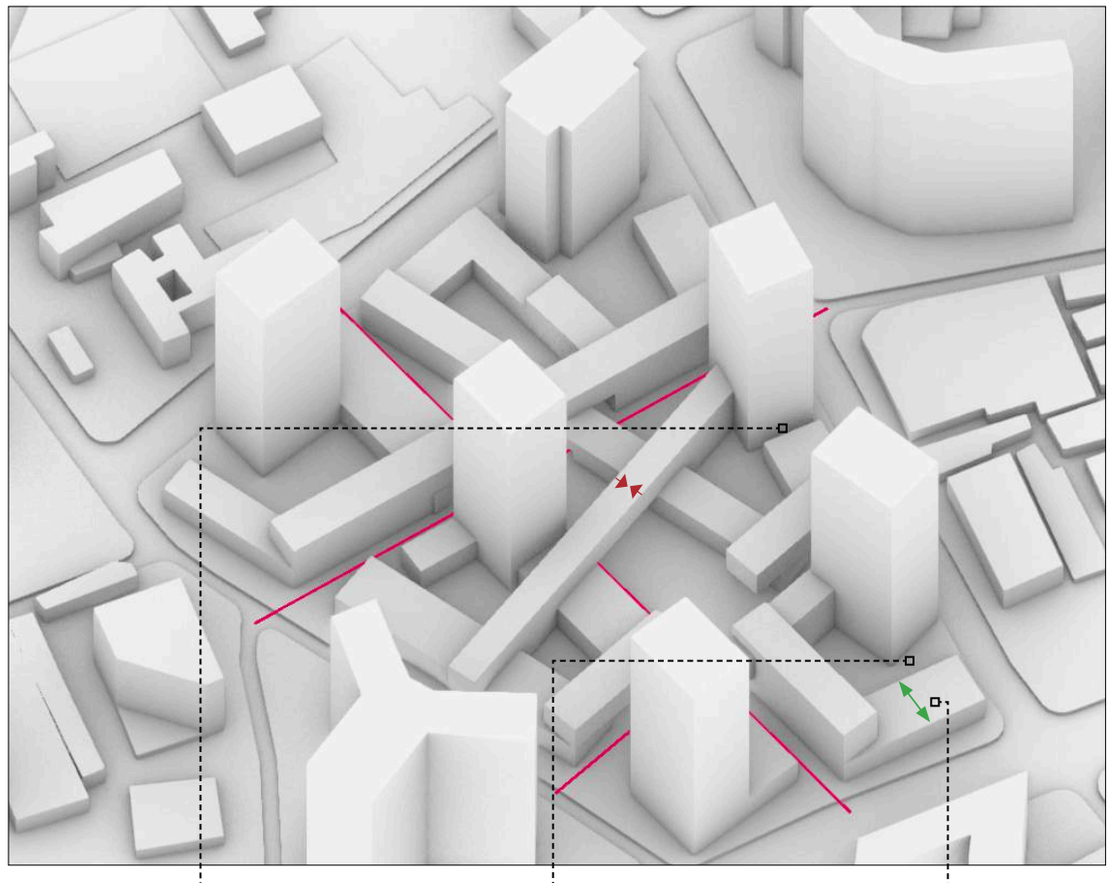
Open Door



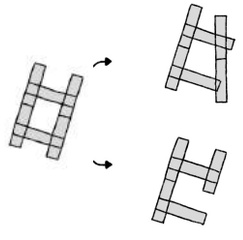
Bike/Walk First Path



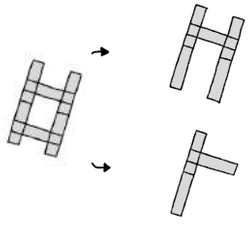
6 Transform Slab



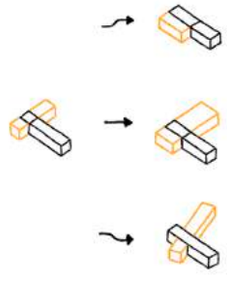
Rotate & Split Courtyard



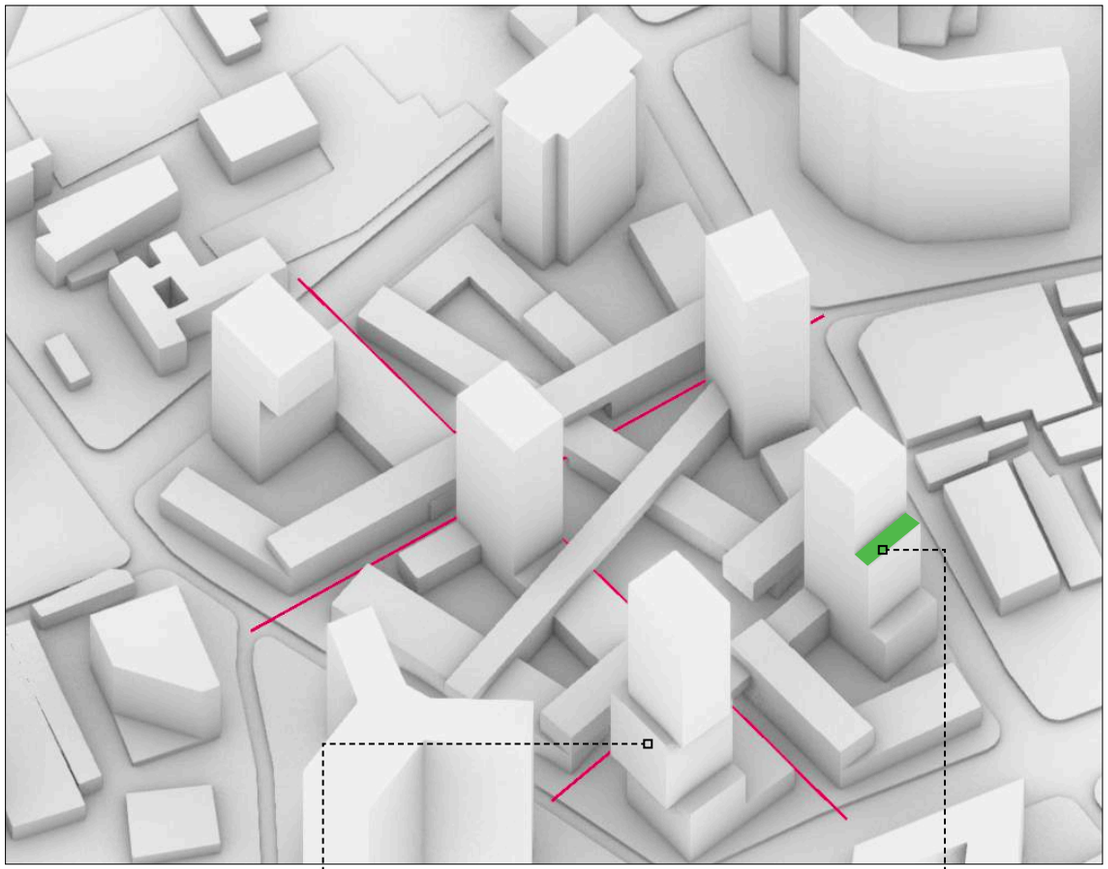
Open Courtyard



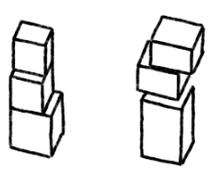
Transform Slabs



7 Transform Tower

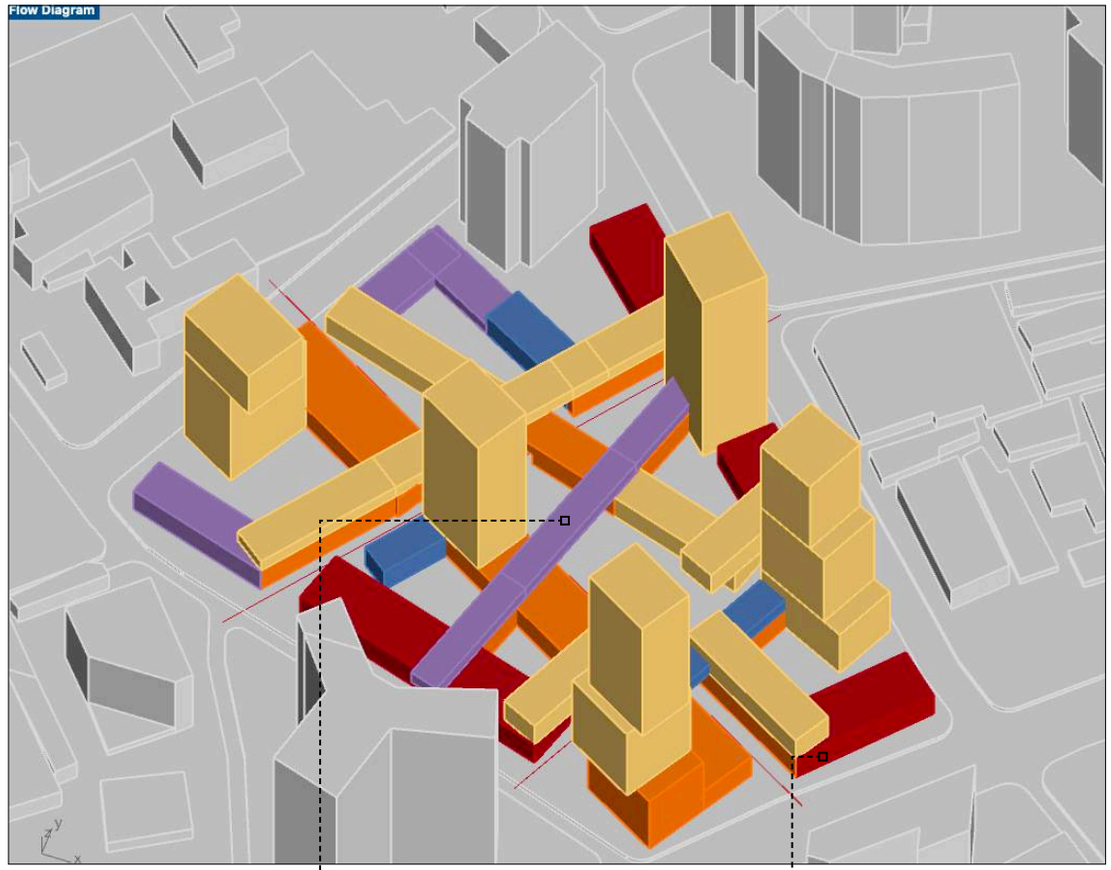


Stepped Towers

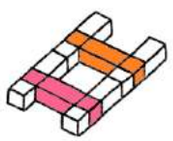


Highrise Collective Space

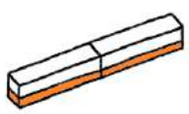
8 Mix Program



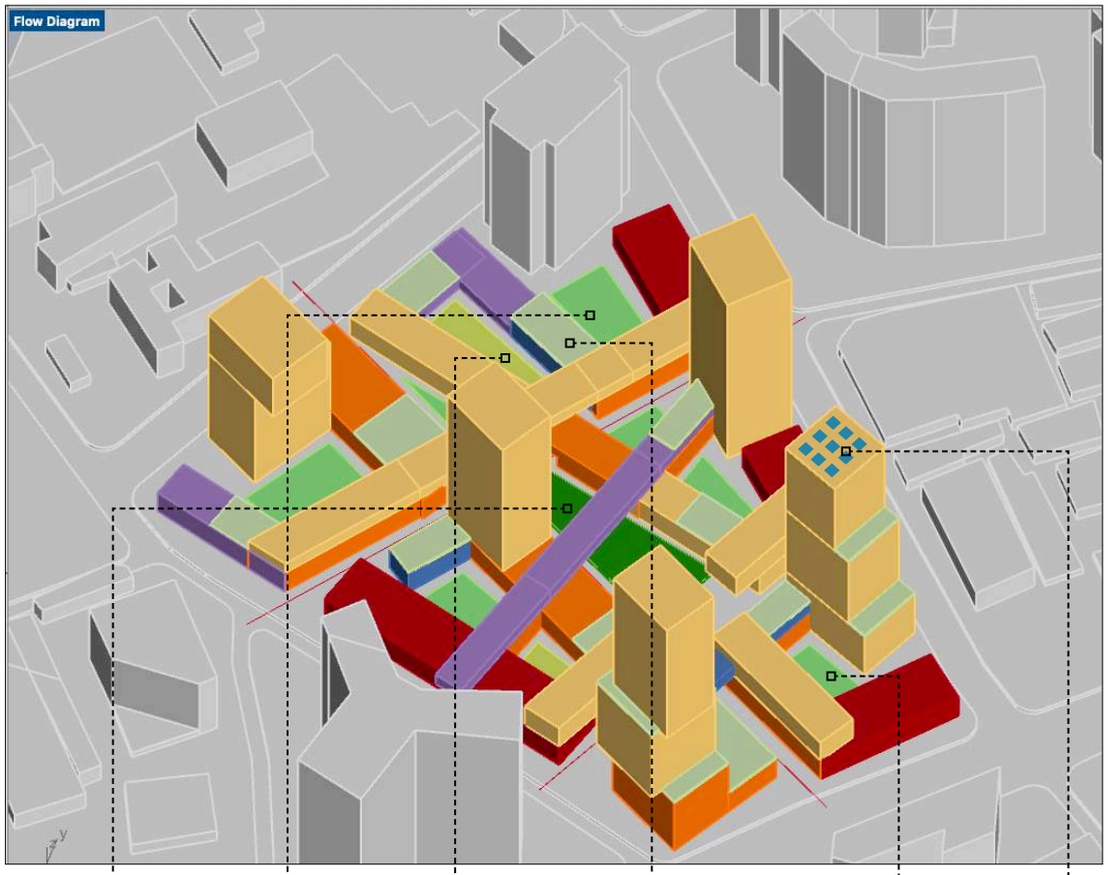
Mix in Weaved Slabs



Mix Low Level along Streets

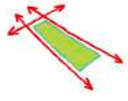


9 Various Green



Various Green Space

Public Bio Forest

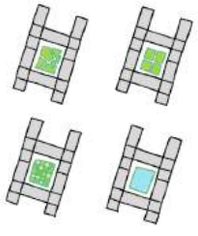


Open Greenland

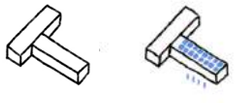
Collective Bio Garden

"Private" Sky Garden

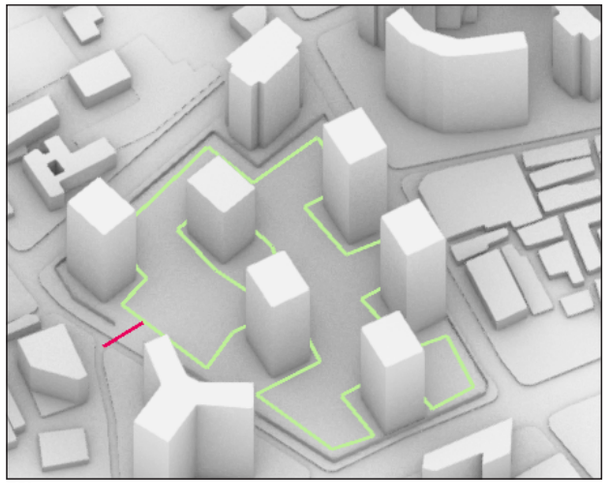
Diversify Open Space



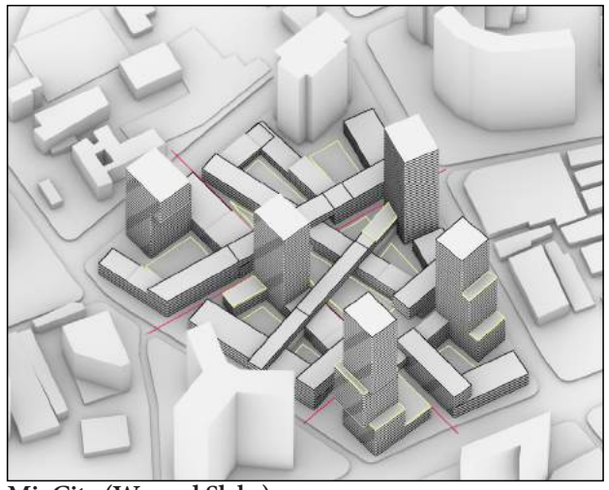
Solar Panel + E Bike Charger



Compare to Xiaoqu



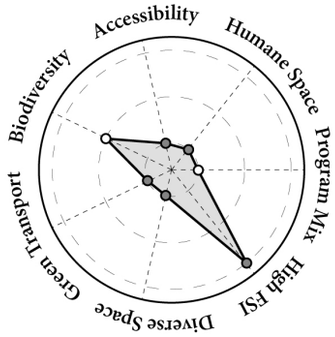
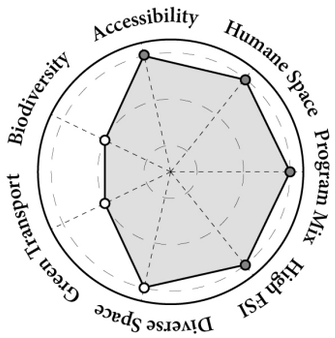
Xiaoqu



MixCity (Weaved Slabs)

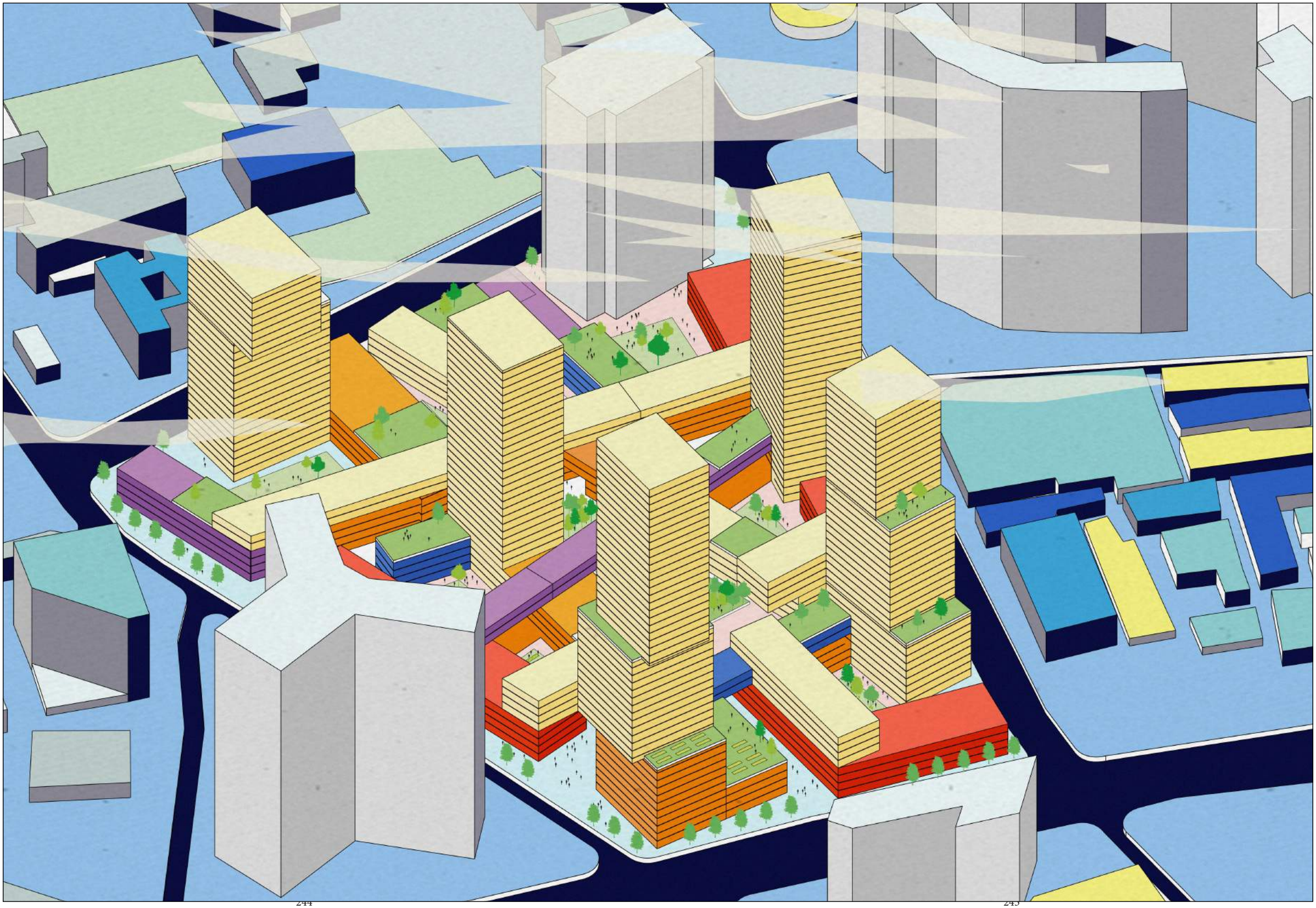
Comparing with Xiaoqu, we can found that many aspects of quality have been updated. With a similar level of FSI, we can create a more sustainable living neighborhood.

From the spatial perspective, the highrise part is actually quite similar. The main difference is in the lowrise part. For the designed MixCity, many low-rise buildings are introduced to occupy the land. Though the GSI level may exceed the current building code, the OSR(or groud green rate) may be lower than expected, the program of non-residential can beyond the limit of urban zoning. The design itself does offer a better blueprint of Chinese cities, which encourages us to rethink the rationality of the current Chinese urban planning system.

