[Siheyuan] = Harmony:
Recover Harmony in Beijing Courtyard Houses

by

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Abstract

Siheyuan is the archetype of traditional Chinese courtyard housing complex. This thesis explores the concept of harmony imbedded in the Siheyuan in context of Beijing. A number of architectural attributes of the model are presented at city, neighborhood, and dwelling scales. It is a flexible mechanism that is adaptive to changes, until it goes out of balance.

In the 20th century, Siheyuan is transformed during Beijing's residential densification. Positive communal transformation and harmonious neighborhood has appeared when the archetype stays in balance. Negative transmutation and loss of harmony happens when balance is broken by overcrowded random infills.

Siheyuan has its potential and value for residential transformation despite its lower density. This thesis intends to bring the broken model back in balance. Today's Beijing Siheyuan preservation and revitalization needs to be according the archetype's own language in order to recover harmony in the neighborhoods.

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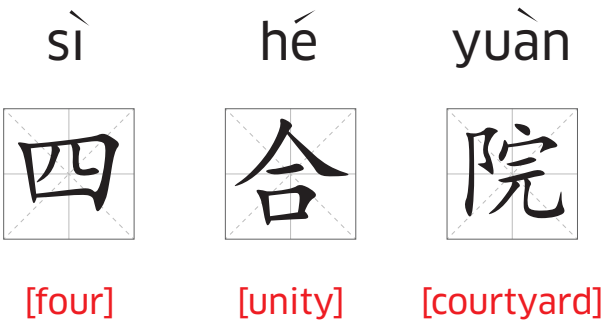
God's heart toward us is always good. Thank You dear Lord Jesus.

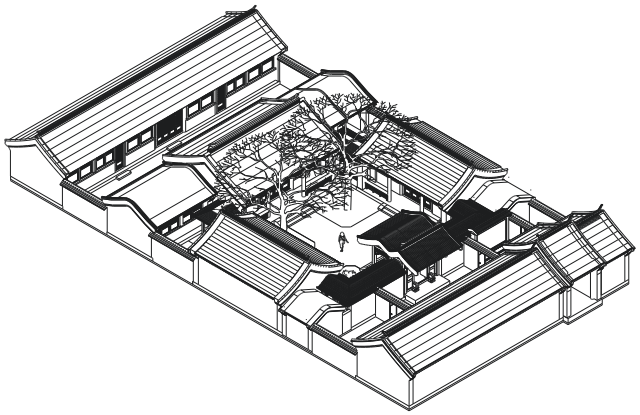
> For he eagerly waited for the city which has the foudations, whose Architect and Builder is God (Hebrews 11:10).

Chapter 1: Introduction

Siheyuan, the archetype of traditional Chinese courtyard housing, still exists in the Old City of the ancient and modern metropolis - Beijing. With over 800 years of history in Beijing hutongs, Siheyuan is the crystallization of ancient Chinese architecture and architectural expression of harmony in Chinese philosophy. “Si” stands for the four directions of north, south, east, and west. “He” means unity, reflecting the harmony between the heaven and the humans. “He” also means enclosure, as the housing complex is surrounded by the buildings and walls in the four directions. “Yuan” means courtyard, which serves as the central venue of the housing complex for bringing in natural elements into people’s built dwelling.



Siheyuan’s name in Chinese language and translation



A tridimentional illustration of a standard three-courtyard Siheyuan

The Beijing hutongs are networks of narrow alleyways linking the Siheyuan courtyard houses. Since 14th century, it became the unique urban fabric in Beijing Old City. Hutong represents an ecological attitude of the Chinese philosophy “harmony between the heaven and humans”. As a kind of intermediate space, indoor and outdoor, architecture and nature, enclosure and openness, all achieve harmony through the spatial intervention of hutong.

Beijing hutong in the 90s; photograph (EasyTourChina 2013)

Rickshaw through the hutongs; photograph (ChinaHighlights 2019)

Beijing Hutong, watercolor painting by Huang Youwei (Wan Fung Art Gallery)

Dilemma of Beijing Siheyuan and Hutong Today

Through time in the 20th century, Siheyuan archetype was transformed, transmutated, and even largely demolished during Beijing's residential densification. The modern development of Beijing is at the expense of losing half of its Old City, of many hutongs and Siheyuan. Although the reconstructed apartment blocks provided more living space, they were damaging to the physical order of the city and will continue to be obstacles to the restoration of Beijing Old City's visual quality and community engagement. The remaining Siheyuan is also in dilemma with dilapidated building quality, overcrowded subdivision density, messy infills occupying outdoor courtyards, loss of harmonious neighborhood, lack of infrastructure and basic facilities, etc. It can hardly satisfy the need for Beijing's social and economic development today. How to preserve and develop the Siheyuan and hutongs in Beijing Old City becomes a prominent topic.

Vision Statement

With the intention to recover harmony in Beijing Siheyuan and hutongs, this thesis looks at Beijing Siheyuan as a symbol of harmony and studies its architectural attributes. The term DNA is used in this document, as a metaphor to examine the archetype's evolution process. It is found that positive communal transformation and harmonious neighborhood appears when the archetype's DNA stays the same. Negative transmutation and loss of harmony happens when the DNA is broken by overcrowded random infills.

Having into account Siheyuan's DNA of harmony as the design tools, this thesis intends to keep the lively quality

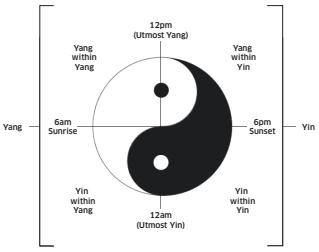
of the archetype's positive communal transformation while exploring the limitations of density increase. Today's Beijing Siheyuan preservation and revitalization needs to be according the archetype's own language in order to recover the harmonious atmosphere in the neighborhoods.

Organizational Overview

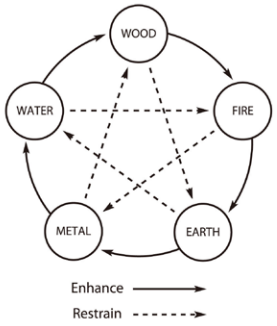
This thesis document is structured around five main chapters. The first chapter "Harmony" begins with the philosophical concept of harmony in Chinese architecture and the architectural attributes of harmony found in the historic model at the city scale (Beijing Old City), the neighborhood scale (Beijing hutong), and the dwelling scale (Beijing Siheyuan). It is followed by the "Transformation", which is devided into three subchapters elaborating on transformation process of the city model, the neighborhood model, and mainly on the dwelling model of Siheyuan archetype. Thereafter, the deisgn intension and methodology is presented, followed by the selected site for developing and applying the design strategies. The last section presents the architectural proposal.

Chapter 2: Harmony

Concept of Harmony in Chinese Architecture



Yin-yang's relationship with time, (Natura Training Institute 2017)



Five element theory, (Hsu 2016)

In Chinese traditional architecture, the translation of Chinese Taoist philosophical concepts of harmony can be summarised as a single coherent notion: "harmony between the heaven and humans". This notion proposes an architecture that follows the actions of the forces of yin-yang, in harmony with natural elements over time. The five fundamental elements which constitute the basis of ancient Chinese cosmology are metal, woods, water, fire, and earth. It is derived from the ancient observation of the celestial bodies in the Northern hemisphere and intending to find the balanced state among different interrelated elements.

"Harmony between the Heaven and Human" refers to a basic mechanism that relates human artefact to wider non-human surroundings, and generates a harmonious form with an innermost unity (Ren 2019, 61). The harmony in Chinese traditional architecture focuses on the inner relationships of the interrelated elements that affects human's living environments including natural environment, social environment, and humane environment.

In traditional Chinese architecture, harmony is not a static thing. It always has this embedded idea that things can be changed. Harmony is all about the balance of many elements. It is a flexible mechanism that's highly adaptive to changes and transformation, until it goes out of balance.

Harmonious Attributes in Beijing Old City

Professor Liang Sicheng said that “Beijing is an unparalleled masterpiece of city planning”.

> Beijing is a planned entity… Beijing’s architecture as an entire system is the most intact anywhere in the world, and as a most extraordinary and precious work of art, it still retains its vitality and maintains its tradition. (Liang 1986, 55)

Shan Shui City

The Shan [mountain] Shui [water] City concept dates back to the 1980s, from the admonition by Qian Xuesen, China’s prominent nuclear scientist, who advocated the idea that cities should form a harmonious relationship with mountains and rivers in the philosophy of “sky, earth and man” (Rowe and Wu 2002, 14). In view of the emerging large-scale cement construction, he put forward a new model of urban development based on Chinese Shanshui spirit, which was meant to allow people to “stay out of nature and return to nature” (Frearson 2013).

Shan-shui location of Beijing (base map from Baidu Map, n.d.)

Beijing, located east of Taihang Mountain and south of Yan mountain. The intersection of the two mountains form a semicircular shield open to the southeast, named “Beijing Bay”. Beijing City situates in the small plain surrounded by “Beijing Bay”. It is the farthest north of China North Plain. Various rivers flow through Beijing from the mountains of the west to the ocean of the east. Beijing boasts a perfect Shanshui geographical setting.

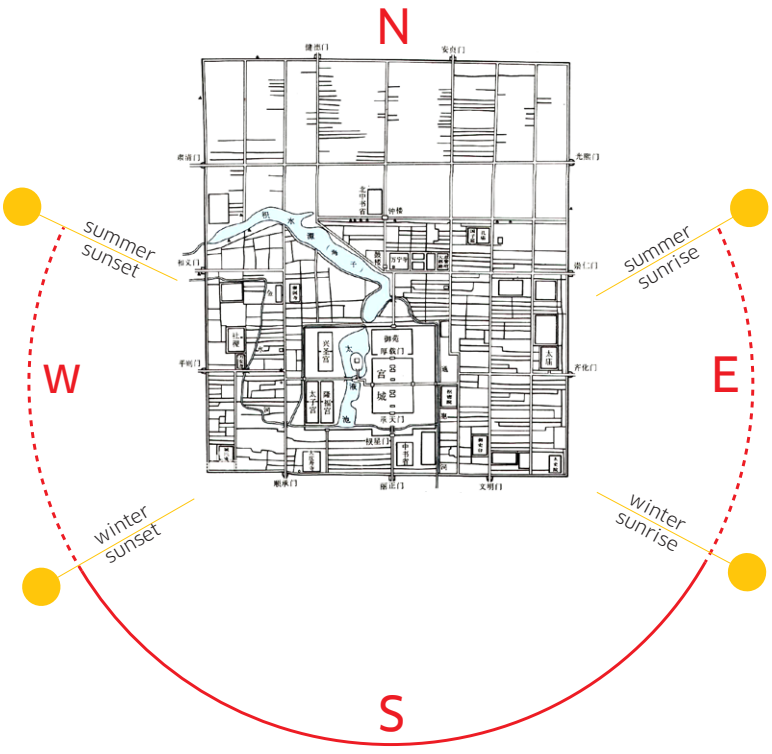
The nature in Beijing is not the pure nature outside of a city, but the nature within the city. It became part of many Beijingers’ daily living and supplied them a sense of belonging in the city.

> I spent my childhood in the Beijing Old City. I would pass by Jing Shan [Mount Jing] and Bei Hai [North Lake] travelling between home and school. I was skating on the icy moat of the Forbidden City in the winter; and learning to swim at Shi Chai Hai [Lake] and fishing besides Yindian Bridge in the summer. Now looking backwards, having mountain and water and bridge in the city center of a metropolitan, is truly utopian. (Ma 2014)

The incorporation of natural landscape into the geometrical layout was another significant accomplishment in Beijing’s city planning. Lakes, streams, islands, and gardens of irregular shapes were skillfully integrated into a formal plan of squares and rectangles. The fine contact and complementarity strengthened the solemnity of the city layout and blended beauty of nature into the built forms. Trees were planted throughout the city and most dense surrounding the major architectural complexes. The large scale of planting trees not only beautified the city but also provided recreational spaces (Wu 1999, 14).

Climatic Orientation

Beijing is located at longitude 116° 25’ 28’’ east and latitude 39° 54’ 23’’ north. It has temperate continental monsoon climate with northwest winter wind and southeast summer wind. The winter is dry and cold and summer is hot with rainfall. Largest noon solar zenith angle is 27° in winter and 76° in summer. Sunshine hours ranges from 9h20m to 15h1m. Its geographical setting determines that housing situates best in the north with window opening to the south for thermal and ventilation reasons (Ni 2009, 84).

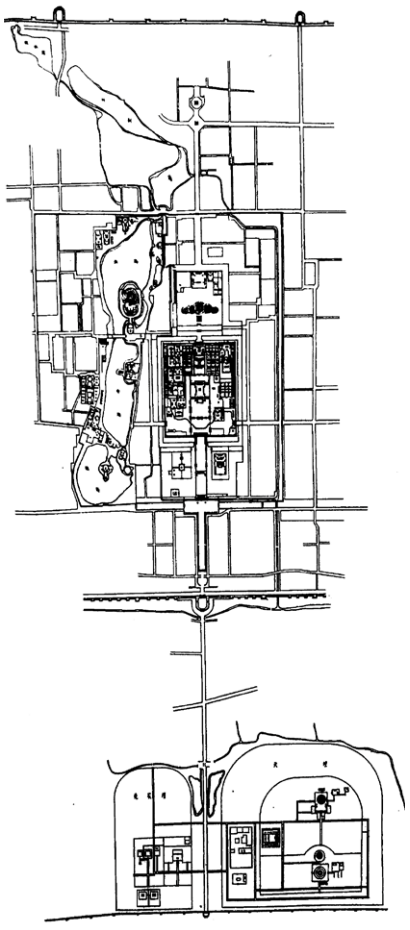


Climatic Orientation of Yuan Dadu, base plan of Yuan dadu (Hou 1988, 27-8)

Central Axis

The city's infinitely varying spaces, is primarily organized by or related to the city's north-south central axis.

Since Yuan dynasty, the original central axis of Dadu was kept and used to relate each new element in the city's plan. The building of the Outer City during Ming dynasty, extended the central axis to 7.9 km. It thus became the most magnificent urban axis of the premodern world. It gives Beijing a unique character and beauty of order. "Both the distributions of architectural complexes and the alignment of a sequence of space make this central axis the city's backbone" (Wu 1999, 12).



Wu Liangyong, the central axis of Beijing, Beijing, 1986 (Wu 1999, 11)

Orderly Street System

Yuan Dadu plan divided the city into many blocks with north-south main streets parallel to the central axis and perpendicular east-west main streets. Hutongs within each block mostly ran from east to west. The large streets, small streets and narrow hutongs were well ordered. Layout of buildings was also distinctly planned. Commercial buildings along the large streets and courtyard houses along the quiet hutongs. With careful consideration of solar orientation, the 68 m by 68 m square-shape residential lots were placed on the north side of the hutongs.

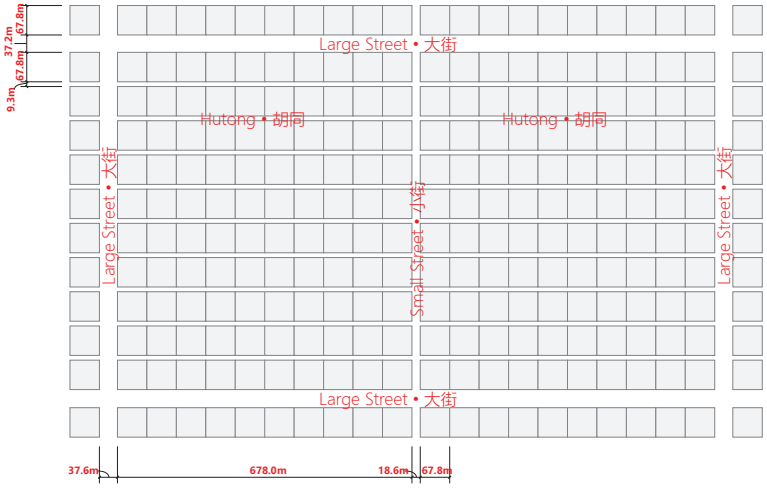


Diagram of Yuan Dadu street planning model (Ni 2009, 152).

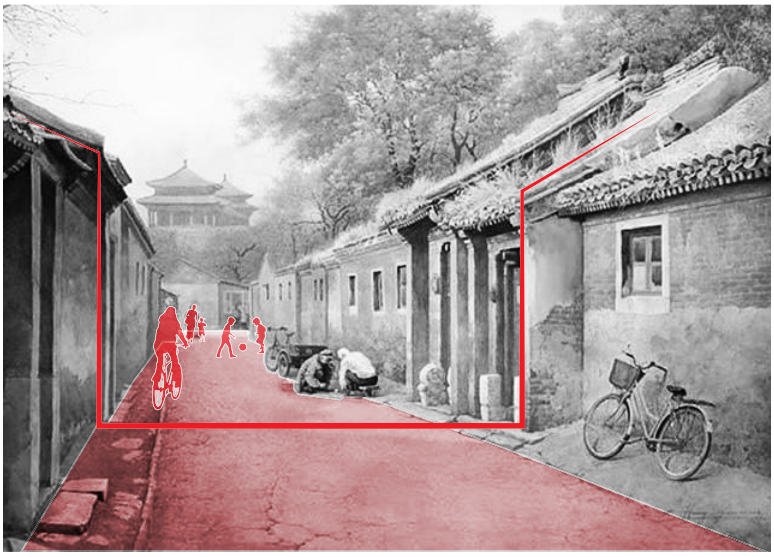
Unity and Variety in Form and Order

As the capital of a feudal society, Beijing expressed a strong order of hierarchy in its architectural morphology, which stretched from the most majestic to the humblest buildings. The resulted aesthetic can be manifested by the unity and variety in the composition of architectural complexes. Palaces, temples, and houses are all composed of simple forms and limited height, but differentiated according to its hierarchical order and proportion. The spatial rhythm of similar single-story buildings created a uniformity in the city profile.