Criteria	Xiaoqu	MixCity (Weaved Slabs)
FSI (< 4.0 is typical requiremnets)	3.9	3.5–4.7
GSI (< 30% is typical requiremnets)	29%	36%
Accessibility	Closed by fences, inclusive to inhabitants but exclusive to citizens	Open to cities and connect the city road, highly accessible.
Human Scale	Quite spacious outdoor space, normally fill with green grass and trees.	Has lowrise slabs in a pedestrain friendly scale, nice to walk.
Program Mix	Normally residential only, sometimes has commerical along the streets	Can easily mix with other program like commericla and offices.
High FSI	Normally maximum high, but below the requirements from zoing.	Lower FSI than Xiaoqu if follows the zoning code.
Diverse Space	Quite faceless, shows homogenous pattern with other Xiaoqu in the city.	Diverse building typology and public space.
Green Transport	Encourage cars since the block is closed by fences. No bike path.	Has open bicycle path and pedestrian path inside the block, encourage green transportation.
Biodiversity	Normally has lots of green, but with limited type of trees or other plants.	Has various type of green space such as central forest and bio gardens.
Evaluation Diagram		

Design Product

Axis View



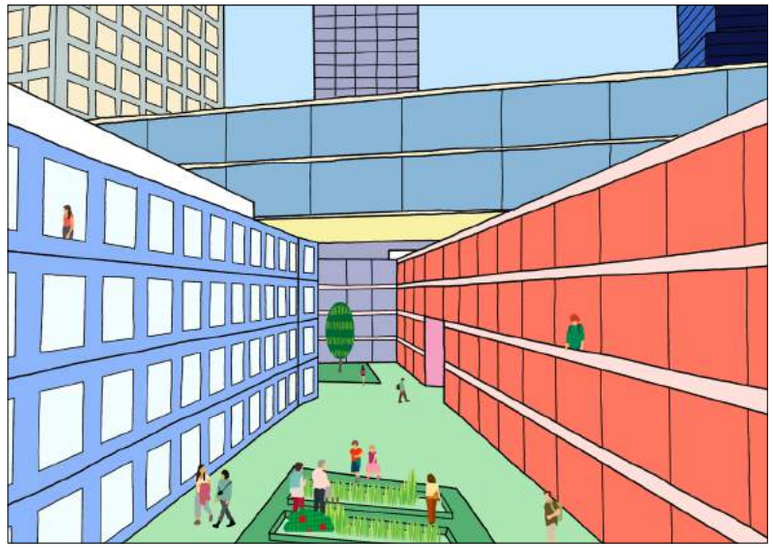
Eye Level

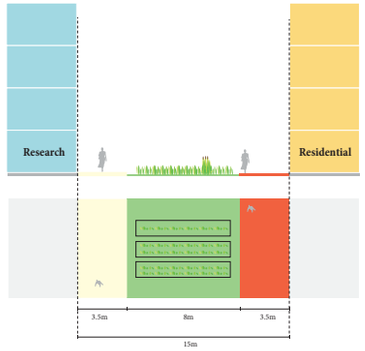
The eye level images show blueprint of future MixCity in a person's vision. The pictures show the pedestrian friendly streets and walkable outdoor space, also present the diversity of building typology and public space.

Street

Square

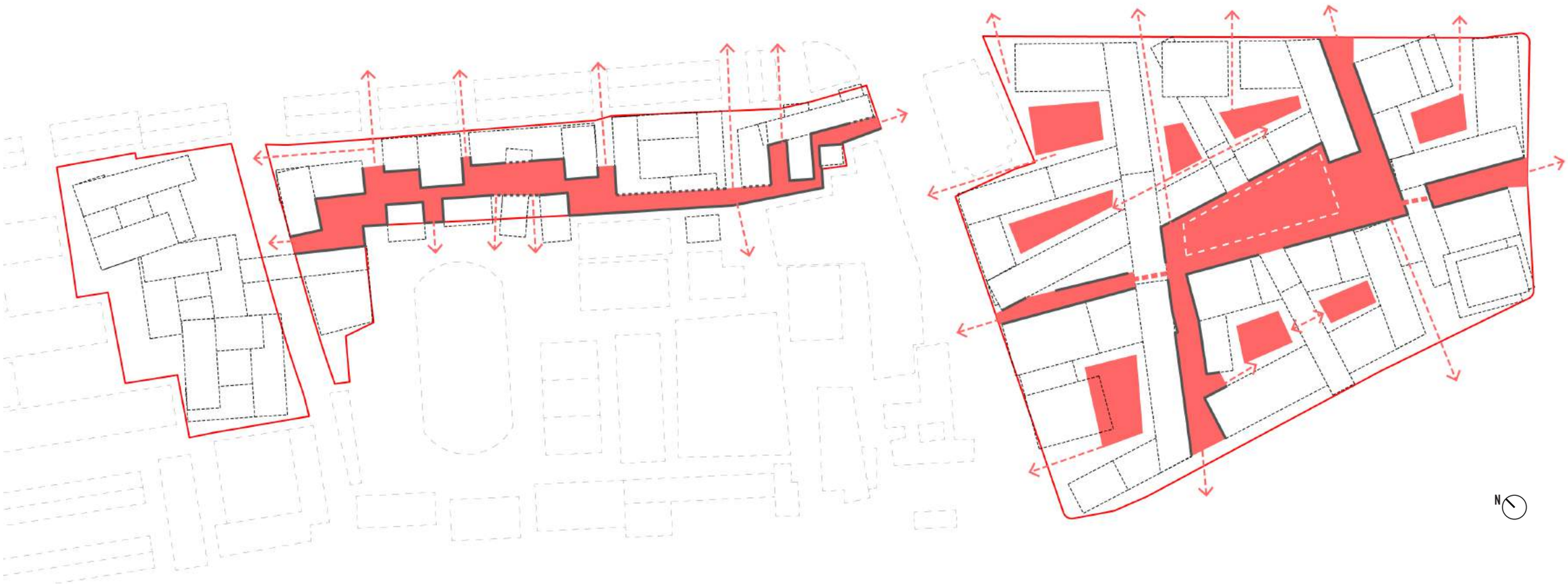
Courtyard (from building window)





Hierachical Space

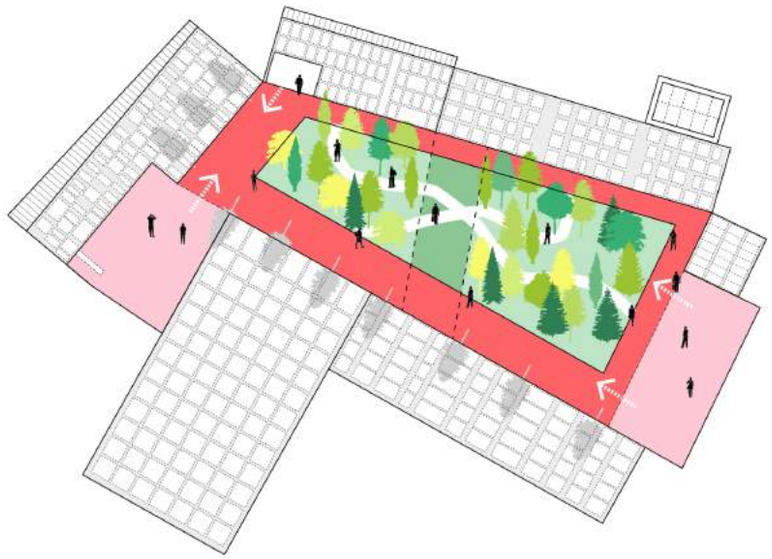
This diagram shows the hierachical system of path and space, which recalls the spatial identity of traditioanl Lilong urban fabrics. The inclusive path also shows the accessibility of MixCity.



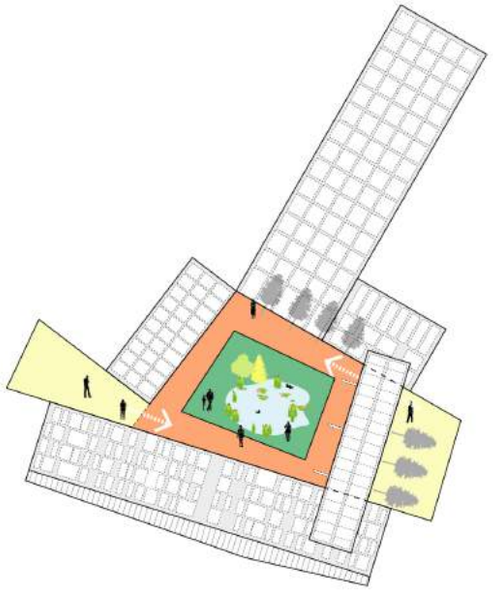
Various Green Space

These drawings show 4 types green space that related to accessibility. Central Bio forest is highly connected to cities, the Open Green land is open to citizens but less open than Central Bio Forest.

Central Bio Forest

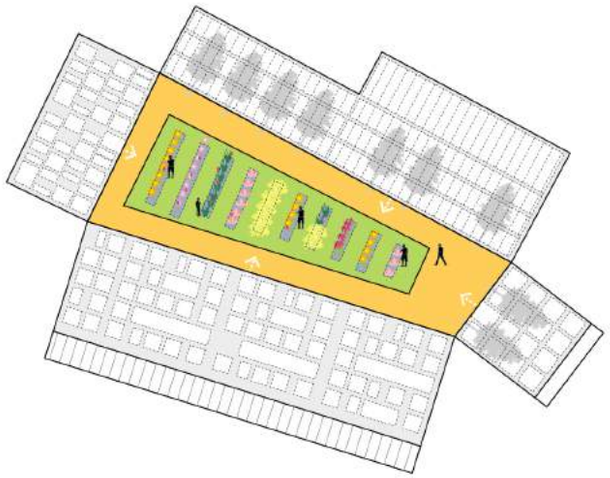


Open Green land

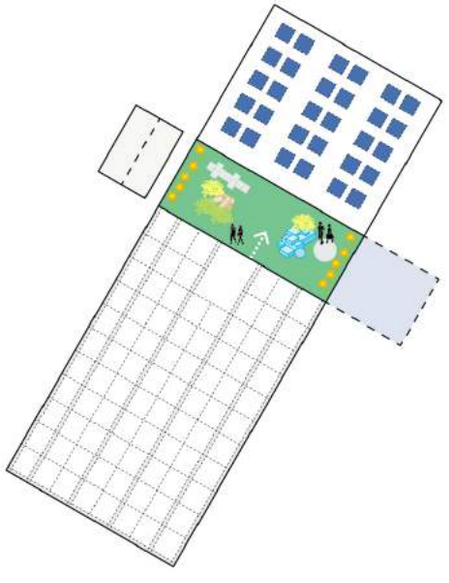


The Collectibe Bio Garden is less public and only for the people who live or work in nearby offcie. And the Sky Garden is alwasy connected to residential towers and it is exclusive for inhabitants.

Collective Bio Garden



Sky Garden



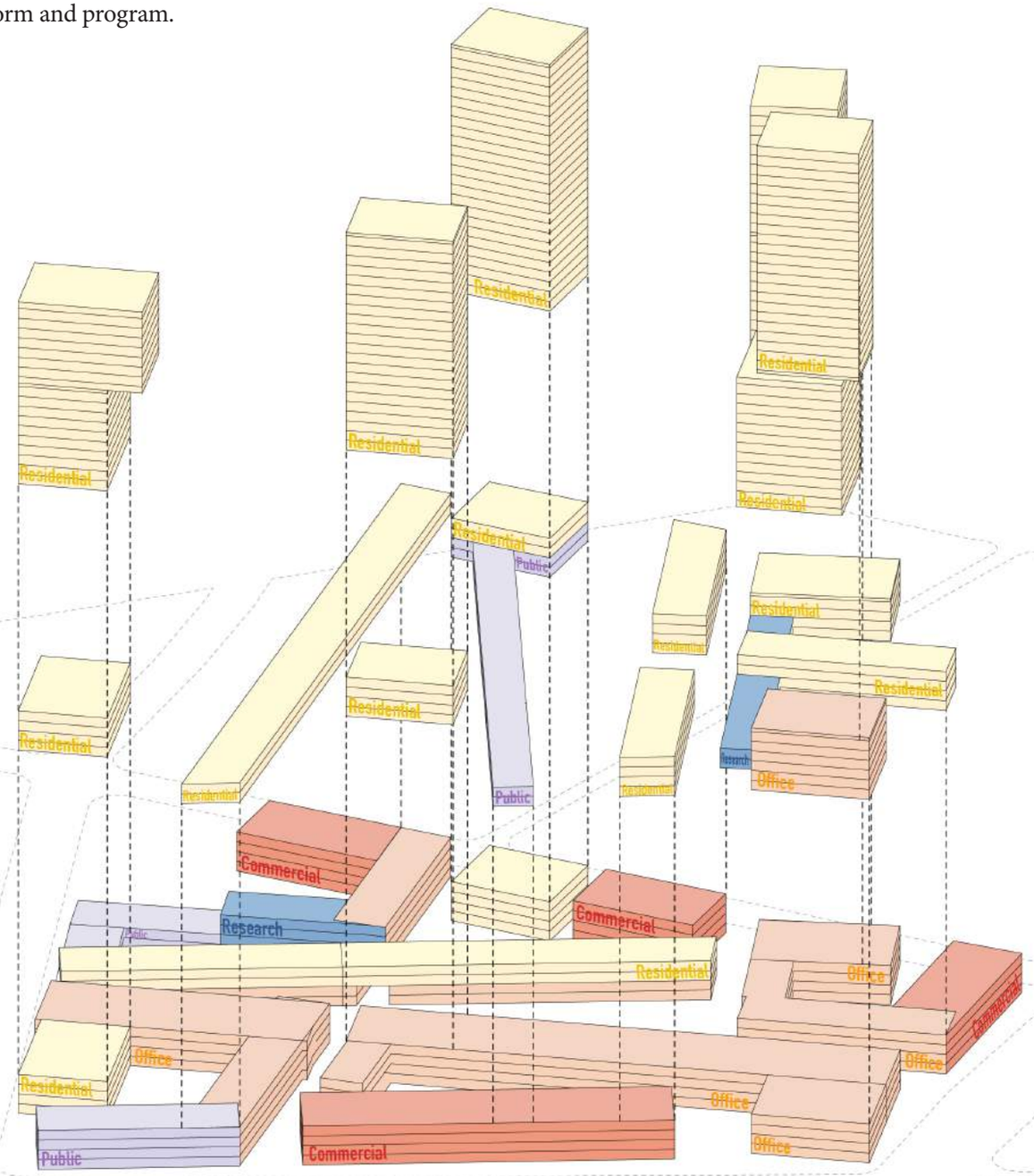
Weaved Program

This diagram shows the FSI and Mix program of MixCity, it explains how program are weaved and mixed in various ways. The distribution of floor area and program show a dynamic composition of form and program.

High-rise

Middle-rise

Low-rise



Project Relevance

Scientific Relevance

The city of Shanghai has been through urban sprawl development for years. In the recent city master plan, the Shanghai government has decided to transform the sprawl mode to the compact city development. To accommodate the continuously growing population, still, the city needs to increase the capacity and density of residential housing. Theoretically speaking, there are many ways of densification, like add buildings in the city's void place, transform the lowrise building into highrise. But among all those densification modes in Shanghai, mixed-function densification mode has been rarely discussed in the academic world. Maybe it is because the zoning code in Shanghai is quite strict that residential-oriented mixed-function is hard to introduce. But theoretically, it could be an advanced way to increase density and relief population issues. Besides, there is almost no academic research adopting the spacemate methodology to analysis Shanghai's building environment. Therefore, I want to utilize those tools and focus the gap of densification by mixing in Shanghai to explore a sustainable residential neighborhood.

Societal Relevance

In the past decades, a large number of Lilong neighborhoods in Shanghai were transformed into monofunctional highrise residential districts. This urban renovation mode caused many problems, but people rarely introduce other ways because there is no time for innovation in the rapid urbanization, and the real estate market is very sensitive so that developers are afraid to make mistakes. In this condition, the Lilong is either been changed into residential districts or been protected as the precious heritage. There is almost no lilong that was transformed into a densified district with mixed functions. But it is reasonable to densify Lilong and introduce diverse functions to accommodate the increasingly growing population and improve efficiency. To bridge the gap, I want to explore the potential to renovate lilong in a different way. By studying mix building typology and mix use programs, we can envision a sustainable living neighborhood.

Ethical Paragraph

In the past four decades, the population of Shanghai has increased from 5.93 million(1980) to 26.32 million(2019). To accommodate this large number of people in the city, Shanghai has expanded its city area to the suburb, and the urban sprawl caused many issues for citizens. Firstly, some people who are living in suburb Xiaoqu typically go to the city center in the daytime, and the suburban neighborhood becomes inactive and lack of vitality. Besides, the office district in the central area may become empty since people are back home at night, it is insufficiency to utilize the expensive land, and the district becomes dangerous in the evening. Furthermore, the commuters have to travel a long distance to work, so they always spend a lot of time on transportation. For the benefit of citizens, it is urgent to solve those issues. On the opposite side to urban sprawl, densification and mix-use program is an effective way to introduce more homes for the growing population. By mix residential neighborhoods with other programs like commercials and offices, people can reduce commuting time, and inactive urban spaces decrease to some extent.

Reflection

Introduction

This project is about the housing problem in Shanghai, China. Since the current residential neighborhood development heavily relies on one Xiaoqu Mode (a type of large scale mono-functional high-rise gated community) and Xiaoqu causes some issues like privatization of public space and social segregation. This project is trying to solve those issues and provide an alternative model for urban development.

The research first explored the mechanism of Xiaoqu development, namely, why it dominated residential urbanization. Then the author illustrates the advantages and downsides of such development. After that, he introduced the vision sustainable living neighborhood as the answer to Xiaoqu. The vision leads to several goals like improving accessibility of community, increasing level of mix program in residential areas, and encouraging green transportation like walking and cycling. Besides, the author shows a case study of how similar "Xiaoqu" development goes in the global history of urban development.

Research & Design

Speaking of the design part, learning from "research by design" methodology. The author use design as a tool in the very first phrase of the project to dig problems of Xiaoqu. The design test unravels potential research issues. Besides, he did design tests in the different phrase of the research part, including the understanding of the context in the early research on Lilong (a type of low rise residential community), FSI and program design test of sample sites, and multiple design options for detailed urban design sites. The design itself becomes a continuous cue through out the project.

To summarise, The product of this project mainly contains a series of investigative researches on the residential community, and an urban design project as an alternative design mode for Xiaoqu.

Speaking of relation between research and design, this project is design-oriented. The author took advantage of the "research by design" mindset to develop his work in time. Instead of doing a large number of researches in the first place. He did quick wide readings to get some common sense of the high-rise residential blocks in Shanghai and use design as a method to explore the design cues and research fields of the project.