The Unity and Variety of color also strengthens the artistic effect of the architectural complex. The monumental buildings have bright colors: “red walls, white pedestals, crimson columns, green eaves”. Contrasting with them are the plain, simple grey-colored houses of common people, who were not allowed to decorate as they pleased. But, like green leaves behind the flowers, they made architectural arrangement of the whole city more splendid (Wu 1999, 13-14).

Harmonious Attributes in Beijing Hutong

Hutong is the lane way in between the enclosed courtyard complexes in Beijing. It has very human friendly lane width to wall height ratio. Beijing hutong represents an ecological attitude of the “Harmony between the Heaven and Humans” through the close and interrelated relationship among human, architecture, and nature within hutong space. It is a practical utilization of traditional Chinese ecological philosophy, which can be seen from the spatial, humane, and natural aspects.



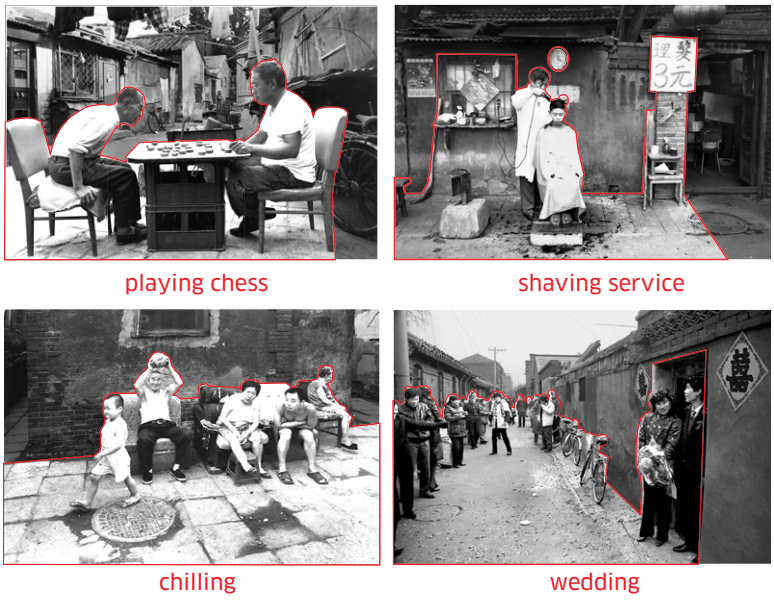
Human friendly scale of hutong; base drawing by Huang Youwei (Wan Fung Art Gallery)

Spatial Aspects

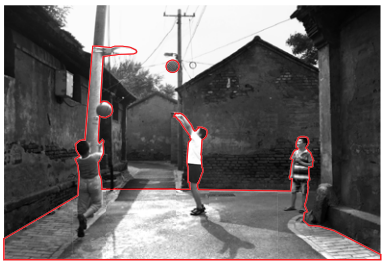
Analyzing from the spatial perspective, hutong is a kind of intermediate space. Indoor and outdoor, architecture and nature, enclosure and openness all achieve harmony through the spatial intervention of hutong. A traditional courtyard complex opens to hutong through the main gate, defines its privacy through the enclosing walls, and connects to the city street system through hutong.

Social Aspects

Looking from the social perspective, hutong is a social space that enhances the neighborhood communication. It is an indispensable public space playing different roles according to its various functional uses. It serves as not only the space of circulation, but also the space of community interactions in the residential areas. In addition, those commercial hutongs, were used as the lively market space for business activities.



Beijing hutongs; photographs by Jia Yong (Jia 2019)


playing basketball


selling newspaper

Beijing hutongs; photographs by Jia Yong (Jia 2019)

Natural Aspects

For the natural aspect, hutong harvests the natural elements: sunshine, wind, rain, and snow. Experiencing the natural phenomenon such as seasonal alterations, people enjoy nature and life inspirations. Together with the outdoor courtyards, hutong is regarded as the harmonious space for the co-existence of humans, the heaven, and the earth (Ni 2009, 96-97).

Vegetation is the indispensable element of hutongs. Almost every hutong exists green life. The most popular kind of trees found in hutongs was Chinese scholar tree (styphnolobium japonicum) in the beginning. Later in the 20th century, black locust tree (robinia pseudoacacia) was introduced from the Western countries. There are also branches sticking out from the walls of courtyard complexes. These green branches enriches the ecological image of hutongs (Ni 2009, 87).


Chinese scholar tree; photograph by Lan Dianguo (Lan 2018)


Black locust tree; photograph by Xiong Hesheng (Wu 2018)

Top left: hutong trees (kknews 2017a)
Top right: hutong trees (kknews 2017b)
Bottom left: trees coming out from Siheyuan (Zhang P. 2018)
Bottom right: birdcages (kknews 2019)

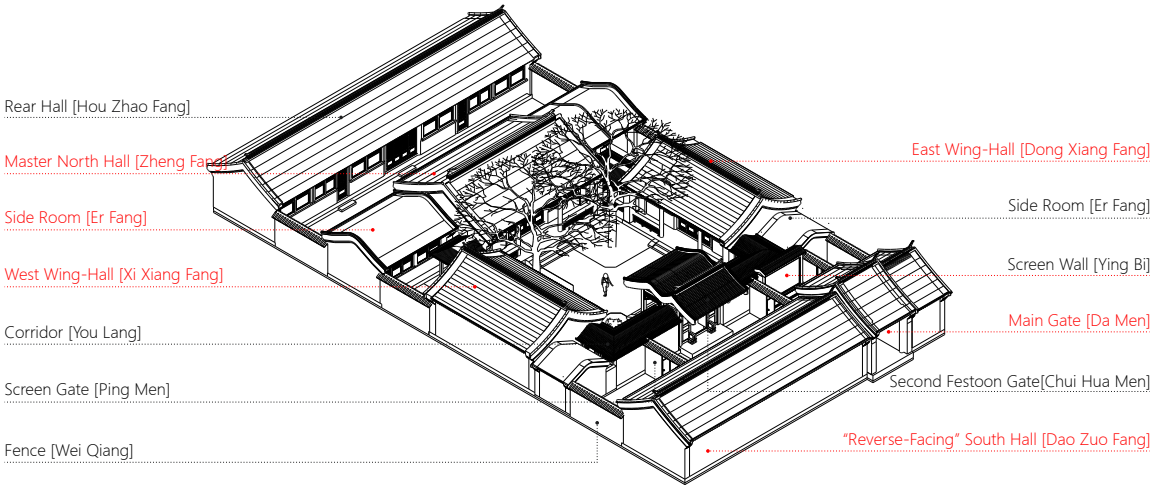
Harmonious Attributes in Beijing Siheyuan

As the archetype of traditional Chinese housing, Siheyuan can be found throughout China with adaptations to climate. This thesis studies the attributes of Siheyuan in Beijing.

Siheyuan is a symbol of harmony. This harmony is manifestated by its many attributes: modularity, proportion, and geometry; axisymmetry and hierarchical order; climatic orientation and ecological philosophy with courtyards. With a set of components and rigorous rules of combination, it works like a mechanism that can adapt to various site conditions. All these attributes make up the harmonious Siheyuan.

Components of Siheyuan

A Siheyuan complex is structured into many components. These components are structurally independent, which allow great flexibility and various possibilities of how they're laid out in a Siheyuan.



Components in a standard three-courtyard Beijing Siheyuan

Main Gate [Da Men]

The front gate to hutong, preferably locates at the southeast corner. A Siheyuan only has one front gate. Its scale and ornaments depends on the hierarchical status and wealth of its owner. Large wealthy complex would have a gatekeeper's room next to the gate.

Screen Wall [Ying Bi]

A screen wall is closed related to main gate. It can be placed outside or inside to screen views before or after crossing the gate. It stands either independently or is integrated into the south wall of east wing hall to save cost.

Festoon Gate [Chui Hua Men]

Also called second gate, it is an inner gate separating the first from the second courtyard. Across from this gate are the private sector of a family.

Master North Hall [Zheng Fang]

A master hall locates in the center north of a Siheyuan. It is the best conditioned building in terms of size, wind and light. Traditionally, it was used as the elder owner's master bedroom or living room.

Wing Hall [Xiang Fang]

Located on both side of the master hall, wing halls rank the second best rooms of a Siheyuan. They were traditionally used as concubine or married son's bedrooms.

Side Room [Er Fang]

Smaller and Lower side rooms sometimes are added to the side of north, east, or west hall. They were used as children's or servants' rooms, kitchens, or storage.

Reverse Facing South Hall [Dao Zuo Fang]

A reverse-facing hall next to the main gate with north-facing poor lighting, since its hutong-side south wall usually had no window or only small high windows. They usually served as guest or male servant's rooms.

Rear Hall [Hou Zhao Fang]

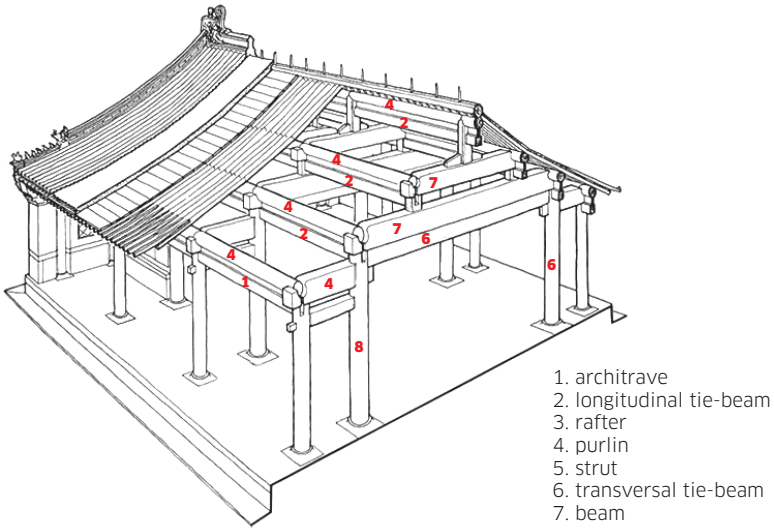
Larger siheyuan with three or more courtyards has rear hall in the back. Its private location was suitable for rooms of unmarried daughters or female servants (Lu and Wang 2017, 114-136).

Spatial Rules of Combination

Jian, Jia – Hall – Courtyard – Complex

Jian and Jia combine into a hall, halls combine into a courtyard, and courtyards combine into a Siheyuan complex (Lu and Wang 2017, 107).

In order to better understand the jian and jia modules, we would first look at the structural system of Siheyuan buildings. The raised-beam wood construction [Tai Liang] effectively reduces the number of columns and provides larger interior space.



Drawing of Tailiang structure (Fas Harvard, n.d.)

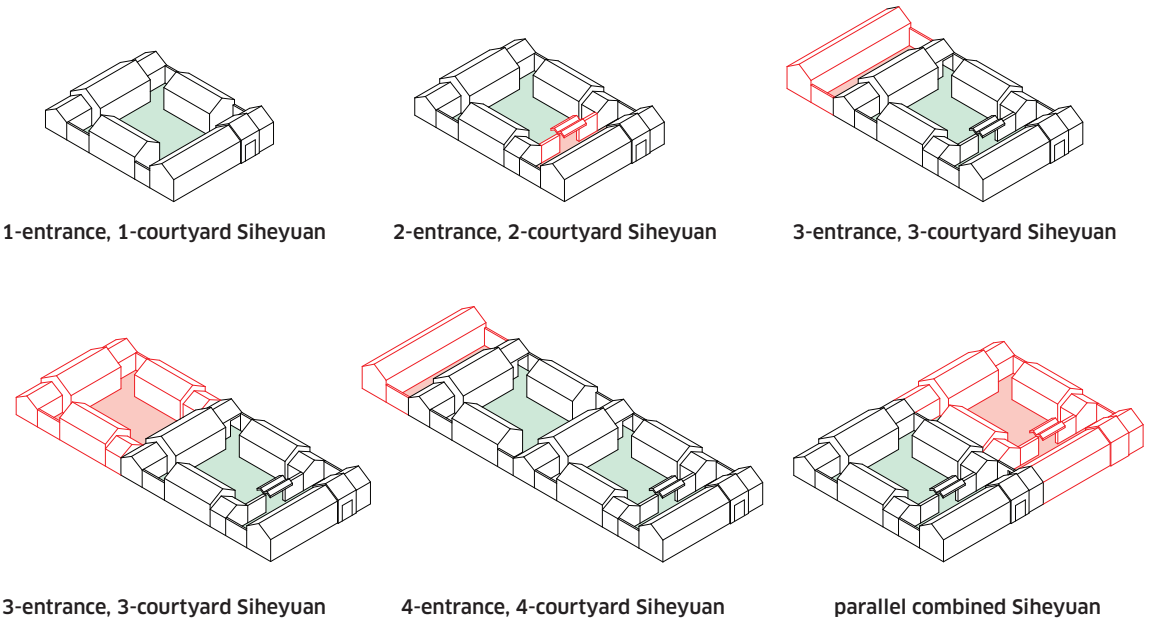
Jian, the modular space between two rows of adjacent columns, determines the width of a hall. The number of jian allowed was decided by the hierarchical status of the owner. Noble residents could be five-jian wide, while common people residents in Beijing were usually consisted by three-jian wide buildings.

Jia, the distance between two adjacent roof purlins, controls the depth of a hall. Noble resident master hall were mostly six-jia (seven purlins) deep, while common people residents

were four-jia (five purlins) deep (Lu and Wang 2017, 158-163).

Serious and Parallel Courtyard Combination

Serious combination method, connecting courtyards along the north-south axis and growing in depth of a complex, are commonly used in Beijing Old City. Small number of large-scale wealthy complexes used parallel combination of courtyards along the direction of hutong.



Courtyard combinations of Beijing Siheyuan

Modularity and Proportion

Modularity serves as the basic method in the spatial rules of Siheyuan.

Geometric proportion can be found in many aspects of the spatial laws of a Siheyuan such as the width of jian, depth of jia, height of column and building foundation.

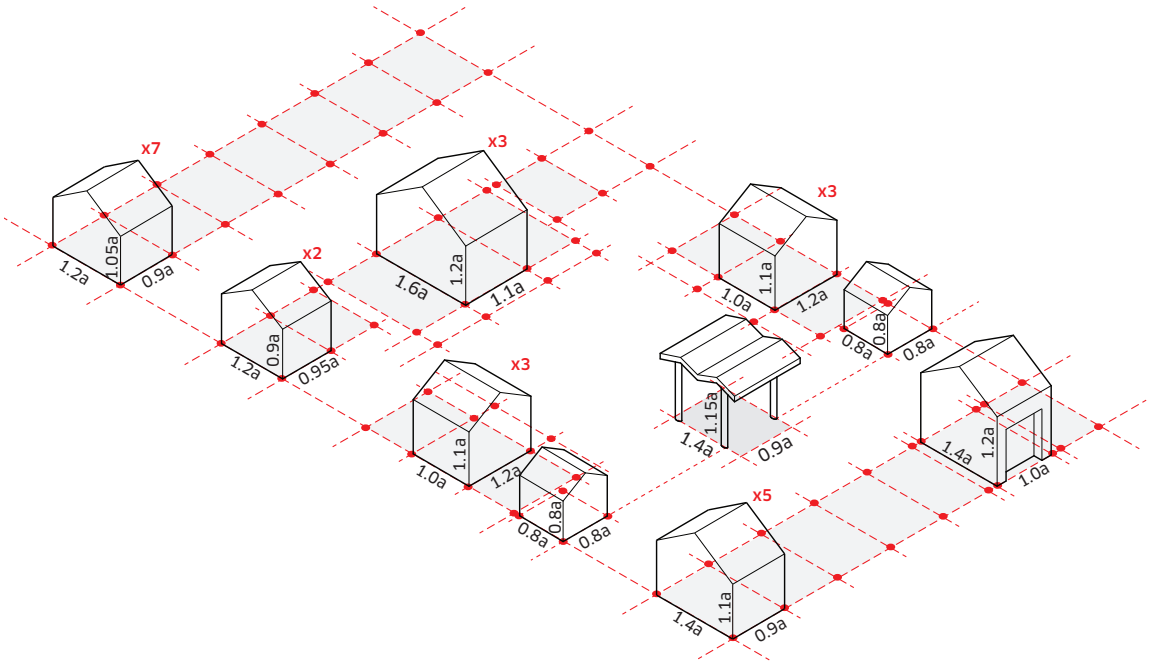
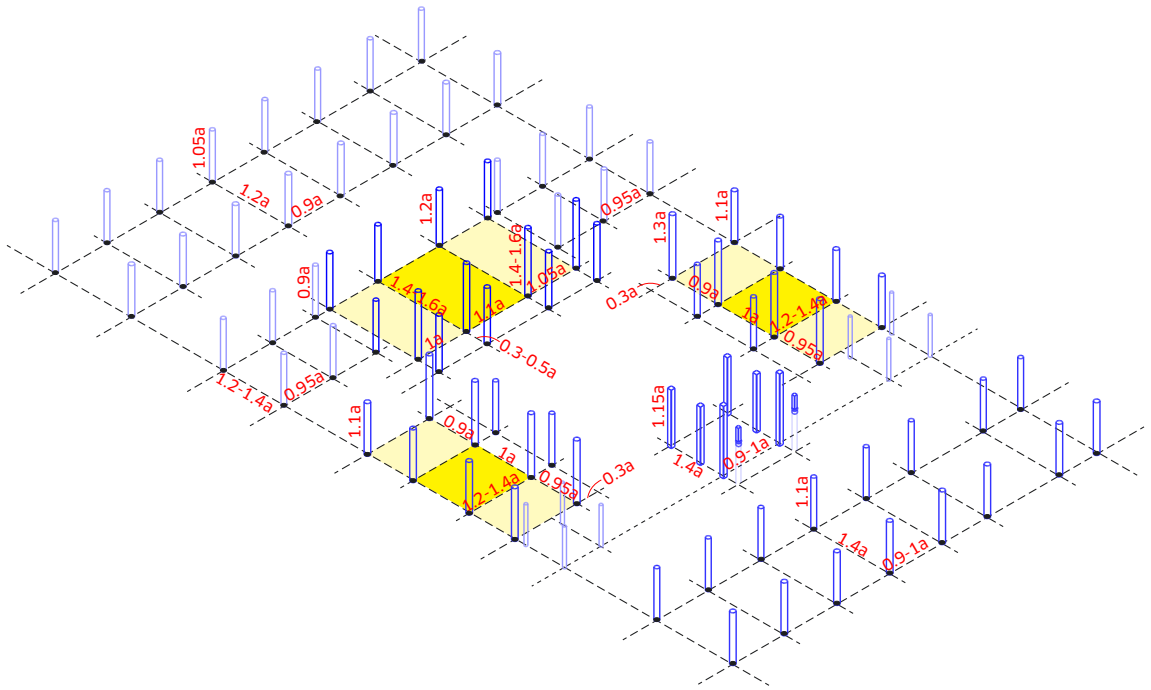


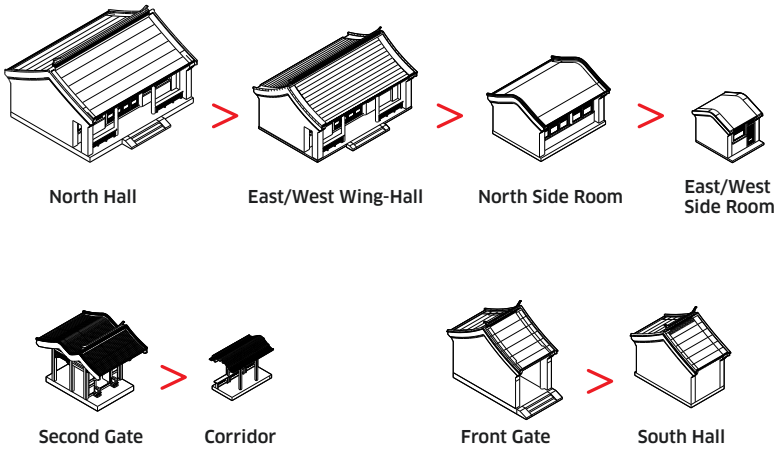
Diagram showing modularity, proportion, and geometry of Siheyuan;
a = 1 zhang = 10 cun. Zhang and cun are ancient Chinese measurement units. Their actual number varies among different dynasties. In Yuan dynasty, one zhang equals 3.12 meters; in Ming and Qing dynasties, one zhang equals 3.2 meters; today, one zhang equals 3.33 meters.
Propotional dimensions referenced from book *Beijing Siheyuan* (Lu and Wang 2017, 164)



Proportional column height of Siheyuan.
Propotional dimensions referenced from book *Beijing Siheyuan* (Lu and Wang 2017, 164)

Hierarchical Order

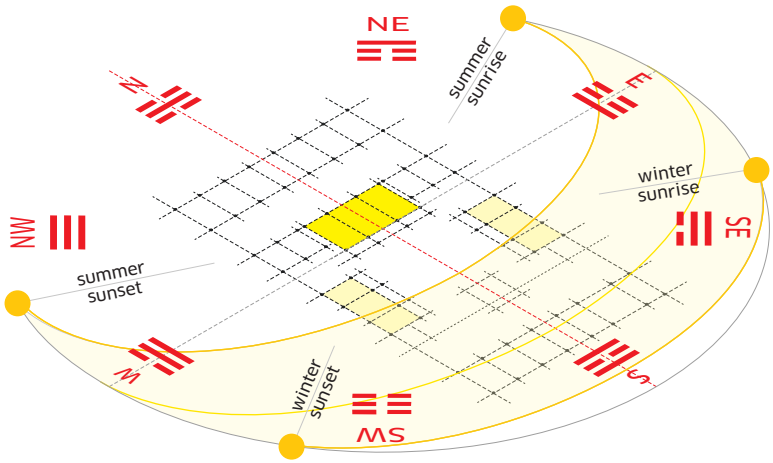
A major reason behind the proportional factors is the hierarchical order of the feudal society at the time. However, despite its feudal origin, the resulted spatial beauty of order lead to the state of harmony.



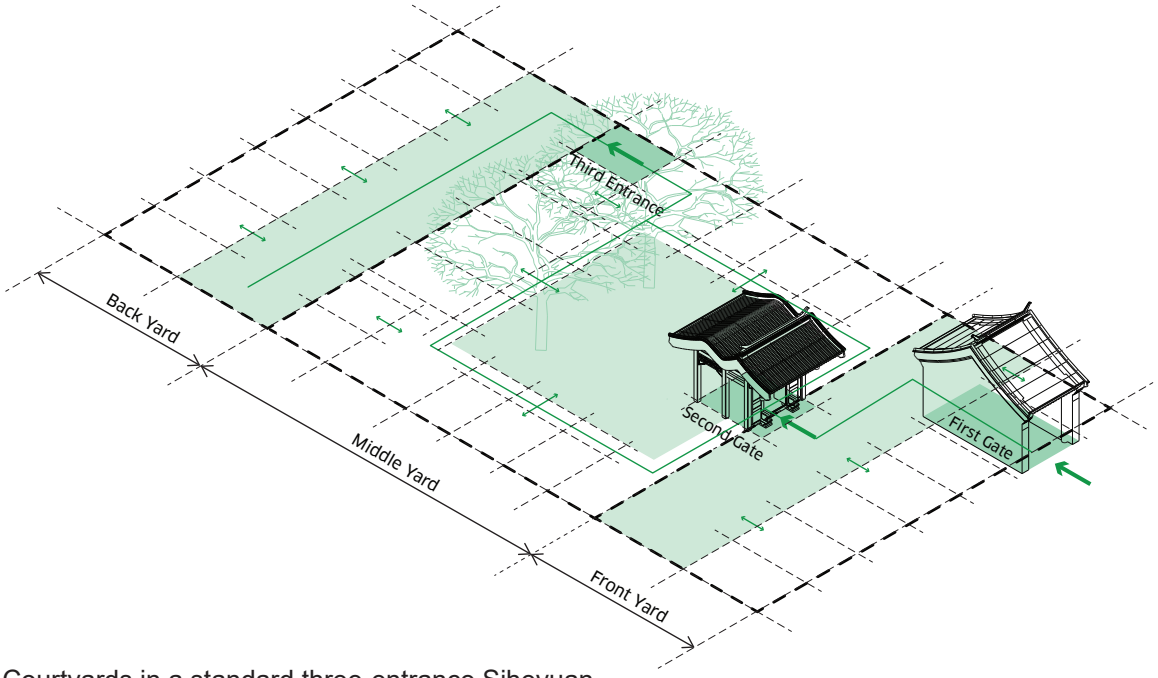
Hierarchical order of Siheyuan components

Climatic Orientation and Ecological Courtyards

Climatic orientation and ecological philosophy through the courtyards also play significant roles in the harmony between natural elements and humans.



Solar condition demonstrated in a standard three-entrace Beijing Siheyuan



Courtyards in a standard three-entrance Siheyuan

> Every courtyard would have a big tree. It seems like our life are all happening under the big tree. The trees in the courtyards are different from the ones in the streets. Courtyard trees are talking closely to people. They play as the center of family and neighborhood relationships. (Ma 2014)

Popular trees in the courtyards of Beijing hutongs include Chinese crabapple tree and clove trees. Fruit trees such as pomegranate tree, date tree, and persimmon tree are also people's favorites in the courtyards.

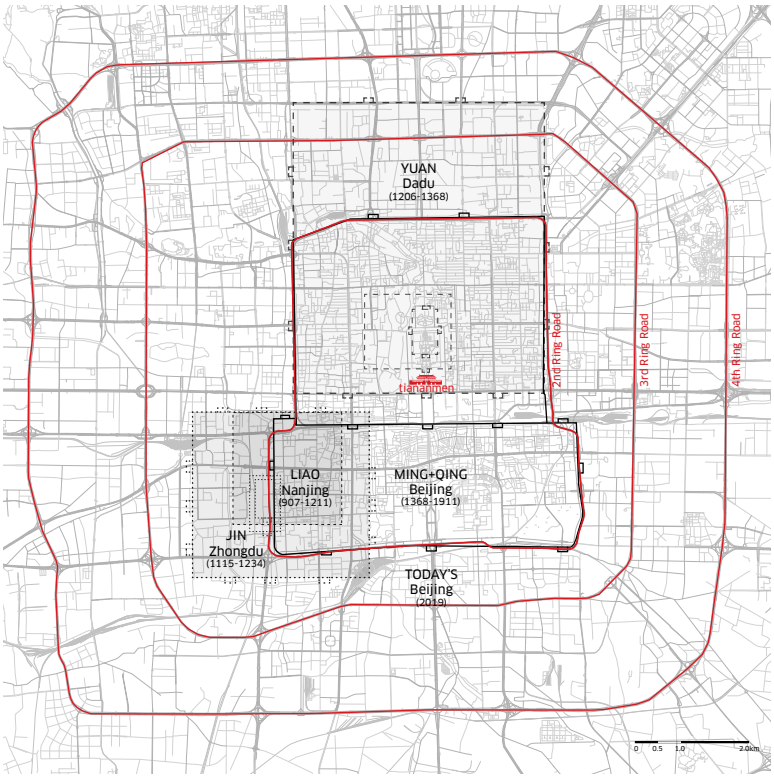
Left: picking dates; right top: cricket game; right middle: picking pomegranate; right bottom: fish tank; paintings by Xie Xiaozhen (Xie 2018)

Temporary canopy is built within the courtyard in the summer for shade or during occasional events such as wedding and funeral of the family. The materials used for courtyard temporary structure are thin fir poles, bamboo poles, reed mats, and hemp ropes. The canopy stands on top of courtyard level without digging into ground. Fir poles are used as vertical columns, horizontal beams, and diagonal bracing. Bamboo poles make the ceiling structure overlaid with reed mats on top. Poles connection are tied by ropes. The shading mats are flexible and can be rolled up or down according to sunlight condition (Lu and Wang 2017, 218).

Left: *Tianpeng* [canopy], painting by Hou Changchun (Xiao 2018)
Middle: *Tianpeng* [canopy], painting by Xie Xiaozhen (Xie 2018)
Right: canopy craftman (Capital Museum of China 2007)

Chapter 3: Transformation

After reviewing the harmonious attributes through the city, neighborhood, and dwelling scales of Beijing, this chapter carries on to investigate in detail the transformation process at the three scales, and mainly the Siheyuan dwelling archetype.



Evolution of Beijing's site since the 12th century: Zhongdu in the Jin dynasty, Dadu in the Yuan dynasty, Beijing in the Ming and Qing dynasties (Wu 1999, 7), and today's Beijing road map (base map from Gaode Maps n.d.)

City Scale - Beijing Old City

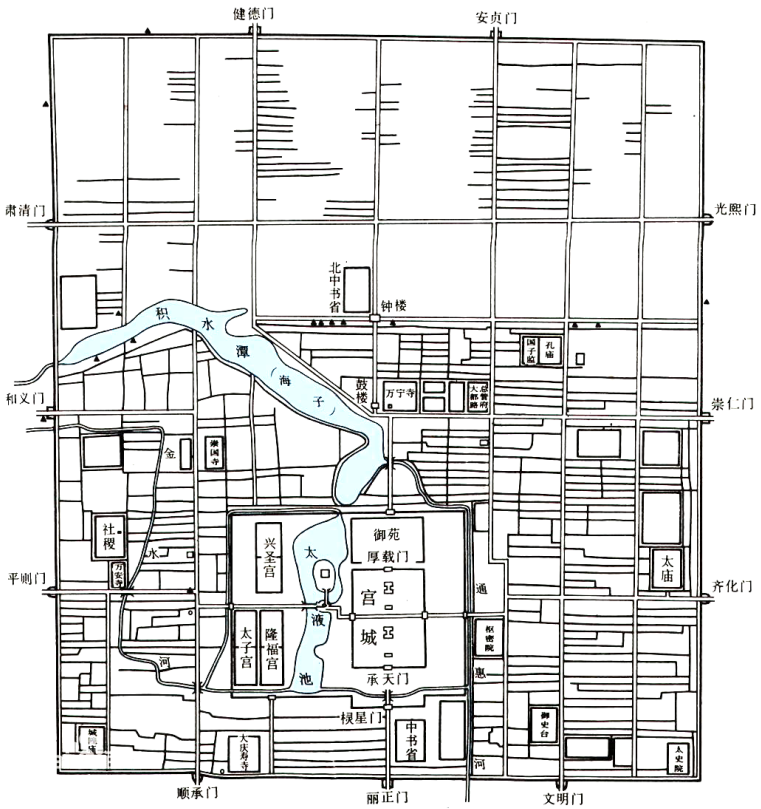
The Ultimate Imperial Capital in China

Beijing, as the last in a long line of imperial capitals in China, it evolved through the last three dynasties of Yuan (AD 1271-1368), Ming (AD 1368-1644), and Qing (AD 1644-1911). Moreover, the planning ideas of Beijing can

also be traced back through the development of concurrent and earlier cities of China. Thus, the City of Beijing may be considered the ultimate crystallization of the planning of imperial capitals in China (Wu 1999, 4).

Yuan Dadu City Planning

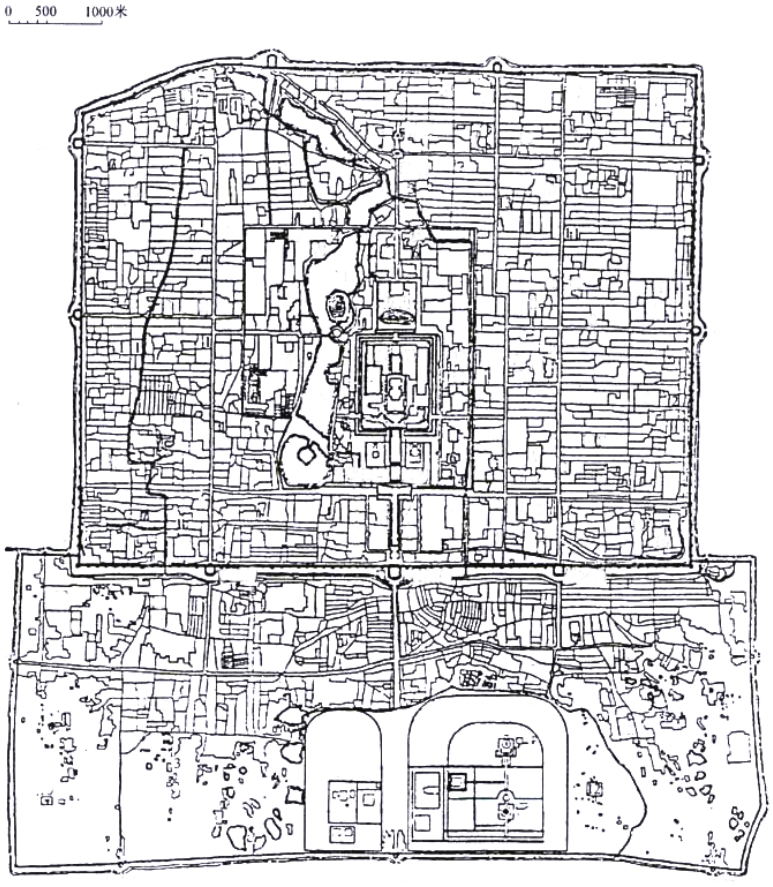
Beginning of Yuan dynasty, a new capital, Dadu [Grand Capital], was laid out as a 6.6km by 7.4km rectangular walled city. Its overall layout reflects the ideal wangcheng [royal city] prototype described in the ancient book Kaogongji (Wu 1999, 4). The Imperial City is in the center south of the walled city. Inside the Imperial City is the Palace City. The rest of the city was divided into many blocks with north-south main streets that were parallel to the central axis.