Methods & Relevance

For the relation of project, studio, and master track. This project is about densification in the rapid urbanization process. The theme is highly connected with the topic Densification/Intensification of Urban Fabrics Studio. It focuses on the urban design and urban renovation on housing and living neighborhood, which is one of the main research areas in the TU Delft Urbanism Track.

When it comes to elaborated research methods and scientific relevance. There are multiple research methods being adopted in this project. Firstly, the author took design as a research approach. Several "design test" was introduced in different period of the research process. He adopted this "research by design" approach since it can unveil the potential problems of different urban design scenarios. It worked very well and facilitated the construction of the logic line. Besides, he use the case study to understand how different residential community work in a long period of time; it helps to prove that Xiaoqu mode is not sustainable to some extend. Apart from that, the author took advantage of the parametric design approach. He scripted an algorithm to play with different building typology by inputting a flexible density index. It worked well while only in several scenarios related to spatial design.

About the social and professional aspects. In recent decades, the real estate market dominates quite a part of China's GDP. The developers mainly choose the high-rise mono-functional residential towers for building typology since it is most profitable. This profit-driven urbanism leads to some issues like monotony and privatization of public space. Thus, this project is trying to explore new kinds of modes for the living neighborhood. It encourages strategies like mix-use, small blocks to achieve the sustainable urbanism.

For ethical issues and design results, the project took the City of Shanghai as the research object and took multiple places for research, like the city center, normal urban areas, and suburban areas. Some sample sites are taken for various research and design tests. After that, one specific site in the city center area is chosen for comprehensive urban design. In this case, the author explores the blueprint for sustainable living neighborhood in Shanghai.

Mentor Feedbacks

Speaking of the feedback from my mentors, Rients and Ulf helped me a lot. To improve my immature design process, Rients introduced me to several sharp mindsets like "Simultaneity Workflow," "build a story and build trust," his investigative approach helped me to dig deeper into the project and make the storyline stronger. For example, in the project, I introduced an alternative mode of urban design to "replace" Xiaoqu development, through several aspects like program mix and FSI are analyzed, the trust is still lacking between the narrator and audience. I dived into literature and found out some really convincing cases in urban history. Besides, his philosophy of investigative research and evolutionary design inspired me to rethink my workflow of learning. Apart from that, Rients gave me the tight rhythm of Analysis-Design-Present "A-D-P-A-D-P…" loop of doing things, which helped me to making progress constantly.

Besides, Ulf offered me a complete framework when doing academic research. He helped me to make the research framework more coherent and understandable to readers. Moreover, his tutoring on the assessment part makes me rethink the design process. The evaluation of the design and quantitive method of measurability makes the report more complete and convincing. For example, several attempts had been made to evaluate the previous condition and design proposal. The ambiguous evaluation failed to tell the audience how the quality has been improved. Ulf introduced me to a method and diagram that clearly and comprehensively improved the assessment part.

Limit & Transferability

This project has it's limits, of course, the biodiversity part is somehow still weak, the urban design is only happening in one site instead of the whole three sites due to unrealistic expectations. And yet the most upset part is bought by Covid-19. Though in recent years, Chinese cities are more likely to open residential neighborhoods since President Xi encourages a more inclusive urban environment. The sudden crisis makes the Chinese government block many cities and force people to stay at home for months. The gated community was regarded as an essential solution to delay the spread of the virus. In this case, more open and inclusive living neighborhoods may hardly be seen in future Chinese urban design, which made this project less valuable.

Summary

As far as from now, I have learned a lot from this project. Through the graduation design, I first have sufficient time to dive into massive materials to understand deeply about the context. By having meetings with my tutors regularly, I start to get used to the design-analysis-presentation process. The process is like an evolution that lifts my project up step by step. Within the process, I learned how to think for different stakeholders (developer, citizen, designer, etc.), how to integrate design and research. But most importantly, to me, I learned how to build a story that makes the design convinced by the audience, I learned an investigative method of doing research and evolutionary workflow of doing design. I believe this approach can also be beneficial to my whole design career.

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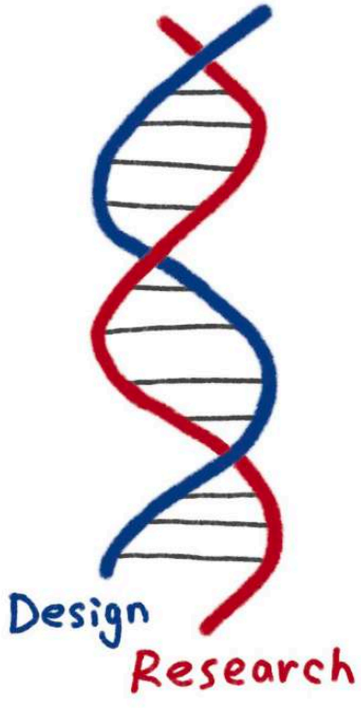
Appendix

Summarized Report Structure

This project take the investigative research and evolutionary design method, the relationship of research and design are bonded and weaved together like DNA stucture. The process of doing the report is also like an evolution.

Context	1st Design	Method	Theory	Quality Analysis	2nd Design Test	Site Analysis	3rd Design Test
Lilong, Xiaoqu, Shanghai...	*Design test*	*Research Question, Method, Output, Approach, Goal...*	*Theoretical Framework, qualities, measurebility*	*Researches on sustianability for people, profit, planet*	*Design test in sample sites for 3 options, gain better understanding for qualities*	*Sample Blocks: FSI, Area, Mix... , Design Action Summary, Sample block quick test*	*Learned from lilong identity and introduced Hierachic Path, Squeezed Voids, Weaved Slabs*

Xiaoqu Study	Design Evolution	Project Relevence	Appendix
Case Study on highrise monofunctional residential neighbnourhood in history	*Evolutionary Design with judgement on quality criteria for multiple typologies*	*Scientific, societal, ethic ..., Reflection, Reference*	*Road map and Acdemice Paper*



TypologyMaker: A Parametric Tool for Urban Density Study

Course: AR3U023_Theories of Urban Planning and Design
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Abstract

Spacemate (M.Pont and P.Haupt, 2004) is a tool that explains the relation between physical density and urban form. It is effective for the urbanist to evaluate density index and understand the building's volume in terms of morphological typology. It is mostly useful for categorization and comparison while it does little to gain a "practical" understanding of the urban fabric. It can be improved to become more useful as a design tool. This paper is trying to introduce TypologyMaker as a complemental tool to Spacemate. The author took advantage of Grasshopper3D (David, 2007) parametric software and introduced TypologyMaker as a tool for urban volume study. He illustrated the framework of TypologyMaker and introduced related cases. Besides, he explained the application of TypologyMaker.

Keywords

TypologyMaker, urban design, urban density, volume study, Spacemate, parametric programming

Introduction

In 2004, M.Pont and P.Haupt introduced the Spacemate as a methodology to analyze the urban density. Unlike most urban density studies that only focus on the calculation of some density figures, Spacemate is quite systematic. It links the building typology to density index such as Floor Space Index and Ground Floor Index. Thanks to the holistic framework, all the building typologies can be categorized into the Spacemate chart (figure 01). This approach helps urbanist and researchers to classify and explain buildings in terms of density. However, Spacemate did not show the link's direction in another way around. Namely, it fails to indicate building typology through the density index.

In real urban design practice, the Dutch designers always do volume density study in the early phase of urban planning. In modeling software, they make 3d volume bricks according to density requirements and arrange them into distinctive building typologies (like figure 08, but do it manually). In this way, designers are able to perceive the feeling of compactness of buildings, and they can envision the spatial layout and future urban planning. This kind of volume study helps designers to test density

requirements and make design decisions for their sites. However, the current volume study is either efficient nor systematic. Firstly, urbanists learned existing cases such as "courtyard" or "row house" typology, and they made similar 3d volumes according to these cases. However, there are more unknown typologies that beyond one's knowledge. Besides, the volume of building bricks are carefully calculated, and it takes much time to adjust the dimension of buildings.
From the above discussion, we can find the lack of connection from density index to building typology. The gap is reasonable since there are so many variables such as *FSI, GSI*, building length, building width, and building numbers in a site. Thanks to parametric software Grasshopper, it is possible to input multiple parameters at the same time and build a tool to deal with them. This paper introduces TypologyMaker as such a tool to indicate possible building typologies by inputting density figures.

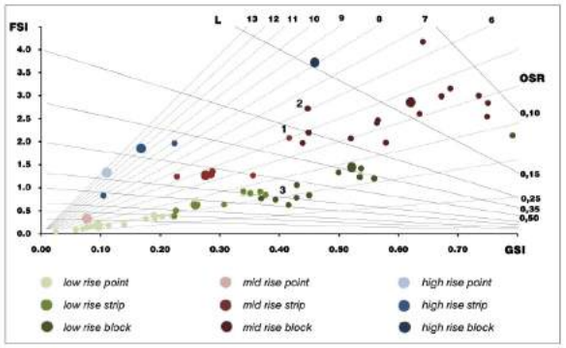

Figure 01: Spacemate Chart of Dutch Examples (M.Pont and P.Haupt, 2010)

Speaking of the parametric method, most of the parametric urban design is focusing on the flowing form of curved buildings. Apart from that, José Beirão (José et al., 2012) proposed a parametric system while mainly focus on urban plans instead of building typology. There is another paper (Pirouz et al., 2012) studied Spacemate and introduced a parametric tool on density. However, it did not focus on building typology, and it is in the city or district scale. For parametric density study in block and building scale, there is rare discussion found. In this situation, a parametric tool for holistic and efficient urban volume study in the block scale is needed. To solve problems of current volume study, the tool should:

- be able to apply to any site's context as long as there is density index
- be interactive, and it should provide "real-time" 3d model responsively while changing input parameters
- be intuitive to use and way faster than traditional volume study

Programming Framework

Since the parametric urban density study based on a NURBS environment (CAS Berlin, 1993), this paper chooses Rhinoceros3D (McNeel, 1998) for CAD environment and Grasshopper3D for a parametric programming interface. To build the tool, the first step is to define parameters. Parameters

can be divided into three parts. The first part is the site as the geometry. The second part is density index like *FSI, GSI, OSR, L*. The third part includes elements in building typology such as floor height, *a, b, Nx, Ny, Dx, Dy* (figure 02) would be explained below.

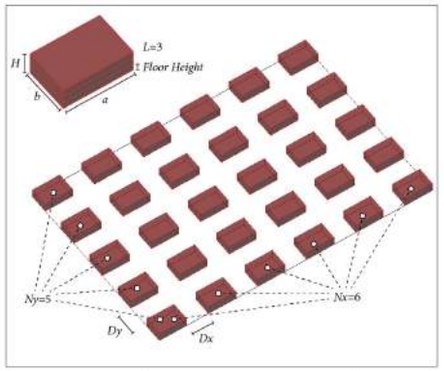

Figure 02: Typology Parameters in TypologyMaker

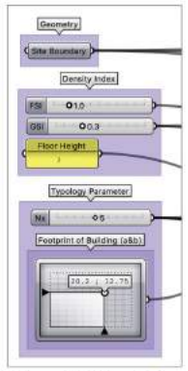

Figure 03: Input Parameters in TypologyMaker

- Site Boundary: it is rectangle and should be certain in a specific site. X-direction represents the long side, Y-direction is along the short side, Site Area can be quickly gain from the multiplication of two sides.
- FSI: Floor Space Index, also known as Floor Area Ratio (FAR), expresses development intensity in a site.
- GSI: Ground Space Index, expresses compactness of buildings in a site
- OSR: Open Space Ratio, expresses the openness and the pressure on the non-built space
- L: expresses the average number of layers in buildings in a site
- Floor Height: Height of one floor, normally 3–5 meters in a building
- H: Height of building, H = L*Floor Height
- Volume: Volume of buildings, Volume = Footprint Area*H
- a: length of building, a is in X the direction in this paper
- b: width of building, b is in Y the direction in this paper
- Nx: amount of buildings in X the direction
- Ny: amount of buildings in Y the direction
- Dx: distance of buildings in X the direction
- Dy: distance of buildings in Y the direction

To distinguish parameters into input and output. It is essential to clarify the relationship between them. Firstly, the site boundary as geometry is input, and we can gain site area out of the geometry. Besides, according to Spacemate (M.Pont and P.Haupt, 2004, P.33), if we know any two values of *FSI, GSI, OSR, L*, we can get another two figures. So, it is reasonable to choose FSI and GSI as input since those two are always density requirements in urban design. In this way, *L=FSI/GSI* and *OSR=1/FSI-GSI/FSI*. To build up the volume of certain *H* (Height of buildings), we also need to take a Floor Height as an input. Moreover, for typology parameters, we can quickly build the mathematical equation of footprint area

that *Site Area**GSI=a**b**Nx**Ny*. Since *Site Area (Site geometry)* and *GSI* are inputs, to make the system responsive, three of *a, b, Nx, Ny* should be input parameters so that the other one can be the only output parameter. Furthermore, because the parametric system can not react towards multiple independent outputs. To control the buildings' spatial form in typology, a and b should be inputs at the same time. From the above discussion, we can conclude that:

Input Parameters (figure 03):

- Geometry: *Site Boundary*
- Density Index: *FSI, GSI, Floor Height*
- Typology Parameter: *a, b, Nx*

Output Parameters:

- Geometry: 3D Models of Building Typology
- Figures: *L, H, Ny, Dx, Dy*

Algorithm of TypologyMaker

The programming script was developed in Grasshoppper3D, and the responsive outcome is displayed in Rhinoceros. Since we have already had the input parameters, we can build up the script based on them. Firstly, the rectangular site geometry is input as boundary 3d models, and the area of the site can be easily gained in Rhinoceros. By doing multiplication of site area and *GSI*, the overall footprint area of all buildings in the site was calculated. Then, the author divided the overall footprint area into many mini footprint block of single building, and populate those building blocks evenly in the site (figure 04). To divide the site footprint rectangle into building footprint block, building typology parameters *a, b,* and *Nx* need to be defined as changeable input according to the above paragraphs. Once the buildings' footprint blocks were generated and layout, the buildings can be extruded based on building blocks with Height. Speaking of the Height of buildings, L can be calculated by dividing *FSI* and *GSI*, and *H* (Height) equals *L* multiply *Floor Height*. After this, the evenly distributed group of buildings can be regarded as a type of building typology.