Plan of Yuan Dadu (Hou 1988, 27-8)

Ming and Qing Beijing City Planning

The new Ming administration moved the Yuan Dadu's northern wall south 2.9 km and the southern wall south about 1 km, making the 6,650 m by 5,350 m Inner City that remains today. Then, a new wall was built to enclose the southern suburbs as the 7,950 m by 3,100 m Outer City. Despite the changes of city shape, the central axis was kept and extended to relate each new elements in the city plan (Wu 1999, 12). Density and population both increased through Ming and Qing dynasties.



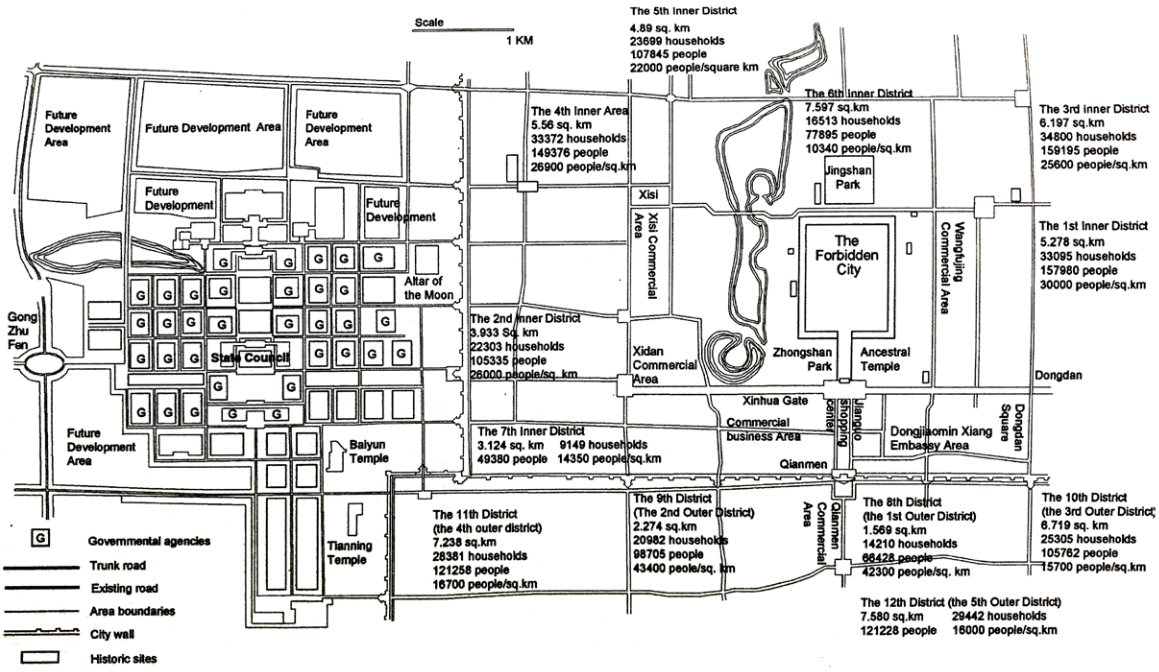
Ming and Qing dynasty Beijing city plan (Hou 1988, 41-2)

Transformation Since 1949

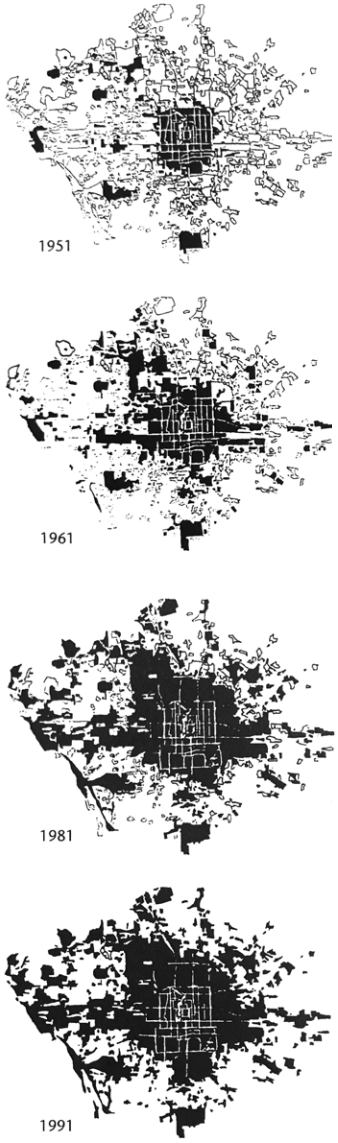
The urban development of Beijing entered a new period in since the foundation of the People's Republic of China in1949. Ever since, the conflict between preservation and development has become more and more serious.

Debate on the Choice of Site

> The argument about the alternatives of "centering new development in the Old City of Beijing" and "setting up a new administrative center in the west suburbs of Beijing" was the crucial point of urban development at that time. Although the later choice might have been more practical, the former was adopted by the policy makers of the time. This resulted in a great deal of new construction in the Old City and, ultimately, compromised the traditional features of the city's structure and landscape. (Wu 1999, 16)



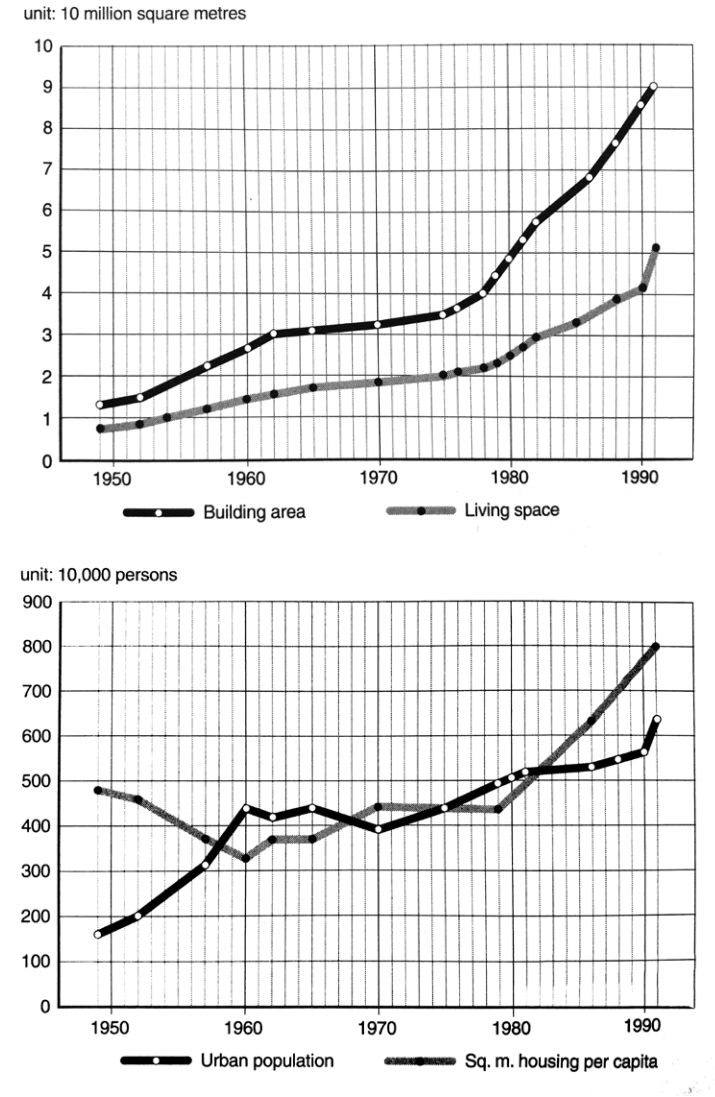
1949 Proposal for the new administration centre in the west suburb of Beijing by Liang Sicheng and Chen Zhanxiang (Wu 1999, 21)



Urban growth in Beijing: expansion of the urban built-up area 1951-1991 (Wu 1999, 45)

Housing Development since 1949

Among the various conflicts between conservation and development in Beijing, the issue of housing causes the most serious disharmony. Since 1949, in response to the large housing demand of the booming population, Beijing has experienced unprecedented housing development. 9 million m² of housing stock was constructed by the end of 1991. The average living space per person increased from 4.7 m² in 1949 to 8.0 m² in 1991 (Wu 1999, 44).



Urban growth in Beijing: increase of population and housing floorspace 1950-1990 (Wu 1999, 46)

> Since the beginning of the 1950s to the end of the 1970s, in spite of great achievements in new housing construction, the traditional residential quarters of Beijing's Old City suffered from haphazard rebuilding as their occupants struggled to meet the immediate demands of daily life; little importance was attached to the urban fabric of the Old City or to the fine points of urban and architectural design. In the late 1980s, the renewal of the Old City's derelict houses became an explicit goal of municipal policy. Although many of the specific measures adopted were imperfect, the overall goal was laudable, as many houses in the Old City were in such bad condition that there was no real alternative to rebuilding them. Unfortunately, the program has over-reached itself. Only a small proportion of the Old City's neighborhoods have been designated for preservation; the great majority are to be demolished and rebuilt on a large scale. Even after most of the derelict houses in the Old City have been renewed, the pace of rebuilding has not stopped and the bulldozers continue to roll over Siheyuan regardless of their quality and condition. We must all wake up to this alarming situation. (Wu 1999, 44)

Street Scale - Beijing Hutong

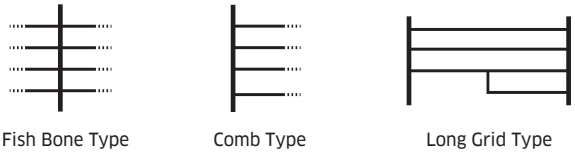
Since 14th century, hutong became the unique urban fabric of Beijing Old City. Due to the population and density increase, the fabric has been transforming from the original plan. Here the transformation process is to be analyzed from both the geometric form and functional use perspective.

Geometric Forms of Hutong

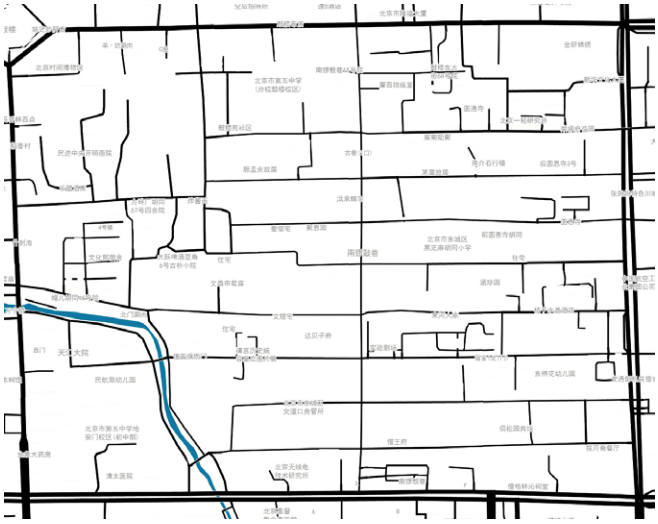
Geometry is used to simplify the forms of hutong as abstract lines. Different geometric combinations of lines represent different types of hutong fabric. Traditional types and new types are compared to understand the transformation process of Beijing hutongs.

Traditional Types

The major types of hutong fabric from Yuan Dadu street planning model are the fish bone type, the comb type, and the long grid type. They have simple and ordered geometric forms. With 9-meter width, they work well in terms of ventilation, boundary making, and social communication. These are the most ideal, classical, and ecological types of Beijing hutong system. Unfortunately, they are rare to find in today's Beijing Old City.



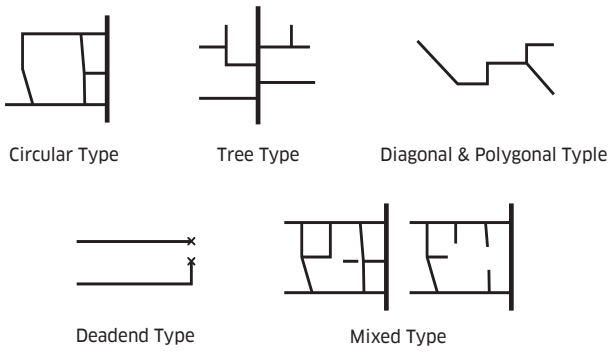
Traditional types of Beijing hutong geometric form (Ni 2009, 74)



Street map of Nanluoguxiang, one of Beijing's historical and cultural preservation zone, still preserving 14th century hutong fabric (Gaode Maps, n.d.)

Transformed Types

Through 800 years of evolution, new types of hutong fabric are found in most areas of Beijing Old City today. The circular type forming a closed ring shape, is a basic and common type. The tree type shows obvious feature of “natural growth” with trunk and branch hutongs. The diagonal & polygonal type is a typical transmutated hutong fabric of contrasting the classical straight hutongs of Yuan Dadu. The Deadend type has only one end connecting to the street and the other end closed up mostly due to the construction of new buildings. Lastly, combined by two of more basic types of hutong fabric, the most common mixed type accounts for 55% of the hutongs in Beijing Old City today (Ni 2009, 76).



New types of Beijing hutong geometric form (Ni 2009, 74)

Street map of Baitasi, one of Beijing’s historical and cultural preservation zone, with transformed hutong fabric (Gaode Maps, n.d.)

Reasons of Hutong Transformation

The Italian architect Aldo Rossi's theory of type proposes that, as the inner law of forming a building, type is the long term accumulation of the basic lifestyle and psycho experiences of people (Rossi 1982). Similarly, the geometric types of urban fabric is also reflection of people's lifestyle. A few specific reasons are analyzed here:

Population increase is directly related to the densification of hutong fabric. Population of Beijing grew from 400,000 in Yuan dynasty to almost 1,000,000 in Qing dynasty and the number of hutongs increased from 413 to 978. Hutong's width was greatly invaded by personal dwelling additions. Less than 120 hutongs are 9 meter wide today. Building height growth also caused hutong scale to be less human friendly (Ni 2009, 78).

Changes of large scale public buildings and noble residential complex played an essential role in the appearing of irregular hutongs. In Yuan Dadu planning, large public buildings took round multiple of hutong grid module to determine their lot size. Although altering the pattern, they fit perfectly into the grid system. However, such modular system wasn't followed after during the new construction or demolition of large public buildings, which resulted in broken grid and irregular hutongs.

There are many other varying aspects contributing to the transformation of Beijing hutong fabric such as transportation methods, water system, commercial business, and society structure.

Functional Uses of Hutong

Circulation, ventilation, natural lighting, and locality boundary are the basic functions of hutong. Besides these, hutong has other functional uses that are transforming through time.

Traditional

In Yuan dynasty, hutong was also called “fire lane“. This denotes a major traditional function of hutong was fire safety. Later during Ming and Qing dynasty, fence gates were added into hutongs during, which provided guard against burglary and enhanced the safety function.

Commercial activities became prosperous in Ming and Qing time, mainly in the southern Outer City. Various kinds of market appeared in the hutongs that even became the name of many hutongs, such as “coal market hutong”, “flower market hutong”, and “rice market hutong”. These “market” hutongs were usually wider in order to perform commercial activities.

Today

Today’s Beijing hutong, thanks to its rich historical and cultural accumulation, has many new humane and cultural functions such as tourism, education, memorial, and cultural heritage experience. Hotels, restaurants, stores and offices started making their way into the hutongs along with the tourism and cultural industry development.

The residential neighborhood densification also developed the social and communal functions of hutong. The residents extended their living rooms into hutongs, making a very lively space. However, when it’s too dense with shed additions and overcrowded car parking occupying hutong space,

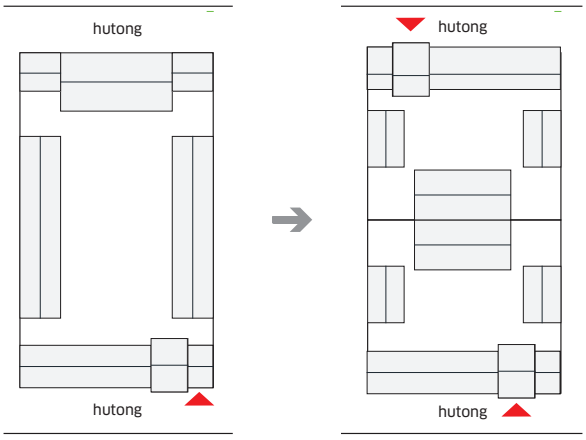
the lively neighborhood and harmonious atmosphere are disappearing in the hutongs today.

Chatting in hutong, 2017; photograph by Jia Yong (Jia 2019)

Crowded car parking in hutong, Baitasi

Relationship with Siheyuan

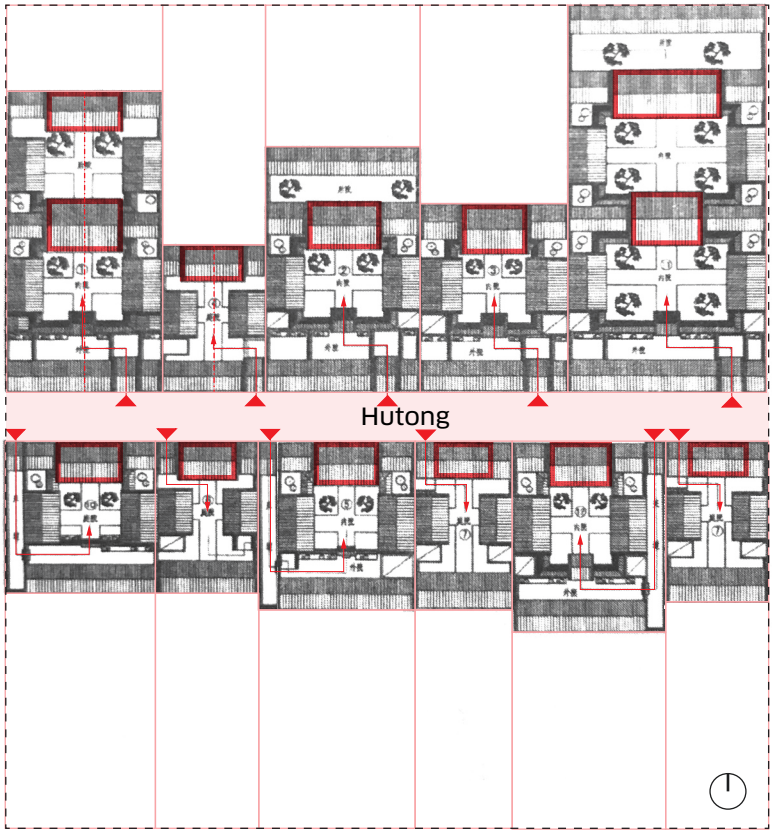
The 68 m by 68 m lot size of Yuan Dadu planning has been subdivided and greatly reduced in size, thus altering the Siheyuan to hutong relationship.



From one Siheyuan complex in Yuan dynasty to two Siheyuan complexes in Qing dynasty (Ni 2009, 155)

In the Yuan Dadu neighborhood plan, a typical courtyard complex always located on the north side of hutong with its front gate opening south to the hutong, thus its south-facing master hall was in the north side of the complex.

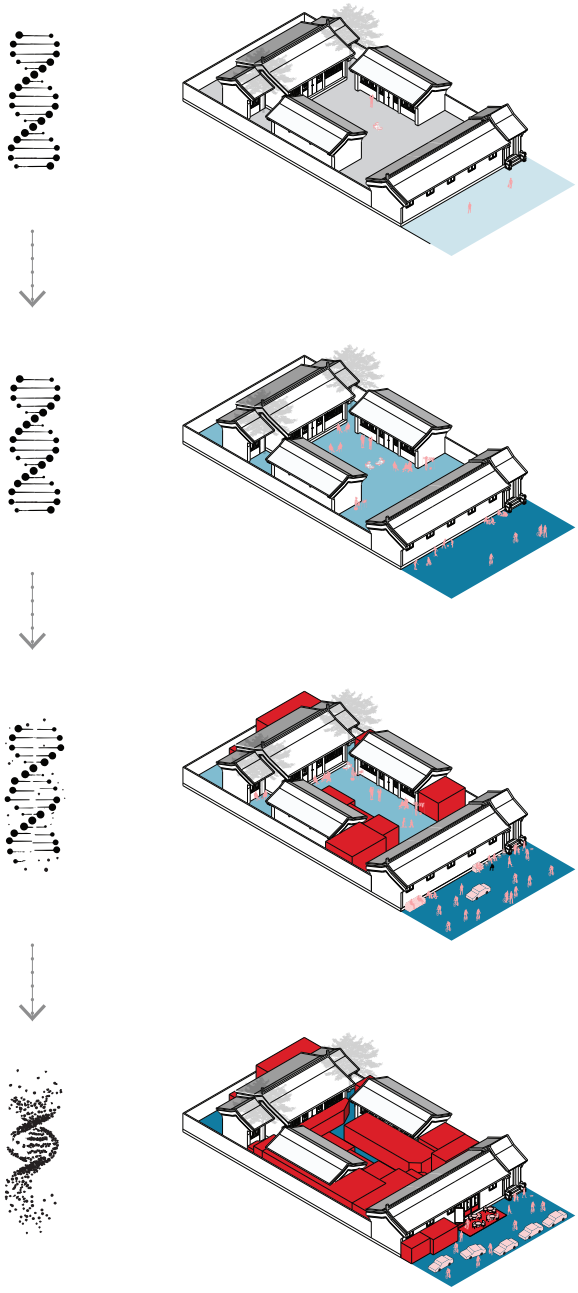
Because of housing densification since Ming dynasty, two courtyard complexes shared the previous north-south depth in between two hutongs in most occasions. Siheyuans situated on both sides of a hutong. Many Siheyuan had to open their main gates to the north. Sometimes a narrow passageway is added to adjust orientation of the siheyuan, to avoid its master hall being reverse-facing to the main gate.



Orientation and gate location of Siheyuan (Ni 2009, 123)

Dwelling Scale - Beijing Siheyuan

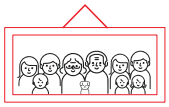
Through time, in the 20th century, the archetype model was transformed, transmutated, and even largely demolished during Beijing's residential densification. DNA symbol is used as a metaphor examine the Siheyuan archetype's transformation process and track the harmony.



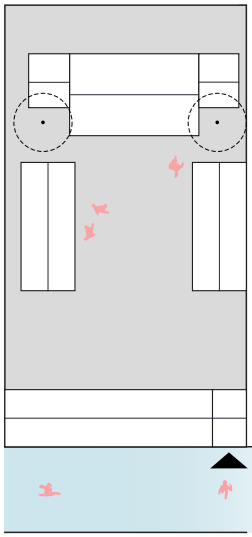
20th century Siheyuan densification process

The Archetype

The original Silheyuan archetype was single family dwelling. Everything happens within the courtyard complex is in a private or semi-private way. Hutong is only path of circulation with temporary use for people.

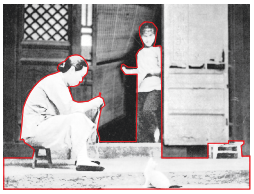


1 unit



family outdoor gathering

knitting

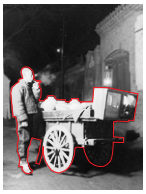


family event

courtyard: semi-private family activies

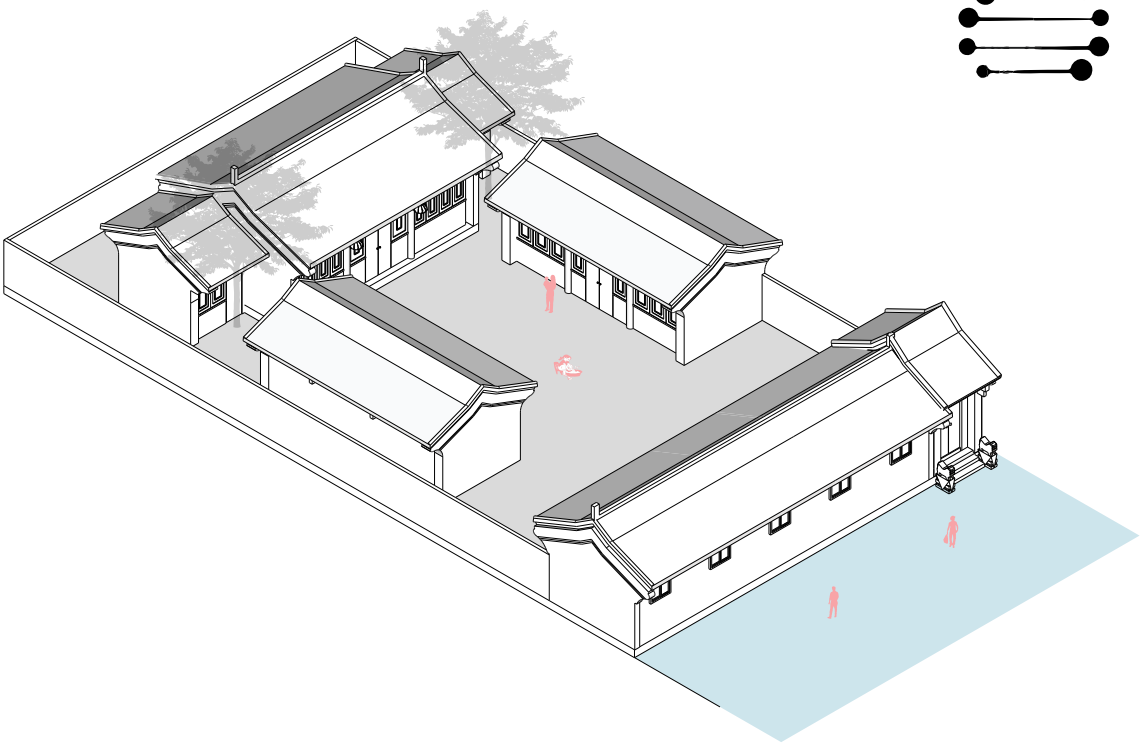
hutong: occasionally activited w/ moments of interaction

house cart



mobile venders

Siheyuan archetype



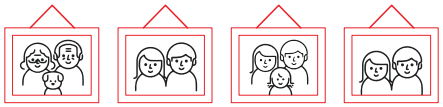
Siheyuan archetype axonometric diagram

Left: traditional hutong space, painting by Xie Xiaozhen (Xie 2018)
Right: traditional Siheyuan courtyard space, painting by Xie Xiaozhen (Xie 2018)

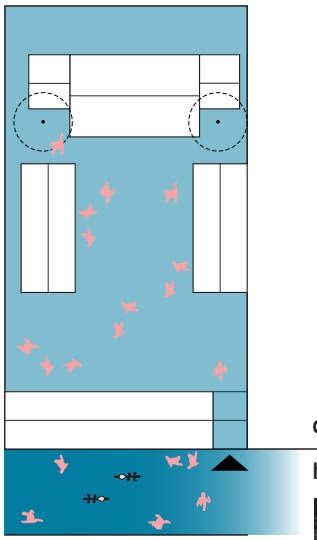
Transformation

Multi Family Dwelling

Private housing then transformed to communal multi-family housing, converting the courtyard into semi-public space. Hutong was activated as community space. The courtyard and hutong became one harmonious place. People were happy in this neighborhood. This positive transformation is something I would like to keep.



4 units



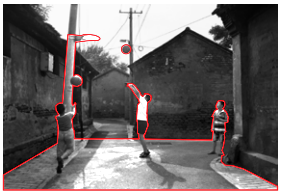
residents meeting

washing & hanging cloth

courtyard: semi-public space

hutong: activited as neighborhood communal space

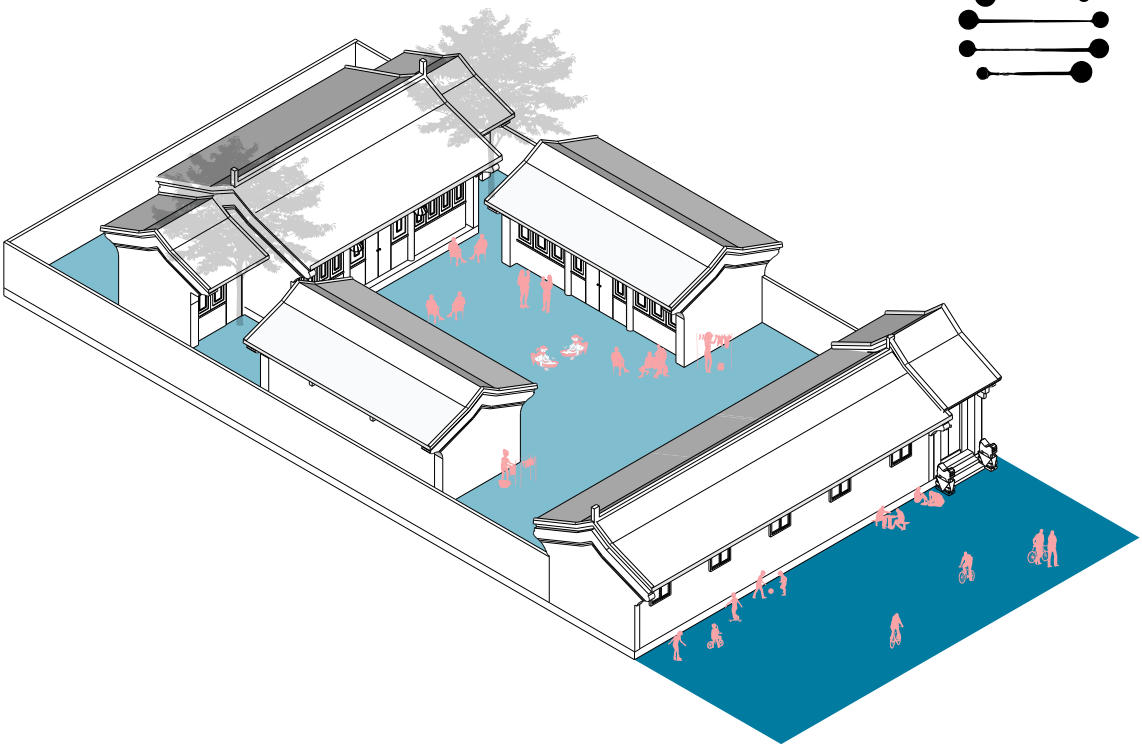
shaving service



playing basketball

playing chess

Siheyuan transformation - multi-family dwelling

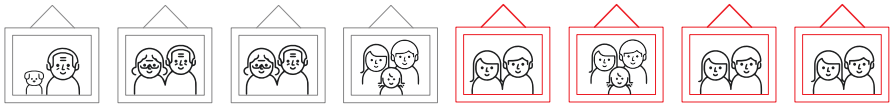


Siheyuan multi-family dwelling transformation axonometric diagram

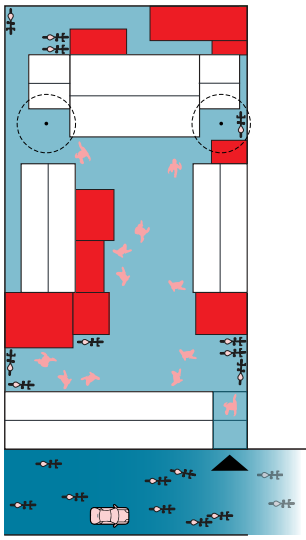
Left: hutong transformed as the community living room, 2017; photograph by Jia Yong (Jia 2019)
Right: musical entertainment in communal courtyard, 1979; photograph by Li Jiangshu (Li 2017)

Infill

The transformation was not only to include multiple families. Shortly after the Tangshan earthquake in 1976, the government implemented responding strategy of building temporary sheds inside Siheyuan, initiating self-built additions. The residents began randomly infilling poor-quality self-built sheds occupying the outdoor courtyard. Hutong was fully activated as the community living room, while bike was still major tool of transportation. The infill's randomness started to alter the orderly DNA of the archetype. But this model could still work under certain limit of additions.



8 units

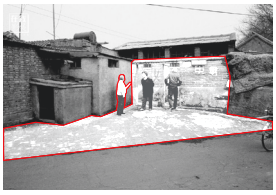


hanging cloth

cooking

courtyard: smaller with self-built infill

hutong: fully activited as community space, long-term acitivities with fixed furnitures