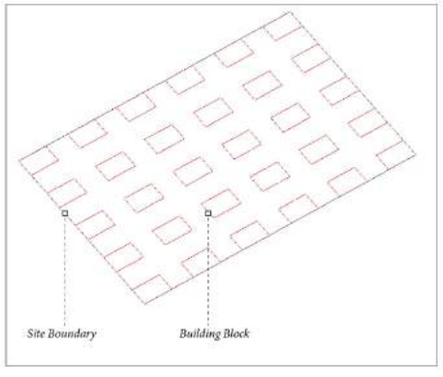

Figure 04: Footprint Rectangles

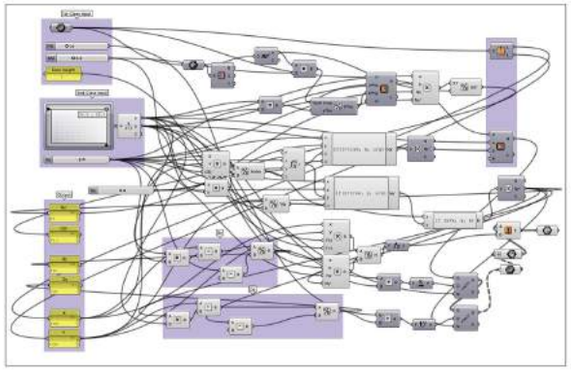
Figure 05: Algorithm of TypologyMaker in Grasshopper3D

Once we finish building up the algorithm of TypologhyMaker (figure 05) as above stated, we can adjust the building typology by tuning input parameters. For example, by adjusting *a,b,* and *Nx*, the dimension and number of buildings can be updated and changed, while building height would stay the same since *FSI* and *GSI* is certain. If the *GSI* is changed, the number of buildings in the Y direction (*Ny*) and building height would be also be changed while the dimension of buildings and Nx would stay the same. When change *FSI* only, the only transformation in building typology is the building height. From the above explanation, we can see the interactivity of the parametric TypologyMaker.

Test Cases & Spacemate

Under specific density requirements, we can gain distinct building typologies. In the following paragraphs, the author will introduce an example and link the outcome of typologies to real-life cases and evaluate them with the Spacemate. For the example test, we choose a 300*200m rectangle site and set *Floor Height*=3m. Besides, the author selects low, medium, and high values for *FSI* and *GSI*, respectively, according to Spacemate Chart (figure 06). By making permutation and a combination of those values, nine building typologies are gained. Besides, real cases in Amsterdam are introduced to match those calculated typologies (figure 07). The nine types are stated as below:

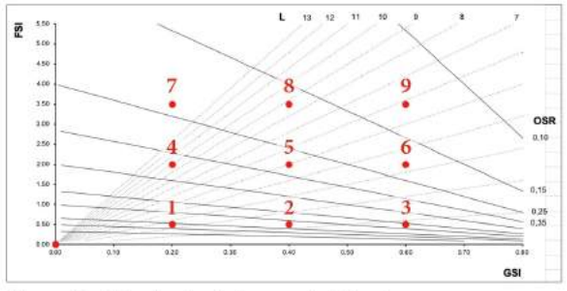

Figure 06: 9 Typologies in Spacemate Chart

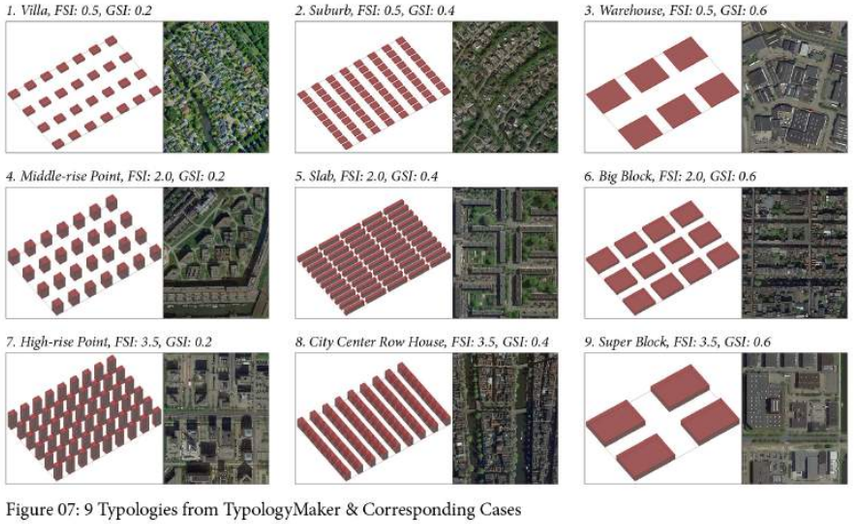

Figure 07: 9 Typologies from TypologyMaker & Corresponding Cases

1. Villa, *FSI: 0.5, GSI: 0.2*. When the development intensity and compactness are both low, buildings are likely to be built as expensive villas in the city's fringe areas. The average floor numbers are 2–3, and the typology can also be countryside houses with farmland.
2. Suburb, *FSI: 0.5, GSI: 0.4*. When the development intensity is low, and compactness is medium, buildings are typically suburb houses that are more crowded than Villa. The floor numbers are normally 1 or 2.
3. Warehouse, *FSI: 0.5, GSI: 0.6*. When the development intensity is low, and compactness is high, the floor layer number is normally one, and it is often seen as the medium size warehouse in suburban areas or large bicycle house in cities.
4. Middle-rise Point, *FSI: 2.0, GSI: 0.2*. When the development intensity is in medium level, and compactness is low, the average floor number of buildings should be 10, so it shows middle-rise apartments or offices in the main city area.
5. Slab, *FSI: 2.0, GSI: 0.4*. When the development intensity and compactness are both at a medium level, the average floor number is five, and there are multiple potential building typologies. The pictures show a typical slab living neighborhood in the main city area.
6. Big Block, *FSI: 2.0, GSI: 0.6*. When the development intensity is in medium level, and compactness is high, the pattern shows low-rise big blocks, it can be courtyarded living block, industrial factories, and other building typologies.
7. High-rise Point, *FSI: 3.5, GSI: 0.2*. When the development intensity is at a high level while compactness is low, the pattern is always high-rise buildings with a lot of public space around. It can be offices in the central city area but most likely to be residential towers.
8. City Center Row House, *FSI: 3.5, GSI: 0.4*. When the development intensity is at a high level while compactness is at the medium level, the building is around eight floors high, and the dense row house typology can be seen in a historical central area like Amsterdam City Center. Despite the "pure building typology," the pattern can also be a combination of low-rise buildings and high-rise towers, and it commonly appears in the modern city's central area.
9. Superblock, *FSI: 3.5, GSI: 0.6*. When the development intensity and compactness are both at a high level, the buildings are commonly 5 or 6 floors high, but they occupied a large extent of land. So, the pattern is shown as super blocks like big shopping malls. Moreover, for hybrid typology, it can also be the combination of low-rise blocks and high-rise towers.

From the above studies and cases, we can see that the height of the building increases with *FSI*. Moreover, for the layout of the building's footprint, it commonly shows as point house when *GSI* is low, as the strip pattern (slab, row house) when *GSI* is in medium level, as bigger block when *GSI* is high. This principle can also be seen in the Spacemate Chart (figure 01, M.Pont and P.Haupt, 2010). However, the above pattern is not absolute. The typology can vary in certain FSI and GSI figures. After setting the parameter *FSI=1.0* and *GSI=0.3*, according to Spacemate Chart (figure 08). By adjusting typology parameters like *a, b,* and *Nx*, we can see villa, row house, and slab typologies are all possible (figure 09). In this case, we can find out the results are beyond Spacemate's pattern and conclude that flexible input parameters make TypologyMaker possible to unveil alternative building typologies.

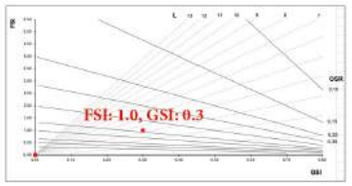

Figure 08: FSI: 1.0, GSI: 0.3 in Spacemate

Figure 09: Different Building Typologies in Same Density Index

Application

In urban design practice, most non-Dutch urban designers make their spatial design first, then calculated the density index of design outcome. After that, they adjust their design to match the density requirements. Meanwhile, it is common for Dutch designers to study density requirements first, then they would do density test and volume study in the pre-design period, so they can come up with better design decision in following spatial design. Now, the introduction of TypologyMaker makes the volume study dramatically easier and more accurate; it empowers the designer to tune the density parameter and generate corresponding building typology. With TypologyMaker, designers may found alternative design possibilities that beyond one's previous knowledge, the holistic method helps designers to be more rational and to make more comprehensive design strategies. Besides, the designer could take TypologyMaker as a tool to explore the hidden logic of real-life cases. When they understand the *FSI* and *GSI* requirements of a built-up site, they can compare the current building typology and other alternative options. Those holistic case studies may inspire urban designers in other designs, and after those design tests, designers can utilise Spacemate to evaluate the density index.

Speaking of real estate developers, they need to study zoning codes from the government and make planning proposals or design assignments based on zoning. In a real estate project, TypologyMaker could easily generate building typology based on density figures like *FSI* and *GSI*. It is beneficial for developers to evaluate the density index in a site. By combining the advantages of Spacemate and TypologyMaker, they could make better design assignments for urban designers.

When it comes to zoning for urban planning, planners in the government normally made density requirements for blocks or plots in cities (for example, zoning planners set *FSI*=1.0 and *GSI*=0.3 for a specific site), but they can hardly imagine the outcome of later design. By evaluating existing land with Spacemate and playing with the density index in TypologyMaker, they can envision the possible building typology of a site. In that way, planners in governments could make more reasonable density requirements.

Strength & Limitation

TypologyMaker is structured as an intuitive and interactive tool; it allows parametric manipulation in a graphic user interface while generating corresponding 3d models based on input parameters. It unveils all theoretical building typologies, providing alternative building typology beyond existing knowledge. The outcome is numerical and visual, and it can be an essential density assessment for designers, developers, and governments. However, the TypologyMaker as a tool still has its limitations, although most of which can be worked out in future development. Firstly, the Site Boundary should be rectangle in TypologyMaker. Inaccurate outcomes may be generated if the input site geometry is irregular. Besides, though the manipulation of the user interface is visual and easy to use, the Grasshopper3d program is not common for most people. In the following development, Microsoft Excel software would be integrated with TypologyMaker so that more people can adjust parameters in spreadsheets. Apart from that, the input parameters now are focusing on buildings instead of public space, so the width of the street (*Dx* and *Dy*) is designed as the output, and it can not be tuned directly. In the end, in real-life situations, it is rarely for a high-rise building to have a long length in north-south direction, that is because the sunlight can hardly go a deep distance. Nevertheless, the current TypologyMaker can not solve those unreasonable results due to its flexibility.

Conclusion

Overall, to make the volume density study more straightforward and more accurate, the parametric tool TypologyMaker was introduced as a complement to Spacemate in this paper. TypologyMaker takes advantage of parametric programming from Rhinoceros3D and Grasshopper3D. It provides real-time modeling and visualization in a 3D environment. The tool is developed to be interactive, intuitive, and efficient for people to use. For application, firstly, it empowers urban designers to make better design decisions and provide alternative design possibilities. Besides, it is efficient for developers to evaluate spatial density in a site. Apart from that, it unveils a possible design outcome to help staff in the government to make better density requirements.

Reference

1. A 3D computer graphics and computer-aided design (CAD) application software developed by Robert McNeel & Associates in 1998.
2. Grasshopper is a visual programming language and environment that runs within the Rhinoceros. The program was created by David Rutten in 2007.
3. Non-uniform rational basis spline (NURBS) is a mathematical model commonly used in computer graphics for generating and representing curves and surfaces. It was developed by CAS Berlin in 1993 for personal computers.

4. Beirão, J., Arrobas, P., & Duarte, J. (2012). Parametric Urban Design: Joining morphology and urban indicators in a single interactive model. ECAADe 30, 1(City Modelling), 167–176.
5. Berghauser Pont, M. Y., & Haupt, P. A. (2009). Space, density and urban form.
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7. Pont, M. B., & Haupt, P. (2004). The Spacemate. The spatial logic of urban density, Delft: DUP Science.

THE DUTCH APPROACH

Study Notes From Jian Yuan

(2018-2020)

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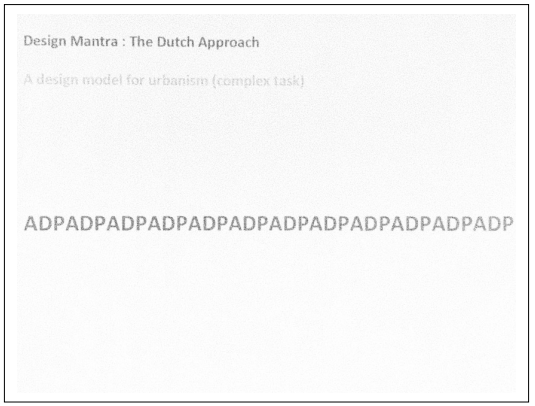


Slides from Rients Dijkstra, 2018

Preface

It was 4th of September in 2018, we fresh students sitting in the BK Urbanism studio, were given another lecture by graduates and teachers. The warm air makes us sleepy.