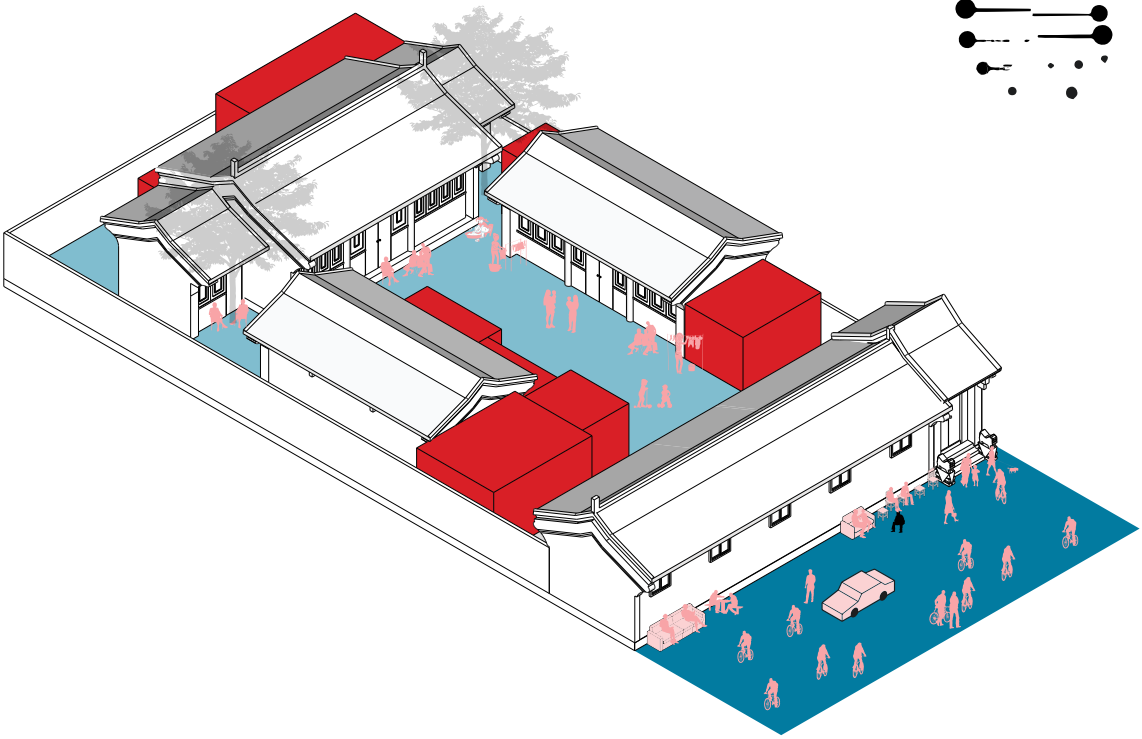


public washrooms

chilling

wedding

Siheyuan transformation, multi-family dwelling with some infill

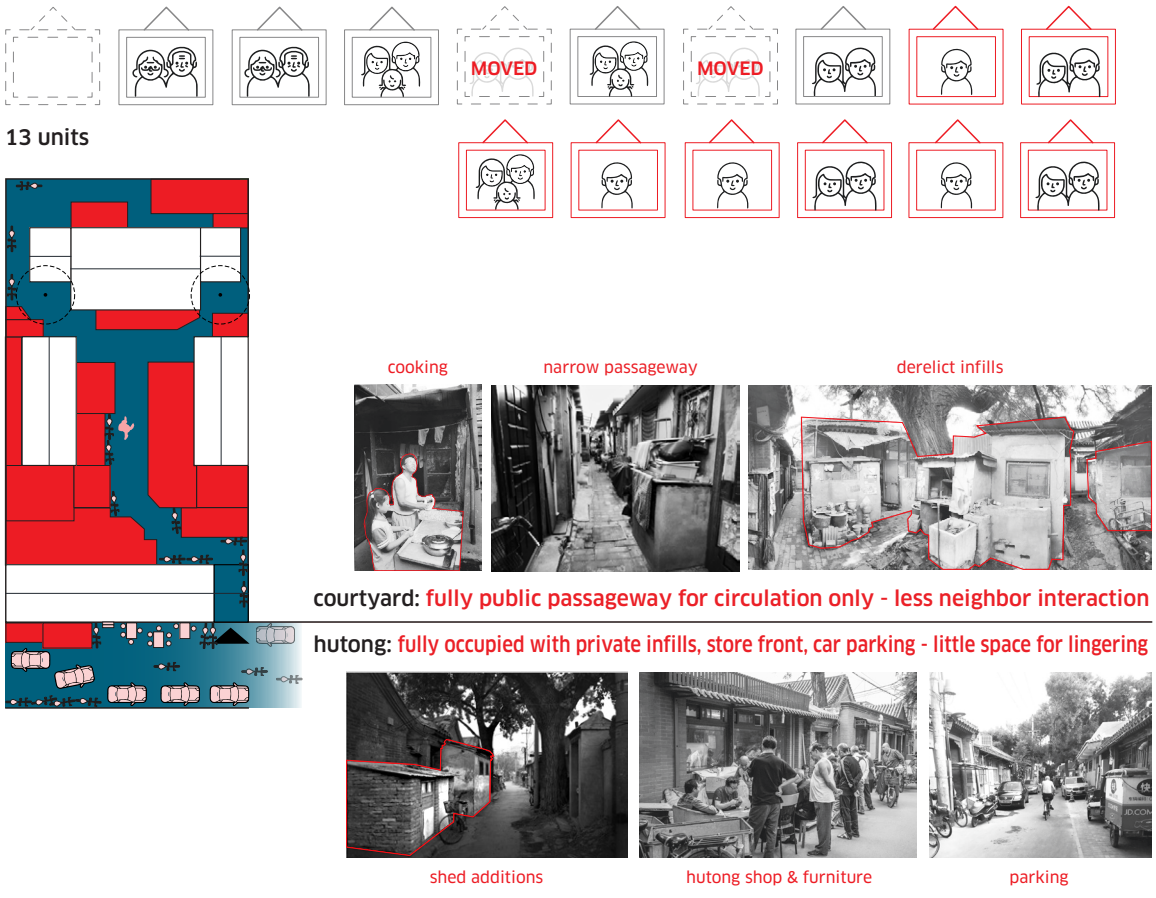


Siheyuan multi-family dwelling transformation axonometric diagram

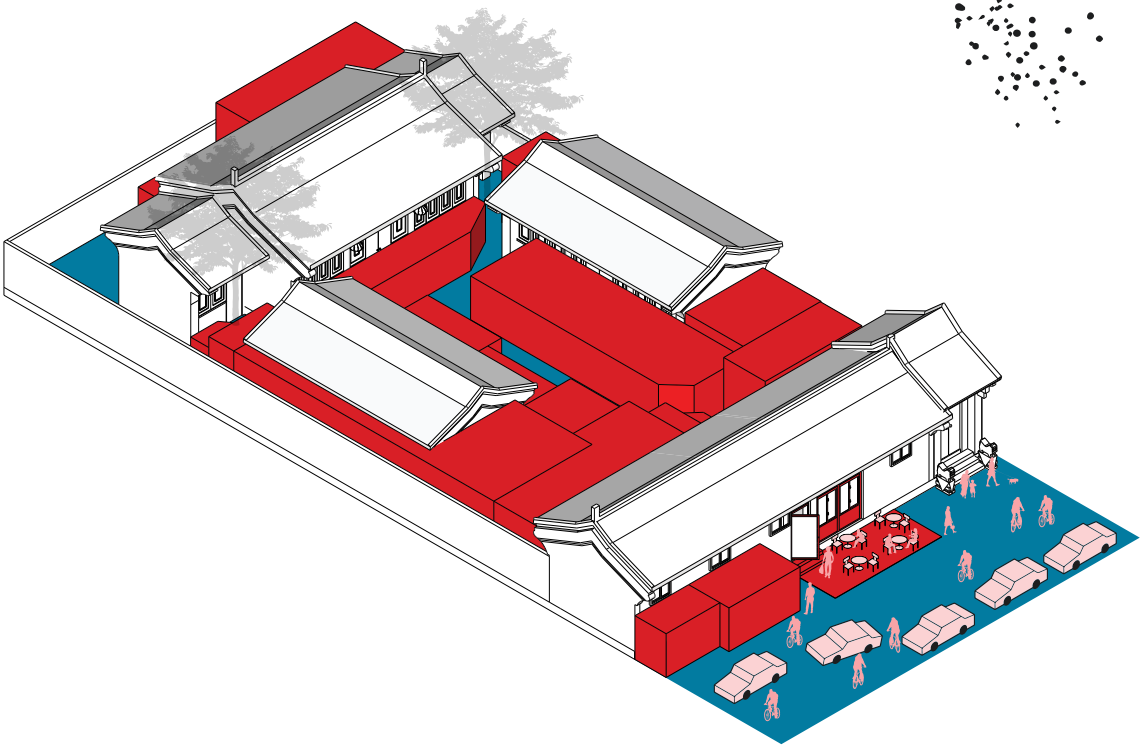
Left: Dafangjia Hutong market, 1996; photograph by Li Jiangshu (Li 2017)
Right: Cooking in courtyard, photograph (Beijing Sijiucheng 2019)

Transmutation

These random and poor additions gradually reached a limit of infilling, when the courtyard space diminished into narrow passageways. It became so dense and messy that the courtyard archetype was lost. Hutongs also became narrower, overloaded by parking. The orderly DNA was broken. No more harmony in the neighborhood. That's why I call it transmutation.



Siheyuan transmutation



Siheyuan transmutation axonometric diagram

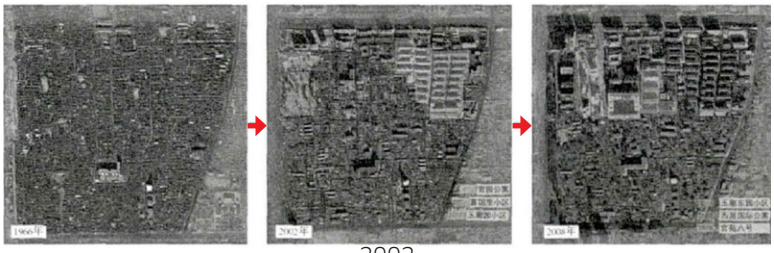
Left: hutong overcrowded by car parking
Right: courtyard occupied by infills

Destroy and Reconstruction

As these transmutated Siheyuan became very hard to live in, they were demolished and reconstructed as massive 5-6 storey apartment blocks. Although providing 3 times as much living space, the higher density caused further strain on infrastructure, which saw little expansion. These apartment blocks were also damaging to the physical order of the city and will continue to be obstacles to the restoration of Beijing Old City's visual quality. Neither the uniform dwellings nor their barracks-like layout reflect the urban context. And sadly, even many good quality heritage Siheyuan were lost in this housing reform movement driven by the developers.

Demolition of Siheyuan in Beijing, photograph by Zhang Jie (Zhang J. 2018)

During 1990-2004 in Beijing Old City: 4,758,000 m² Siheyuan were demolished, 639 hutongs were torn down for reconstruction with beneficial policies supported by the government (Lu and Wang 2017, 268).



Satellite maps showing housing development in Baitasi area
(Dang 2019, 42)

In the Baitasi area of Beijing Old City, half of the historic city block was deconstructed and reconstructed with apartments.

The street view image shows these 6-story apartments with no life, no collective dwelling, and no positive public space. People are losing community attachment, losing a sense of culture. This is not the solution for Beijing Old City. Such model can be anywhere in the world.

Street view of the reconstructed apartments
(photo from Baidu Maps n.d.)

Chapter 4: Design Methodology

Thesis Intention

I believe that there is significant value for preserving Siheyuan despite its lower density. Culturally, it stands as a living museum of the rich Chinese history. Socially, it provides much more healthy and harmonious communal living. Ecologically, natural elements' blending in courtyard and hutong at a human-friendly scale make it a more sustainable model than apartment blocks.

In the past transformation process, Siheyuan wasn't understood as a model that has an opportunity for residential transformation, so was it demolished. But the key problem is that the changes happening to the model could not get back in balance, not the Siheyuan model itself. It's fine that it's transforming, but it got off balance. My thesis intention is to put the model back in balance not by going back in time necessarily, but by going back one step in order to step forward and bring in balance again. Thus, recover harmony in Beijing Siheyuan and hutongs.

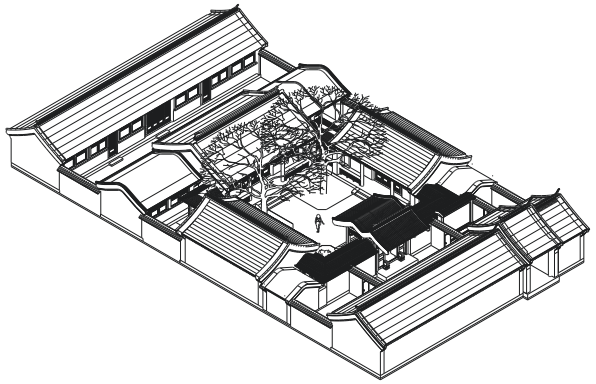
Design Strategies

Three major design strategies will be guiding the design proposal: subtraction and addition; increase permeability between Siheyuan and hutong; and plug in new semi-public/ public programs along the hutong.

sì hé yuàn

四 合 院

[four] [unity] [courtyard]



Early wish image

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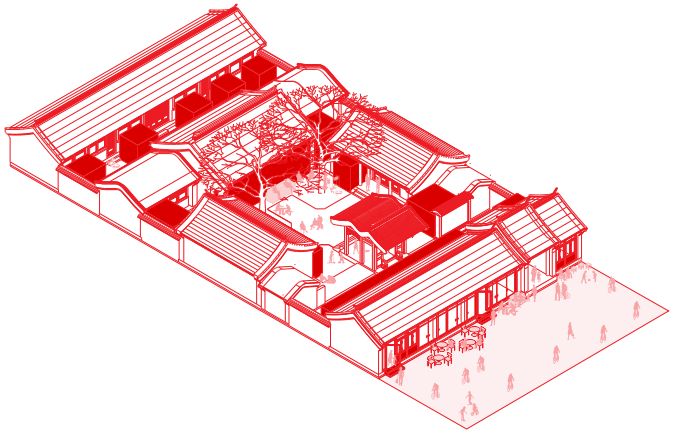
sì hé yuàn

四 和 院

[four] [harmony] [courtyard]



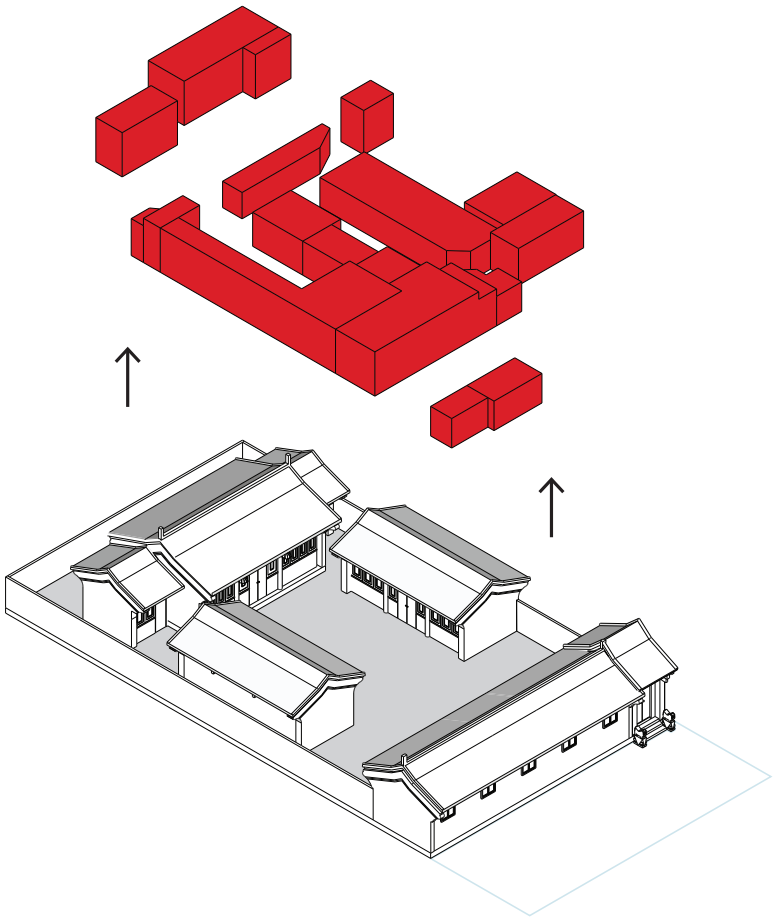
Subtraction/Addition

Subtraction of Poor Quality Random Infills

The existing self-added sheds did temporarily help with people's quality of life. But architecturally it was poorly built; and spatially killed the courtyards. I will subtract the existing random and poor infills in order to implement new additions.

New Addition According to Archetype Attributes

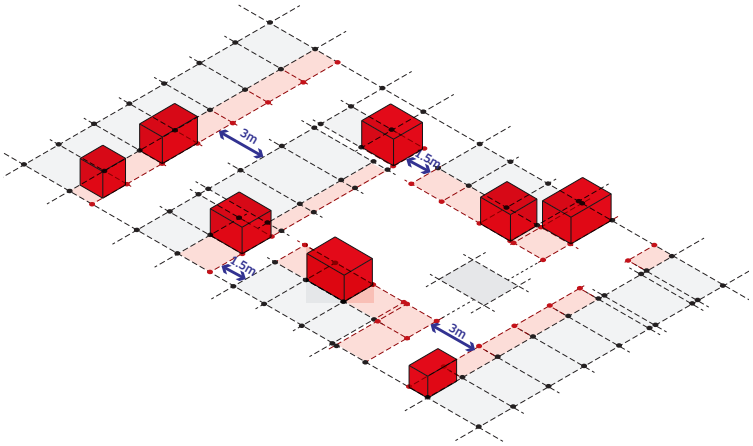
New additions improving density will be ruled by the attributes of the archetype. The courtyard may become smaller, but what I want to preserve is the lively space, the harmonious atmosphere.



Subtraction of existing random poor infills

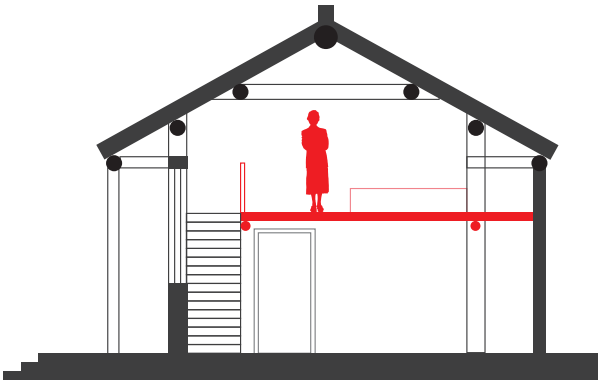
New horizontal additions should grow out from original structural grid, within a limit controlled by solar and shadow condition.

New vertical addition will prioritize the preservation of existing heritage buildings' roof structure and utilize roof volume to insert mezzanine level if height allows.



New horizontal additions growing out from archetype grid

Add additional stories only if the existing building did not require heritage perservation and the solar performance allowed.

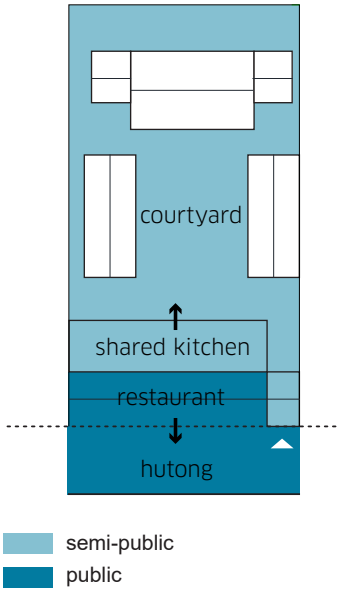


New vertical addition: mezzanine

Increase Permeability between Siheyuan and Hutong

With not many hutongs left, the government has realized the importance of preservation, but what they did was something going back in time and against the neighborhood's need. They were massively closing up the walls opened along the hutongs, which removed most convenient shops in the hutong. The neighborhood lost its convenient places to grab breakfast and buy groceries, lost its favorite restaurant where neighbors could sit and chat.

Instead of closing-up, my intention is to increase the permeability, reconnect the courtyard and hutong space.



An example diagram: semi-public program for Siheyuan residents only; public program open to both courtyard and hutong.

Plug-In New Semi Public / Public Programs

Plug in new semi-public and public programs along the hutong-side buildings will help reconnect Siheyuan and hutong. New programs should be carefully selected to fit in the neighborhood's daily life demand while preserving its cultural and harmonious atmosphere.

Suggested categories of new programs:

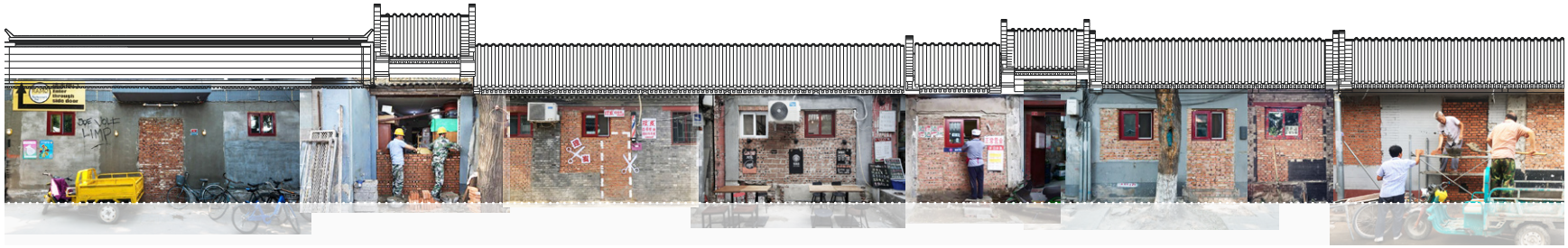
communal - indoor and outdoor activity space;

office - cultural and creative industry;

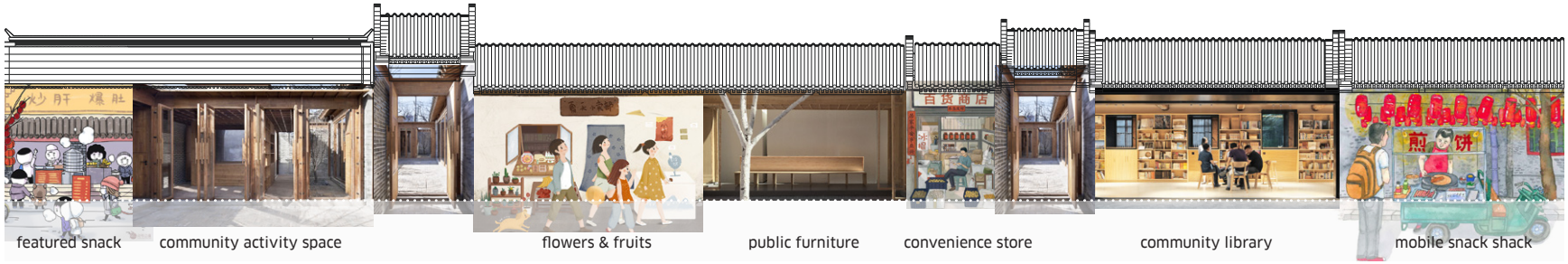
retail & commercial - service serving local residents and promoting traditional craft skills;

tourist & visitors - hotel, airbnb.

Further examplary proposal of new semi-public and public programs is explained in Chapter 6: Architectural Proposal.



Collage showing the government closing up the hutong building openings



Collage of opening up hutong walls for public program serving the community

Other Strategies

Material

The material strategy is both culturally conserving and technically innovative. The major strategy of wood structure and brick wall shall be carried along. But new light structure system and new types of bricks are going to be introduced. For each building's courtyard-facing elevation, the same proportion of stereotomic vs. tectonic as the archetype will be referenced.

Larger ratio of window and new translucent material is necessary to allow more natural light to go inside the units and at the same time providing privacy. Traditional Chinese Xuan paper shall be incorporated with window glass to achieve the translucency.

In the case study of a Beijing Siheyuan renovation project by architect Matsumoto Daisuke, a new material composed by PVC and Xuan paper was used in the windows to achieve the desired lighting effect.

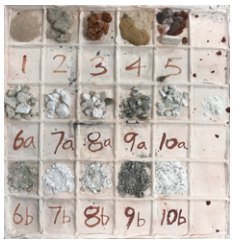
Video screenshot of architect Daisuke's case study showing the new PVC Xuan paper material sample for Siheyuan window (BTV 2019)

A brick making test using construction waste materials was conducted to explore possibility of re-using demolition waste materials.

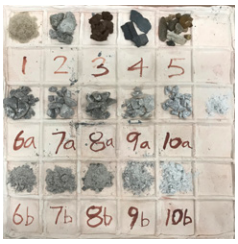
Step one, 10 kinds of construction waste material was collected and fired.


Collecting Waste Construction Material


Selected Material



Making Test Samples

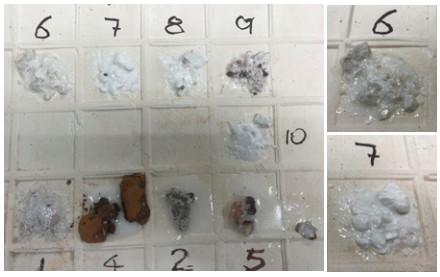


Firing Result

Brick test step one: found material

Step two, 50% of frit material was mixed with the found material to test the bonding relationship of the two. The frit material was used to add translucency effect to the new material mix.

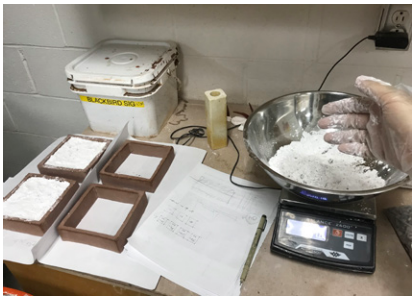
50/50 Mixing Samples



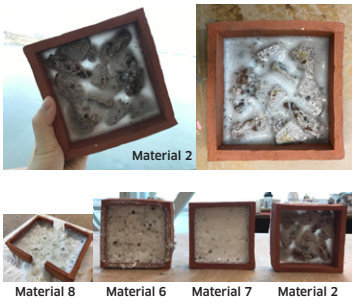
Firing Result

Brick test step two: found material + frit

Step three, material 2, 6, 7, and 8 were selected for an up-scale size test.


Mixing Process

50/50 Mixing Samples



End Result

Brick test step three: 5'' x 5'' upscale

The frame of material 8 was broken during the firing process. Other three upscale test samples came out with different results of brick thickness, light translucency, and surface texture.

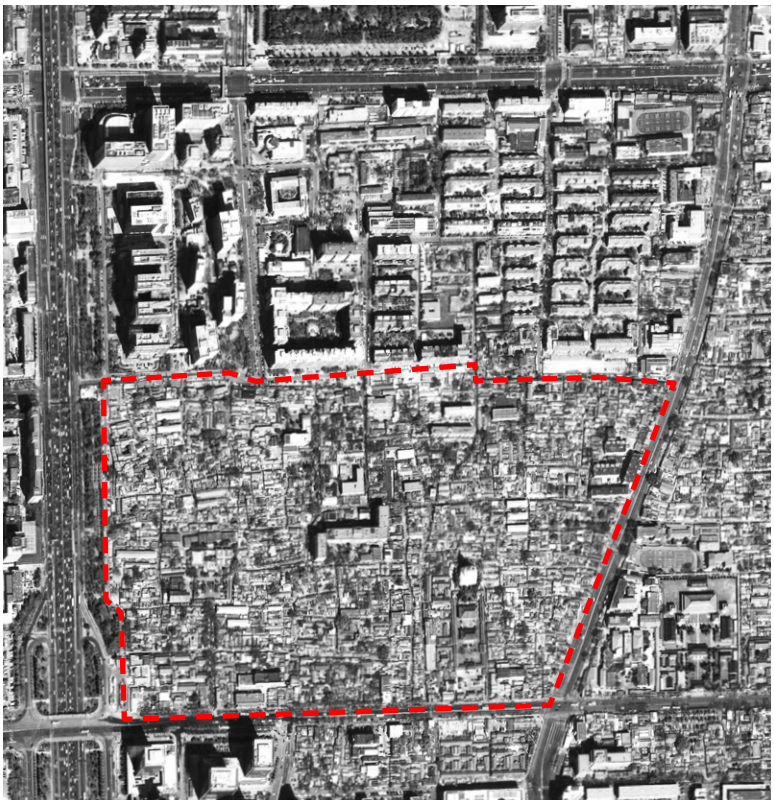
Ecology Pursue and Harmony in the Courtyard

As many trees were lost during the past random infilling process, new trees and vegetations should be replanted back into the recovered outdoor courtyard.

Chapter 5: Site

Baitasi Zone

The remaining undestroyed half of the city block mentioned in chapter 3, is named Baitasi zone today. It has a mix of things. Hutongs are updated and transformed according to the need of the society, incorporating various new programs. Random and poor-quality infills can also be found all over the area. This is the site I would like to work on because both of its hutong fabric and Siheyuan dwelling is under active transformation.

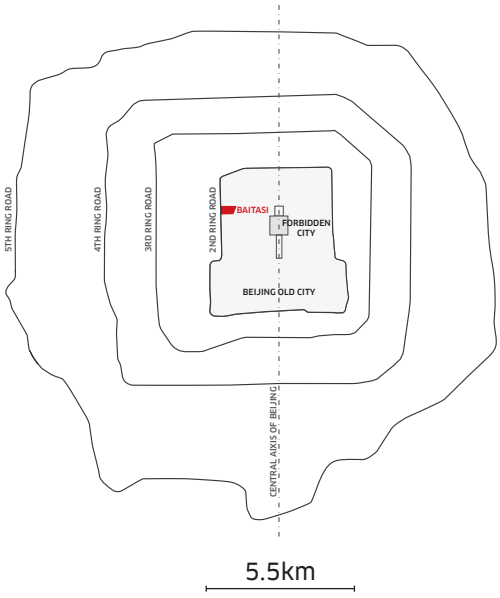


Satellite map of Baitasi zone (Baidu map, n.d.)

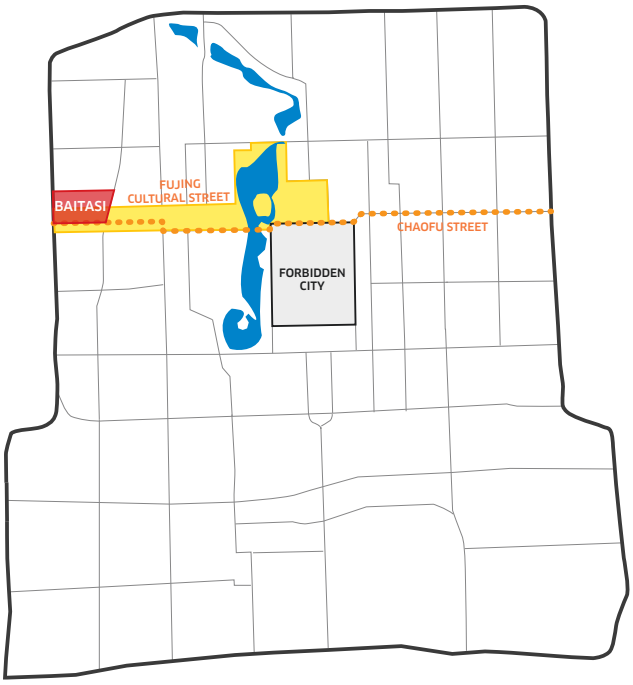
Birdeye view of Baitasi area (photograph from Baitasiremade.com)

Location

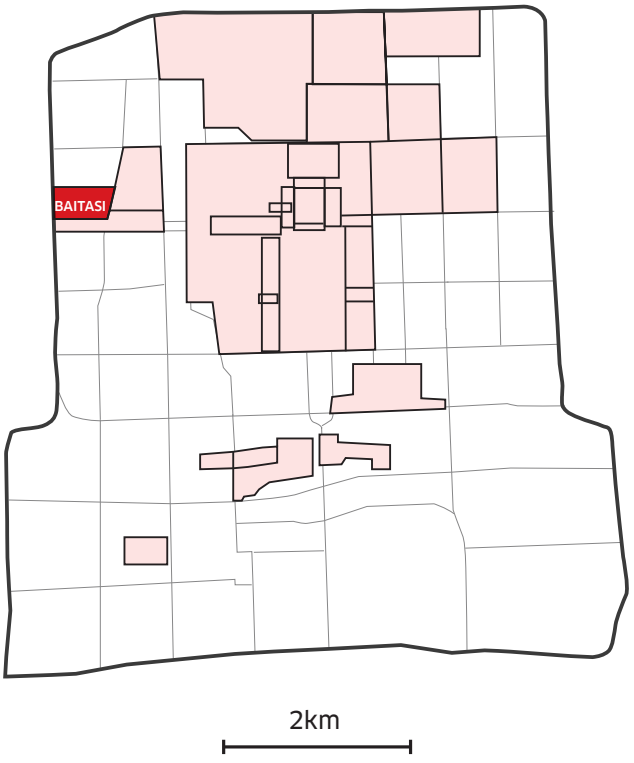
Baitasi (the White Pagoda Temple) is a historical and cultural preservation zone covering about 370,000 m² located just across Beijing's Financial Street in Xicheng district. To its north is the Xizhimen business district and to its west is the Fuchengmen commercial area and the Sanlihe administrative district. The Xidan and Xisi shopping areas border the temple to its east. Baitasi remains a peaceful cultural oasis for the public in the heart of new Beijing.



Baitasi in relation to Beijing



Baitasi in relation to Beijing Old City



Baitasi in relation to Beijing historical and cultural conservation zones

Fabric Transformation

The death and rise of several large scale public building complexes determined the unique hutong fabric in Baitasi area.

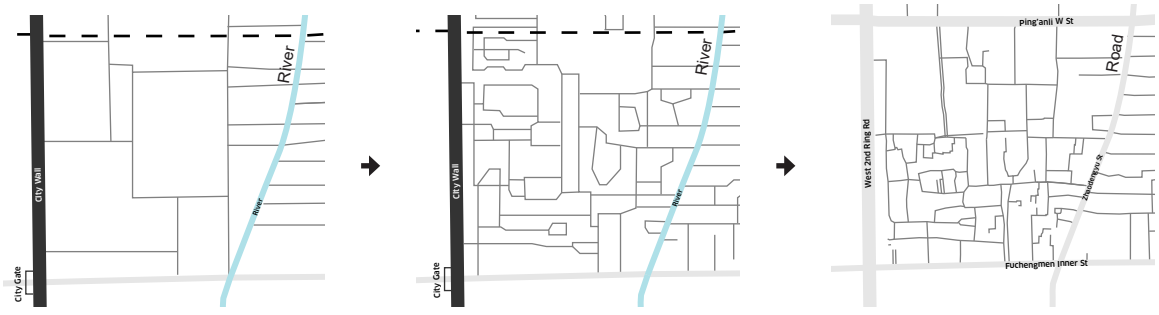
During Yuan dynasty, Baitasi area was mainly used as place of worshipping. The White Pagoda Temple, previously named Wan'an Temple, was an iconic public architecture in Yuan Dadu. It was burned down and rebuilt in Ming dynasty. The original temple complex was ten times larger than today. The hutongs around White Pagoda Temple today were all belonged to the temple complex.

New road looking towards the new museum

To the northwest of the temple, a large daoist palace was constructed during Ming dynasty as the imperial worshipping place. Urfornaturaly, it was burned down in 1626 and gradually became hutongs dwelled by common people.