Suddenly, a page of slides called Dutch Mantra waked me up, "ADPADPADP...". The formula of three letters' loop explained a principle of design workflow: Analysis, Design, Present, Repeat. It hit something in my head like I had been long for this for a long time.

In the following two years, I found out that the content or tasks we are working in the Netherlands are not special. Values like sustainability, walkability, diversity are, of course, prominent, but not very different than other countries. In contrast, the way that dutch designers are working interests me. It is something I have not learned but feels connected with deeply.

"Do investigative research and evolutionary design and sell your product to others by telling a story." It is hard to summarise the dutch approach in short words, but this is it, if I have to.

I do not know the source of this philosophy, it may from the long trading tradition on the sea of dutch people for hundreds of years, or it may links to the journalist and scripter experience of architecture godfather Rem Koolhaas since the 1970s.

In my two years of studies in TU Delft and MVRDV, I meet several moments in design that blow my mind when learning from tutors, colleagues, even lecturers on the internet. I feel urgent to grab those ideas and write them down. Otherwise, I may miss them forever.

Rients told me that Urbanism in TU Delft is starting to lose the tradition, we feel urgent to bring it back.

Now I am about to graduate, to keep what I have learned from the dutch methodology, I made this little booklet. The words may be inaccurate, and ideas may not be dutch exclusive at all. I wish those ideas could be accompanied with me in my design career and, hopefully, would be judge, strengthen, against, or reinvented in the future.

2020.6.25

Contents

Structure

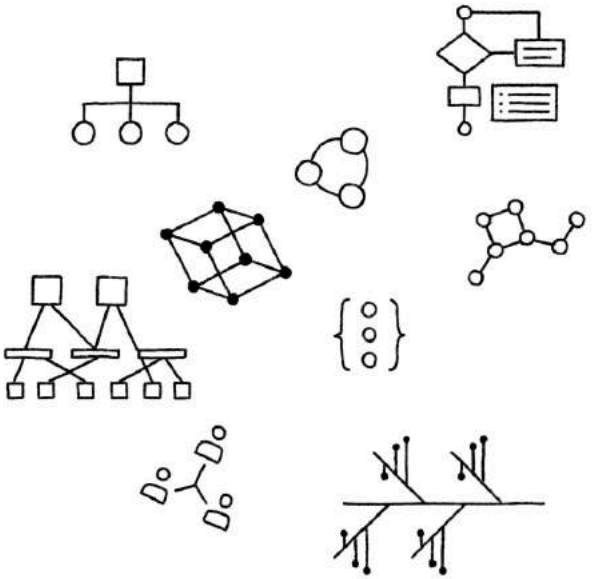
01

Structure First

The most effective way of doing complicated things is to build its structure first.

Sketch an outline before writing long articles, scratch a draft before serious drawing, arrange tasks in Calendar before doing them...

There is various form of structure to different things. Be creative in building free forms of structure that is adaptive to its context.



02

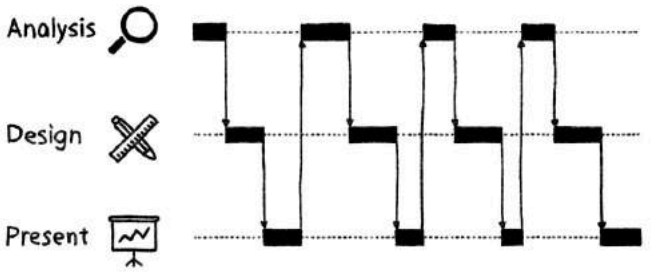
A-D-P Loop

Design Mantra:
"The Dutch Approach"

A: Analysis(Research)
D: Design
P: Present

Iteration: A-D-P-A-D-P-A-D-P-A-D...

In the dutch way of design, the loop of ADP helps the design to evolve and refine.



A-D-P-A-D-P-A-D-P .....

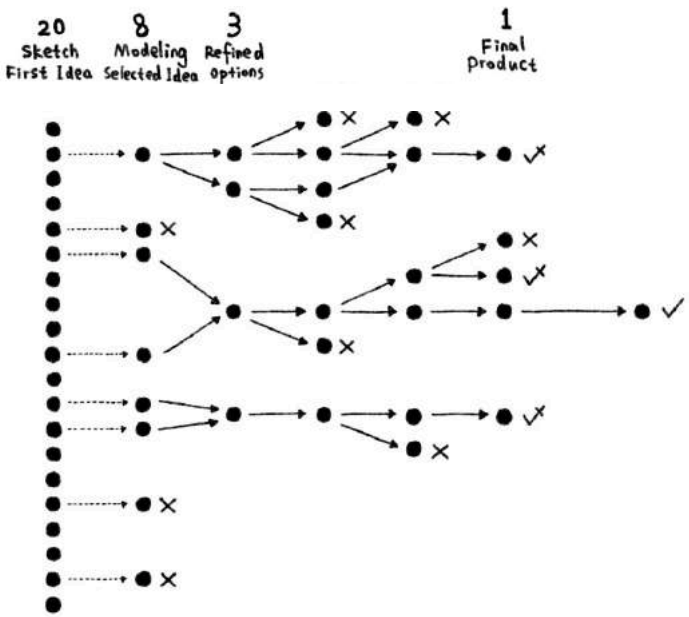
03

Evolutionary Idea Tree

"I prefer evolution to revolution"
— Bjarke Ingels

20-8-3-1 (The number of 20, 8, 3 may varies according to different project)

Think of 20 quick simple strong ideas first, then develop 8 of them. Within the evolutionary design, the 8 ideas would compete with each other, by merging and selecting, we get 3 possible options for refined design. After further tests, we chose one final option for the designed outcome.



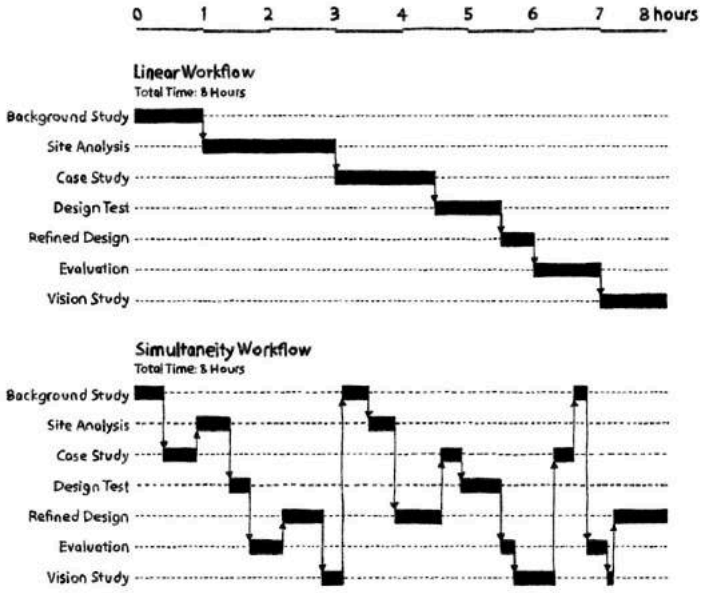
04

Simultaneity Workflow

"Do a lot of things together"
— Rients Dijkstra

We humans are born to focus on one thing in working, do things simultaneous seems disruptive for brains. However, practice proves that the most effective way of doing things is to do each thing a little instead of dive into one thing deeply. After getting aware of all the information, the design direction may change timely.

- Design starts early, not after research.
- Work multiple parts simultaneously, not linearly.
- Work on each thing a little, not on one thing a lot.



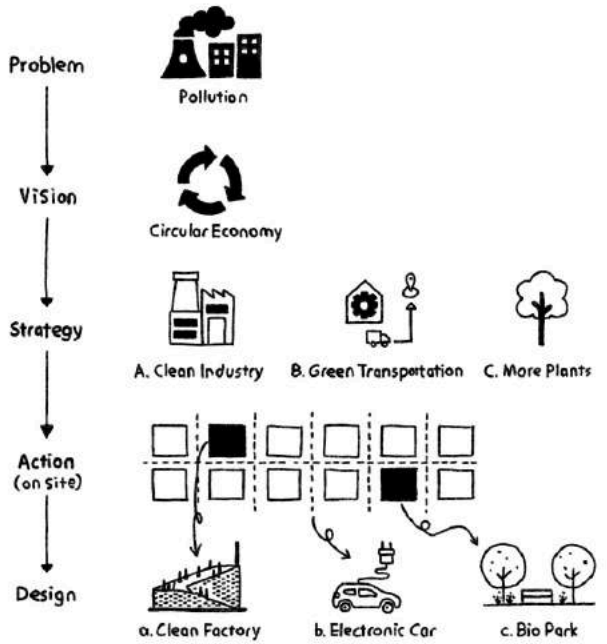
05

Project Structure

Problem > Vision > Strategy > Action > Design

- Without the problem, there is no need to change.
- Without the vision, there are infinite directions.
- Without the strategy, there is no connection between vision and action.
- Without action, there is no spatial design.

This structure leads to the design product.

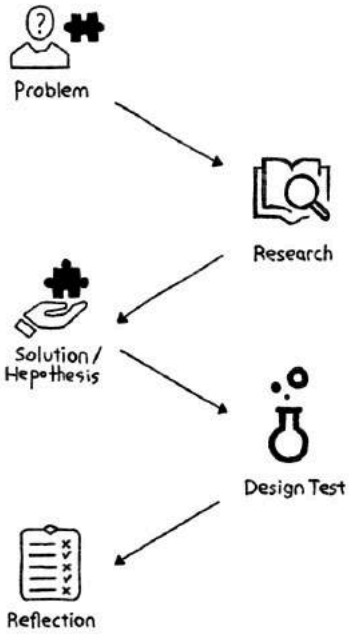


06

Design Workflow

> problem
> research(a little theory)
> hypothesis/solution (if do this, this would happen)
> design test (improve hypothesis)
> reflection (to hypothesis)

Like economy and other social science, the academic project of Urbanism also goes this path to build a convincing and integrated design process.

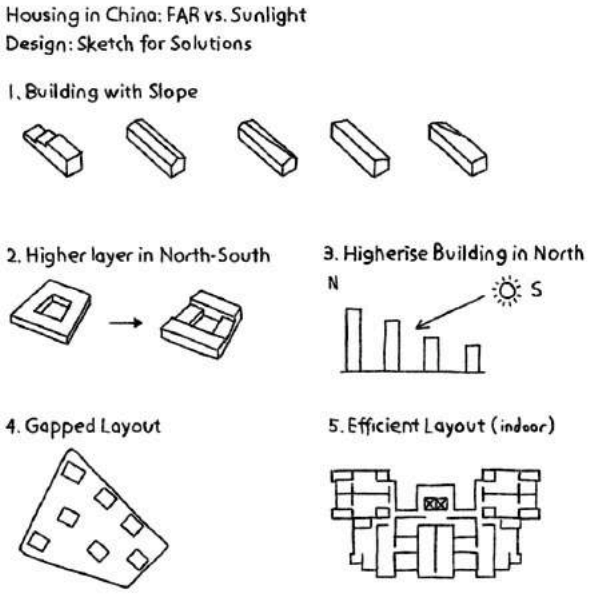


07

Research by Design

Design first, sketch solutions. Design with common sense but without comprehensive research.

The design itself should be the starting point, and as a tool to inspire research, criteria like walkability/accessibility/vitality is assessment after design. Otherwise, criteria impose too many restrictions on design.



08

Design by Research

The design should be evidence-based instead of fantasy-based. The most effective way to support design is to first do research. The material that comes out of research would be inspiration and motivation for design decisions.

Housing in China: FAR vs. Sunlight
Research on:

1. Specific Policy

- How long sunlight required a day?
- Various in cities?
- Special situation? Rewards?

2. How Do Others Do?

- Hongkong? (two system in one country)
- Singapore? (Chinese Culture, like sunlight)
- Netherlands? (high population density)

3. Other Solutions?

- Mix in low level?
- Distinguish "house" and "apartment"?
- Special indoor layout?

Design

09

Evolutionary Design

"Jian, remember good design process is always evolutionary."

— Rients Dijkstra

Develop Typology - SCJCR:
sketch > criteria > judge > conclude > repeat

You go from simple ideas (quick sketching and testing, many ideas) to more and more refined ideas (slower, but fewer "candidates"). When doing this: high speed, pen on paper.

- Sketch a single idea (example: very high towers with small footprint).
- Criteria are like: must achieve some of the values of Lilong, must have mixed program
- Judge: using the criteria I have developed
- Conclude: small footprint high tower is...
- Repeat, next idea.

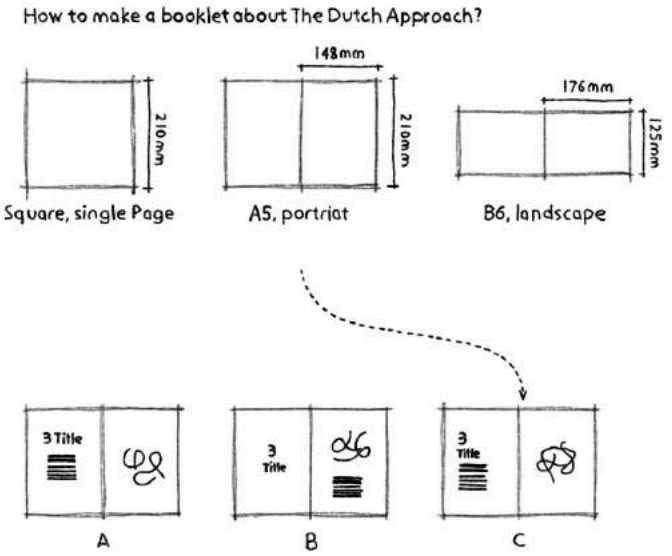
Example see:
32 ***Step Story***

10

Sketch First

No matter how fast technology is developing, hand sketch is still the fastest way to express ideas.

Do hand sketches first as tests before any formal production like illustrator drawing or Rhino modeling.



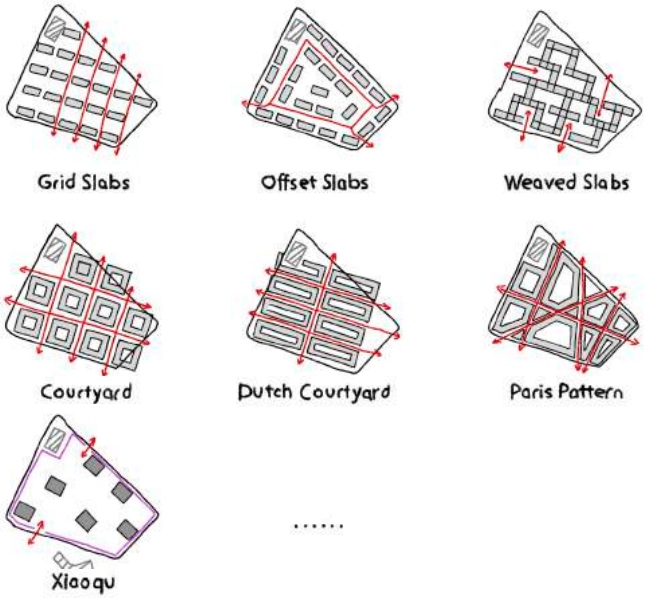
11

Design Option Tests

"The more waste you produce in the design process, the less waste you end up building in the city."

— Bjarke Ingels

Make distinctive options as much as possible and evaluate them by using criteria that were set before.



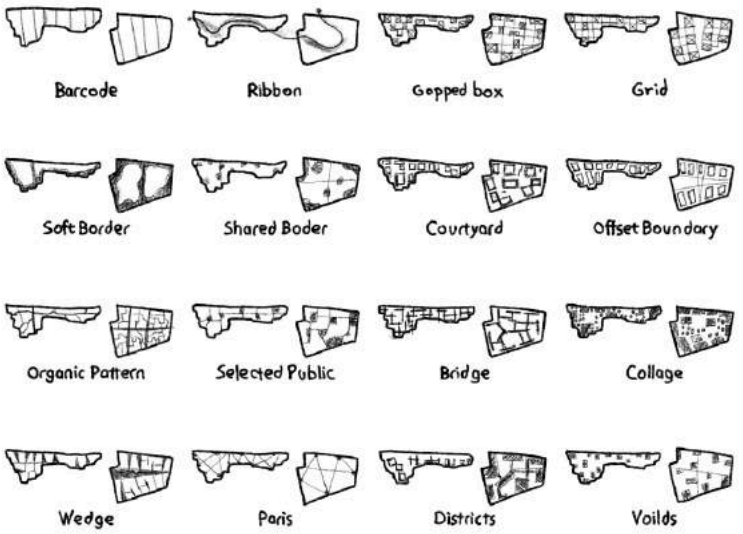
12

Be Clear, Be Distinctive, Be Sharp

"Ideas should be distinctive."
— Kyo Suk Lee

When proposing the first ideas of the design direction, the ideas should be:

- Clear. Otherwise, people do not understand.
- Distinctive. Otherwise, people can not tell.
- Sharp. Otherwise, people do not remember.



13

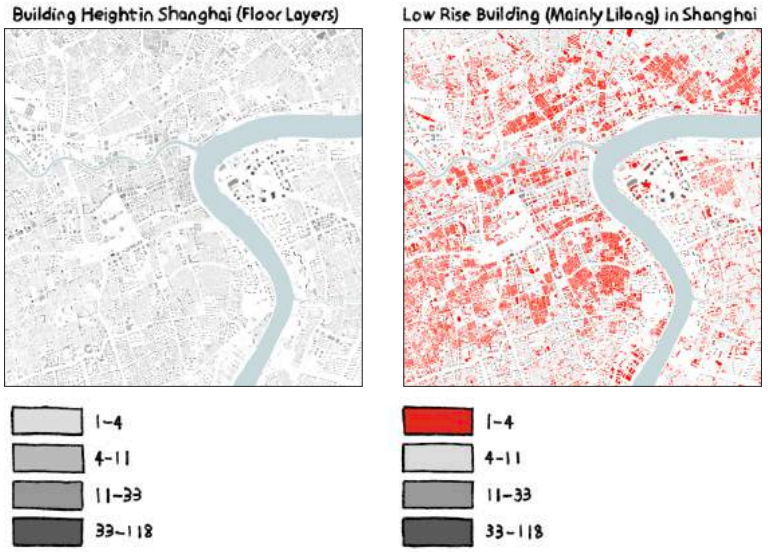
"Draw conclusion, not information."

— Teake Bouma

There are various types of drawings, normal drawings present, good drawings indicate.

Without creative thinking in drawing, the drawing becomes an inventory of neutral information. However, when we start to leave out and emphasize information, the drawing shows clues of finding.

Good drawings show information, Great Drawings tell a story.



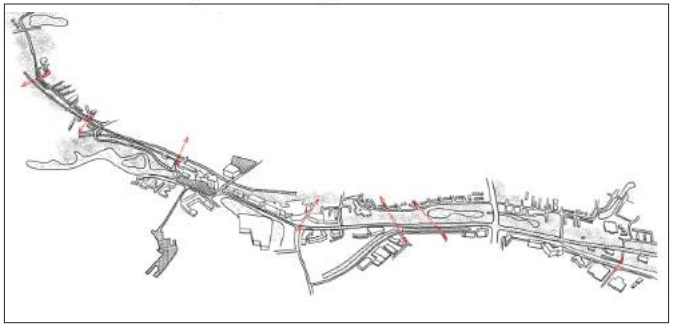
14

Do Experimental Drawings

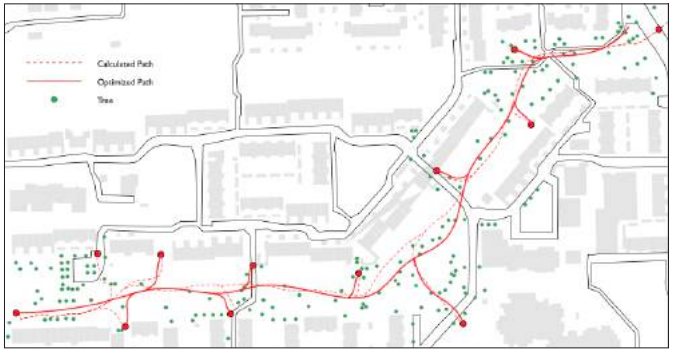
There are thoughts hidden in language, and drawing is a visual language to express design thoughts.

Since the classical drawings (nolli map, for example) set a fixed paradigm of thinking, we could do experimental drawings to present new thoughts in design. No matter it is low or high tech drawings.

Low Tech Hand Drawing: Possible Linkage in Rail Area



High Tech Algorithm: Possible Routes for New Path



15

Think Out of Box

Think more, test others, try harder.

Be Creative, do not work in a straight line, different ways of working produce different ideas.

16

Interact with Environment

- find ways to empower people that influence their physical environments

- involve the local community and create a sense of ownership

- make use of existing heritage, "do not reinvent the wheel."

— Bjarke Ingels

17

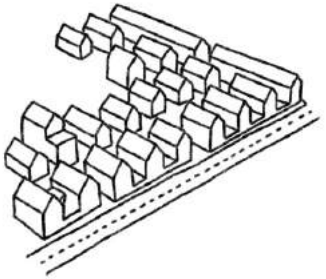
Design from The Eye Level

"Think how people look from their streets and windows"

— Ulf Hackauf

Some design seems promising from the bird's view. They may not be walkable in the streets.

Design from the eye level, go down to the streets and neighborhoods, think of children, think of the elderly, think of the dogs.



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✓

Research

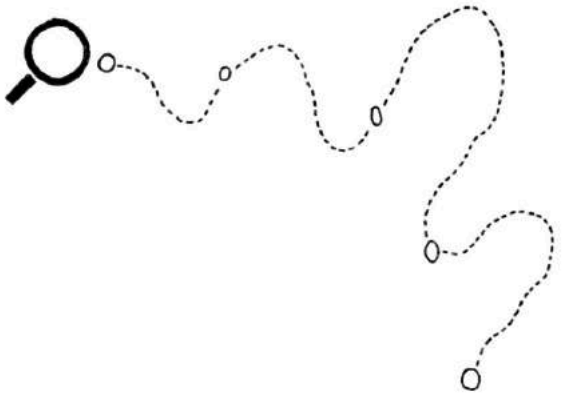
18

Investigative Research

"Mine most information before intervene, define the greatest potential or biggest problem to inform design decisions."

— Bjarke Ingels

Learn from investigative journalism.
Do research,
investigate,
find evidence,
collect clues,
conclude findings for design.



19

Post Research Questions

The trick to building a good story is to post a great question.

- What is the real problem on the site?
- What is the real trigger behind the problem?
- It is a simple design decision, or is there a deeper economic or cultural reason behind it?

How to achieve A vision by B method in C background?

Propose sub-questions:
- What is A? Why A?
- What is B? Why B? How B?
- What is C? Why C? Where C? When C?

20

"What If?"

Think of scenarios.

- What if sea level rises in the Netherlands? What if not?
- What if the population explosion in India? What if not?
- What if the economic crisis in China? What if not?

Think of possible future scenarios; think of ideas that have not to be considered yet, think of the extreme situation.

The more we think, and we test, the more prepared we will be when things come.

21

Find Ideas

"I don't care square meters, I want the idea!"

— Winy Maas

Ideas are from everywhere,

the existing site, context, economy, society, culture, everything may contain idea.

Transform the idea to spatial language.

Stick to the idea, find reasons for the idea.
Detail small design is for later, Idea first.

Do not lose ideas in later design; keep it strong.
Keep distinctive idea options. Don't combine in the beginning.

The idea is the trigger for our design decision, and also the reason for clients to our design.

22

Build Idea Bank as Toolbox

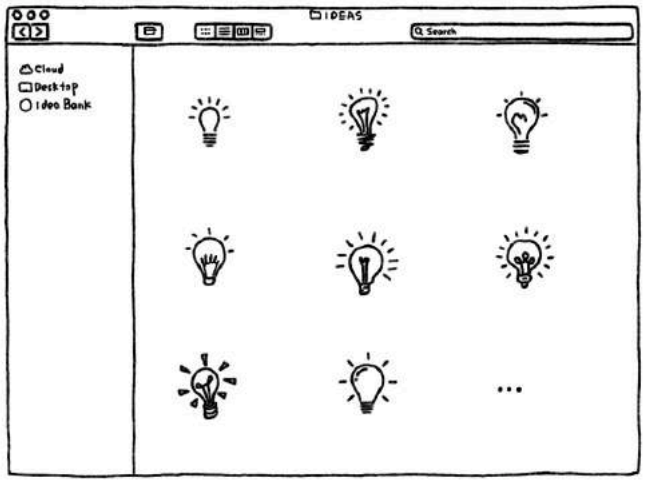
Develop ideas in projects

Collect them into a structured idea bank.

Ideas can be recycled, improved, and reused.

There are different solution ideas on different sites.

Choose the proper ideas for the context and build the responded toolbox.



23

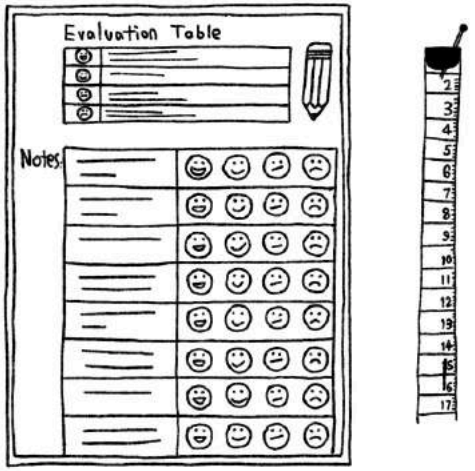
Evaluation & Assessment

"The quality we want to achieve should be regarded as evaluation tool for later design."

— Ulf Hackauf

When vision is sets and criteria are settled.

Qualities may not be the direct force in the creative design process, yet it must be the assessment to measure if we go in the right direction.



24

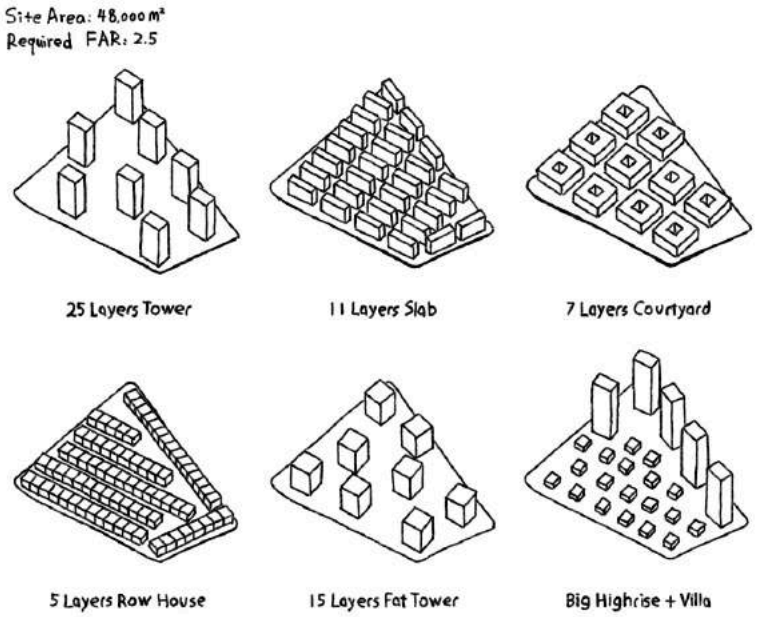
Volume Study

"Understand the unknown with what we have known."

For every plot of land, we can do volume density studies.

Tests are various building typology in the same density figures.

Same FSI (GSI) requirements, test towers, slabs, Barcelona courtyards, paris fabrics, etc.



25

Scale Comparison

The scale is an essential element in urban design. The same urban fabrics with different scales have different qualities to people.

By comparing with the same scale of famous cities or urban fabrics that we are familiar with, we could undertsand the site better.


Shanghai


Shanghai Bund


Beijing


NYC


Paris


Tokyo


Barcelona


Amsterdam

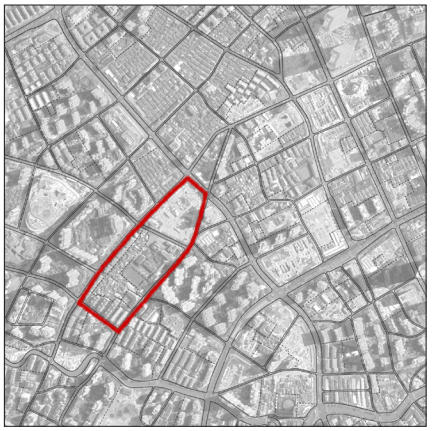

Delft

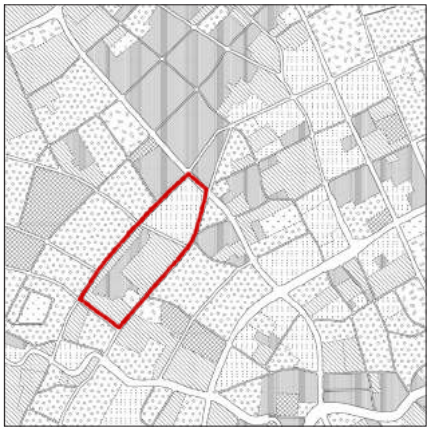
26

Typology Study

The typology study of urban fabrics is an effective way for urban designers to understand spatial identity.

There could be countless colors of facade style of highrise towers in a city. However, they may share the same urban typology.



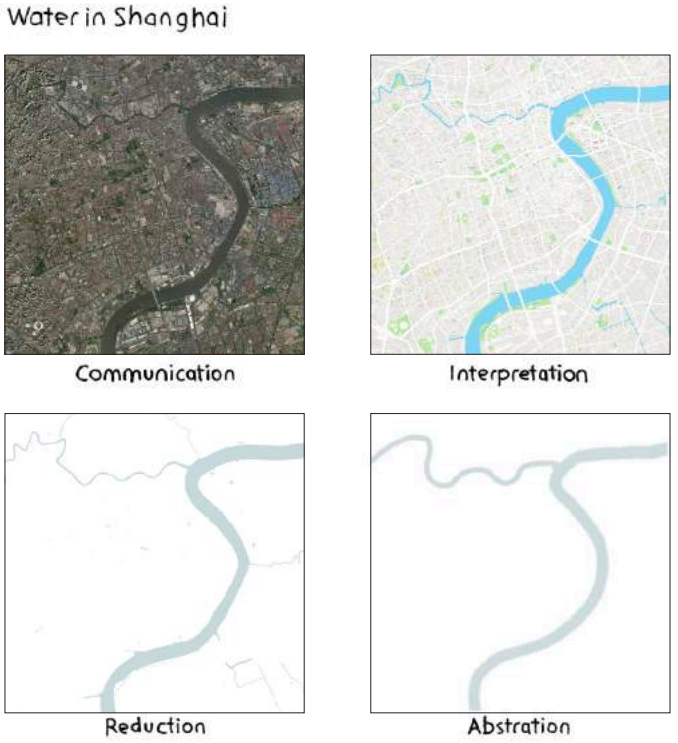


27

"4 Types of Drawings"

— Jiaxiu Cai

There are four types of drawings:
1. Communication (inventory of information)
2. Interpretation (nolli map, Kevin Lynch Map)
3. Reduction (selected content from interpretation)
4. Abstraction (subjective portrait)



28

Technology Serve Humanity

"Technology serve liberal arts, serve humanity."

— Steve Jobs

We are in the insection of technology and liberal arts.

With the development of modern technology,

GIS, grasshopper, programming, generative design, parametric design, AI Architects...

We should be aware of that technology should be the tool to improve the design, not replace the design.

We need computational design, not shit generator.

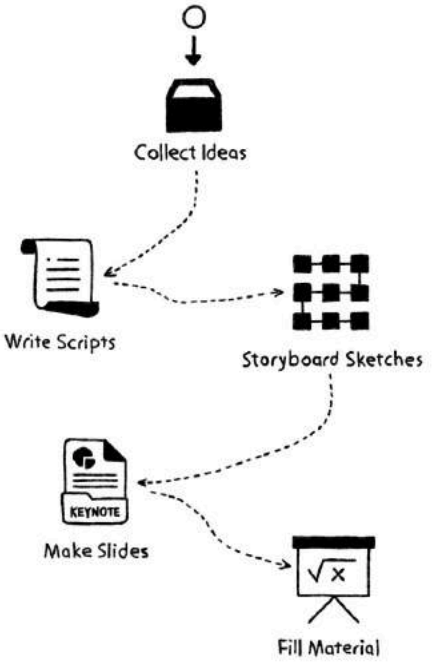
Presentation

29

Presentation Preparation

As a Journalist and Screenwriter, Rem Koolhaas establish a paradigm for presenting stories in architectural design.

> Collect Ideas
> Write Scripts
> Stroyborad Sketches
> Make Slides
> Fill material (of research and design in slides)



30

"Build a story"

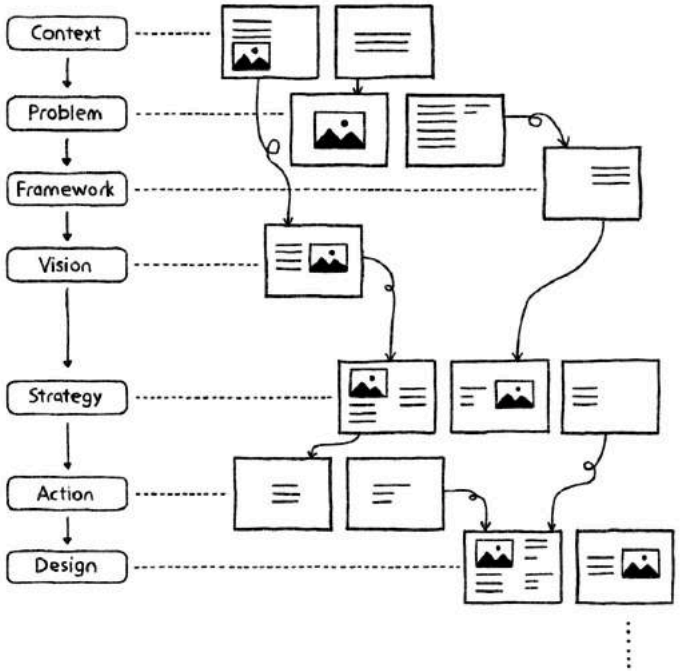
"There is no objective truth in design, only good or bad stories."
— Rients Dijkstra

We can never satisfy every stakeholder, but we can make great design by building up a story.

Scientific research on design always focuses on very small things, but in reality, the design is nothing like that, it is messed up with lots of information.

Without a story, there are endless research possibilities that can be done, and each of them can be down for a Ph.D., but a story sets the Limits.

Philip Pullman: "After nourishment, shelter, and companionship, stories are the thing we need most in the world."



31

"Build Trust"

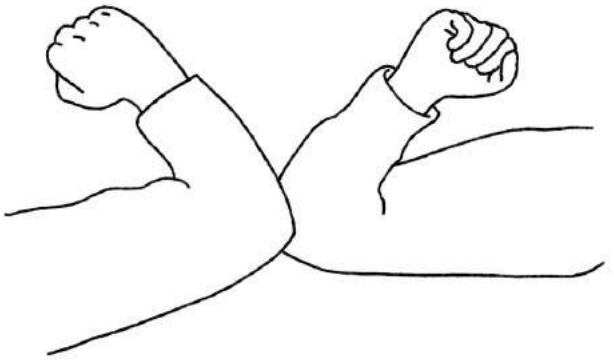
— Rients Dijkstra

The story will not be a story unless people believe it.

To build a good story, we need to

- curate the right material we present very carefully
- reorder the material properly to keep the engaging audience
- Present in a way that the audience easily accepts (tune, accent)

The story is based on trust. Persuade the audience with sense and touch the audience with sensibility.



32

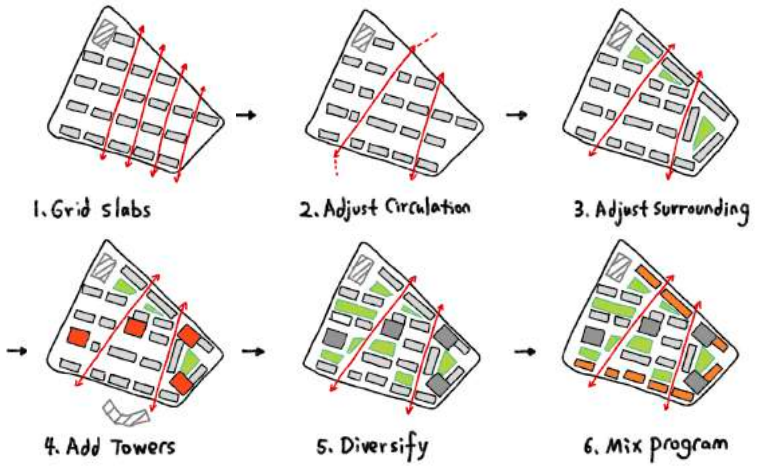
Step Story

The stepped Story method is both the way we do design and also the way we present to the audience.

In design, the step story sets a clear mindset for us to improve the design step by step, it has a clear logic for evolutionary design, and we can rethink with each step easily.

Of course, the real situation in design is more chaotic. Instead of stick to step 123 strictly, we may go back to change step 3 after finished step 5 or jump steps constantly. The main structure is based on an evolutionary stepped approach.

For the audience, the step story illustrates how we refine the design in a clear way. It helped communication with both sides.



Structure see:
09 *Evolutionary Design*

33

Fluent Presentation

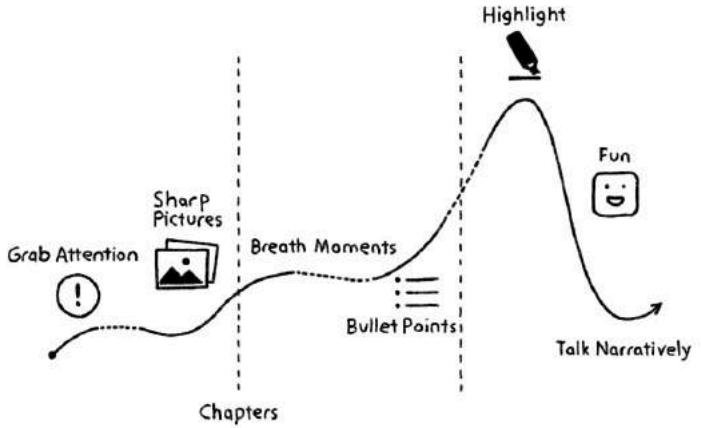
The content we present matters,
Present with questions can grab the audience's attention (Bouma)

The order we present matters,
Do not talk linearly, but narratively (Bouma)

Avoid long text in presentations,
Bullet points plus sharp photos make your audience understand the most (Ulf)

Make the audience focus on one thing at a time,
Contact with the audience (Bouma)

Speak in a pleasant rhythm,
Not talk too fast, leave moments for breath (Rients)



34

"Play with The Expectation"

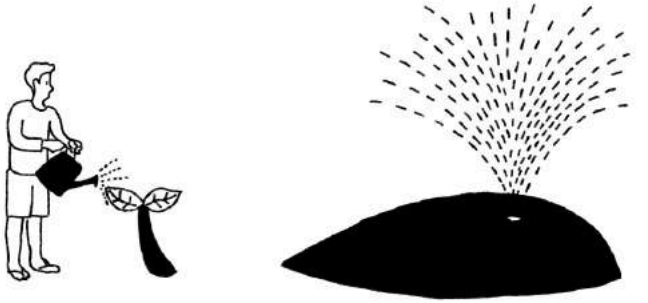
— Rients Dijkstra

Do expectation management.

Do not raise high expectations in the first.

Play with expectations in the process.

Deliver surprise in the end.



MixCity

Investigative Research & Evolutionary Design on Mixed Densification
in Shanghai's Living Neighbourhood