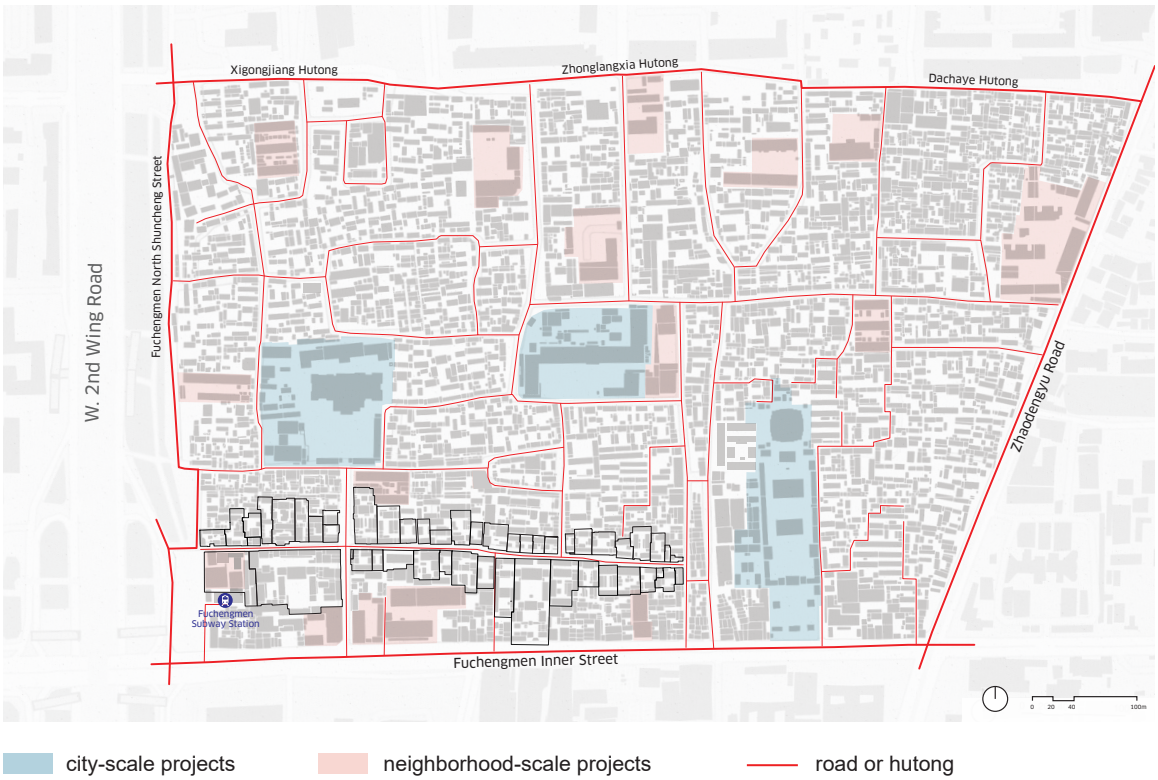
Front gate of the new museum

In 1954, the government decided to build a new museum in memorial of the famous writer Lu Xun, who used to live in Goumenkou Santiao Hutong. A new road (Fuchengmen Road) was constructed south of the museum leading to its front entrance. Later the museum west expansion also altered the hutong fabric (Dang 2019, 36-37).



Yuan Ming/Qing Now

Baitasi hutong fabric transformation



Map diagram of Baitasi (base map from Archdaily 2018)

Baitasi Today

Out of the 370,000 m² area of Baitasi, 74.07% land is of residential use. For the rest, cultural heritage and commercial business occupy a big share. Schools, hospitals, public administrative offices can also be found in the area (Dang 2019, 39).

What's interesting with Baitasi zone is that, it is already a fabric being transformed. There's opportunity of both preservation and development. It could be a counterpoint alternative to what's happening in those apartment blocks. It would work better in terms of communal, cultural, ecological aspects, as a more sustainable model.

Buildings and hutongs in Baitasi

Commercial life in Baitasi

Transmutated Siheyuan courtyards in Baitasi

Furnitures in hutong

A kindergarten

Friendly neighbors

Chess on a parked motorcycle

Current Conditions and Issues

Demographics

High population density: 13, 000 residents, 32 residents/km²

High ratio of old population: 25.1% > 60 years old

Large floating population: 51%

(Dang 2019, 40).

Buildings

There are around 4000 buildings in Baitasi area. 70% buildings has poor quality issue. Over 50% buildings were building during 1950s. More than 51% families have self-built sheds. The average floor area per person is around 13 m². 32.8% families have less than 10 m² dwelling area per person. The average dwelling area of rental tenants is only 9.62 m² per person (Dang 2019, 40-41).

Public Facilities

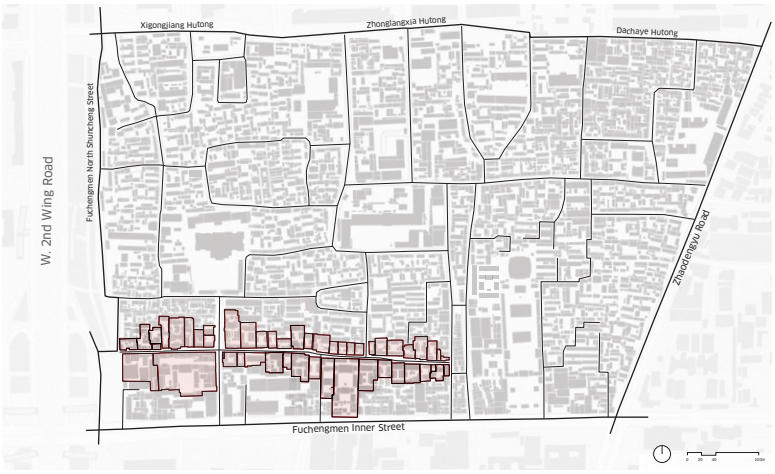
Although the community has improved public space condition by repainting the exterior walls in hutongs, the exisiting municipal infrastructure system in Batasi is seriously aging and cannot satisfy the demand. Sewage system are incomplete and need upgrading. Over 90% Siheyuan don't have private toilet inside the complex (Dang 2019, 41).

Hutongs

Baitasi has 30 hutongs. Most of them are quite narrow with three-to-five-meter width. 22% hutongs are less than three meter wide. Transportation condition in the hutongs is terrible with mixed car, bike and pedestrian moving and messy parking issue (Dang 2019, 41).

Gongmenkou Toutiao Hutong

Then I chose Goumenkou Toutiao Hutong to closely study the Siheyuans along this hutong and apply the design strategies. It is one of the longest hutongs in Baitasi covering more variety of Siheyuan conditions



Location in pink color of Gongmenkou Toutiao Hutong in Baitasi zone (base map from Archdaily 2018)

Site photos along Gongmenkou Toutiao Hutong

Map diagram of Gongmenkou Toutiao Hutong
(base map from btsremade.com)

Lot Analysis

Most of the lots are for residential use. Commercial and government offices locates on the south side of the hutong. Only a few retail shops and restaurants exist in the hutong. Fuchengmen subway station locates on the west end of the hutong.

Land use diagram (base map from btsremade.com)

Most of the property lots are owned by the government directly or sub-administrative organizations of the government. Only a small number of lots are privately owned. Some has mixed-ownership.

Property ownership diagram (base map from btsremade.com)

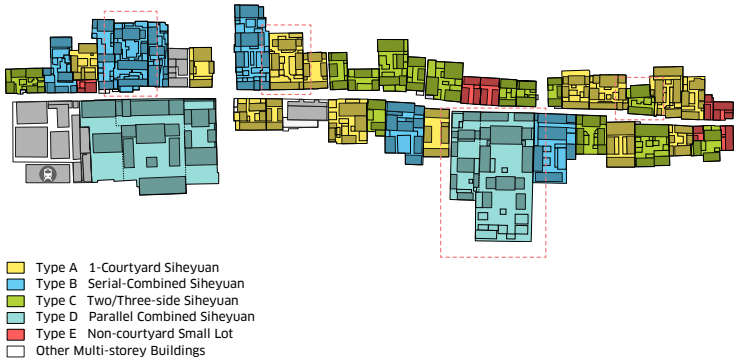
This diagram roughly represents the current conditions of the buildings along Gongmenkou Toutiao hutong. It shows the relative “new” and “old” building condition.

Building condition diagram (base map from btsremade.com)

Based on the analysis diagrams and lessons learned from previous Siheyuan archetype’s attributes, I peeled off the random additions trying to recover the original courtyard condition of the lots.

Map diagram of Gongmenkou Toutiao Hutong showing recovered Siheyuan (base map from Baitasiremade.com)

Type Catalog



Siheyuan type diagram (base map from btsremade.com)

All the Siheyuans along the hutong are then categorized into a type catalog:

Type A – Single courtyard Siheyuan;

Type B – Serial combined Siheyuan complex;

Type C – Two or three-side only Siheyuan;

Type D – Parallel combined Siheyuan complex.

For each type, one sample is selected for further design exploration.

Catalog: Siheyuan types of Gongmenkou Toutiao Hutong

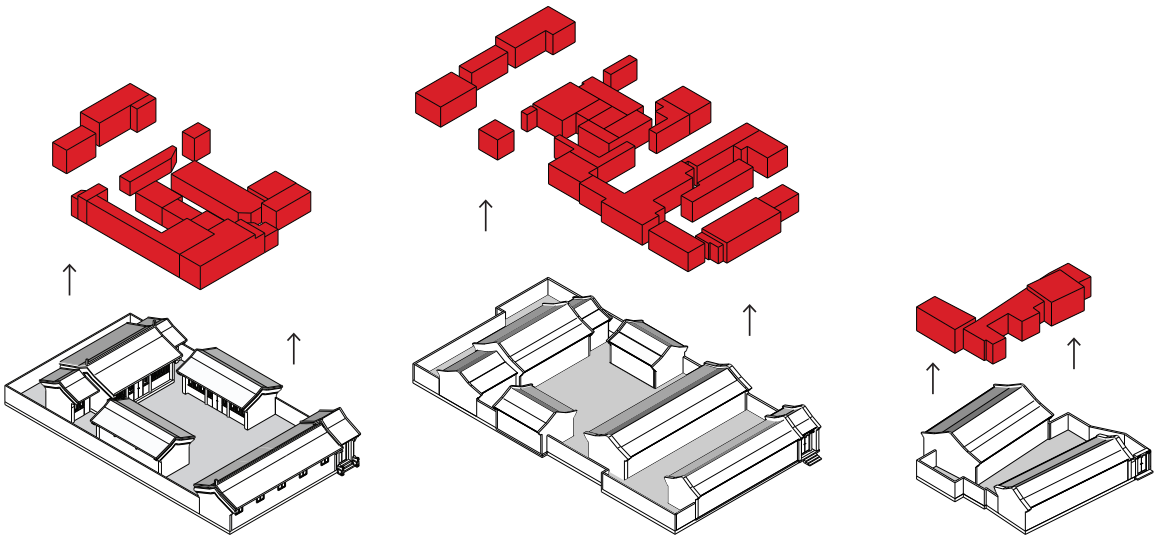
Chapter 6: Architectural Proposal

Type A, B, and C - Communal Residence

Selected samples of Type A, B, and C are further explored with a series method of Subtraction – Limit Test – New Addition – and ReProgramming. Each comes up with two programming scenarios targeting different density levels.

Subtraction

To begin, existing random poor quality infills are subtracted to bring back the Siheyuan courtyard condition. Part of the recovered land will be proposed with new additions; part of the land will be given back to lost outdoor green space.



Type A - Lot No.47 Type B - Lot No.55 Type C - Lot No.9

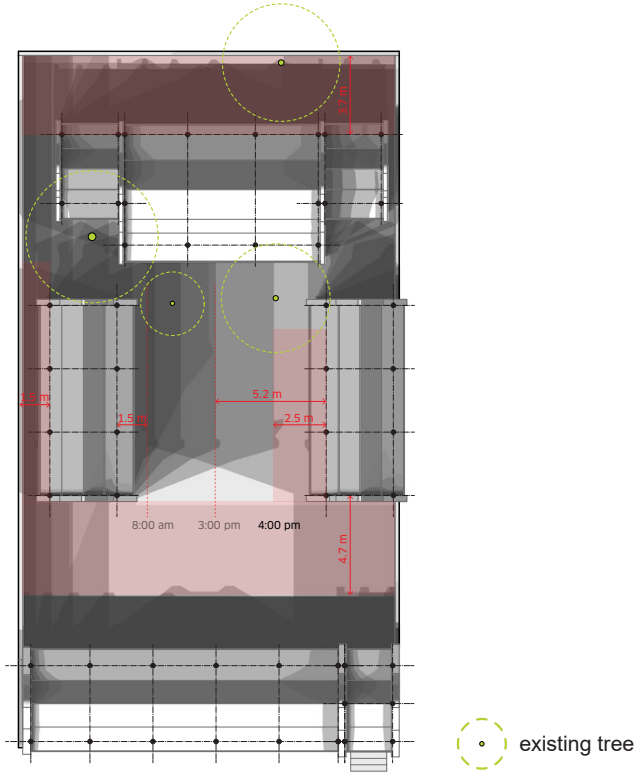
Subtraction of existing poor infills

Limit Test

One major problem of the current infills is that most rooms receive little or no direct sunlight. In order to increase the living condition of future new additions, solar study is used to test the maximum horizontal limit for proposing new addition. Limit is cut off by the sunlight condition of 4pm on equinox. This provides 8 hours direct sunlight on equinox and more than 4 hours direct sunlight on winter solstice.

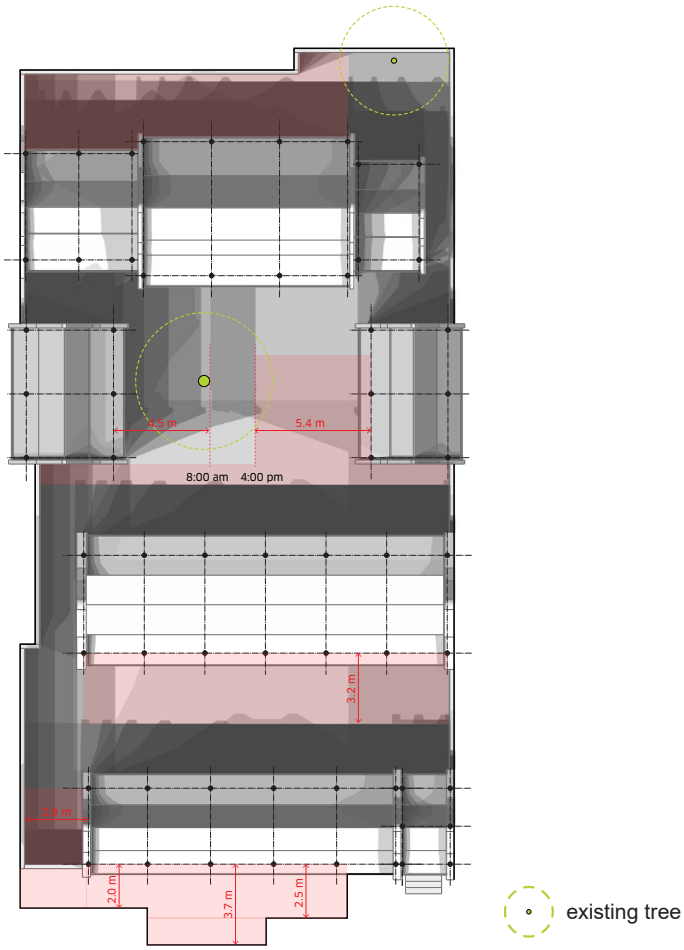
The modular (jian) system of Siheyuan archetype is applied to the remaining buildings for spatial reference. Existing trees are shown.

In the solar study roof plan diagrams, areas shaded in red tone represent the total area available for new addition, which may be divided or shifted later.



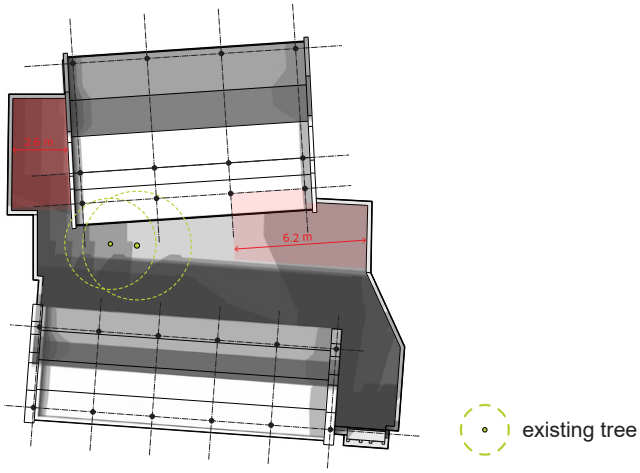
Type A - Lot No.47

Solar study diagram of lot No. 47 showing shadows through the day on equinox



Type B - Lot No.47

Solar study diagram of lot No. 55 showing shadows through the day on equinox



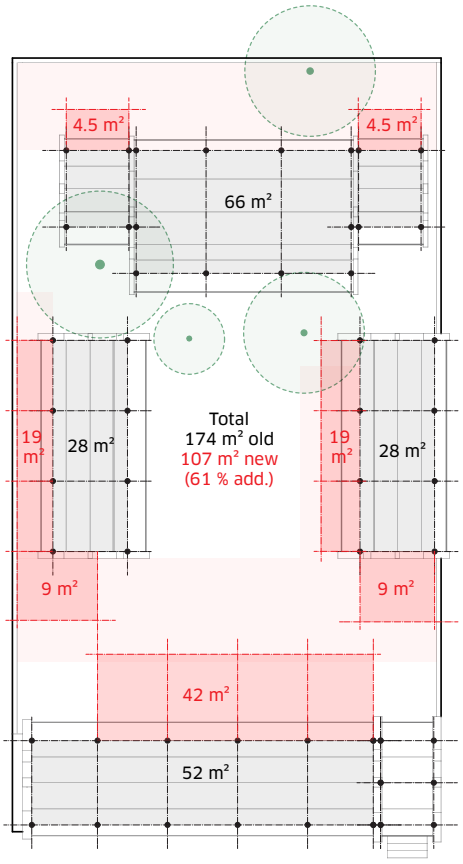
Type C - Lot No.47

Solar study diagram of lot No. 9 showing shadows through the day on equinox

New Addition

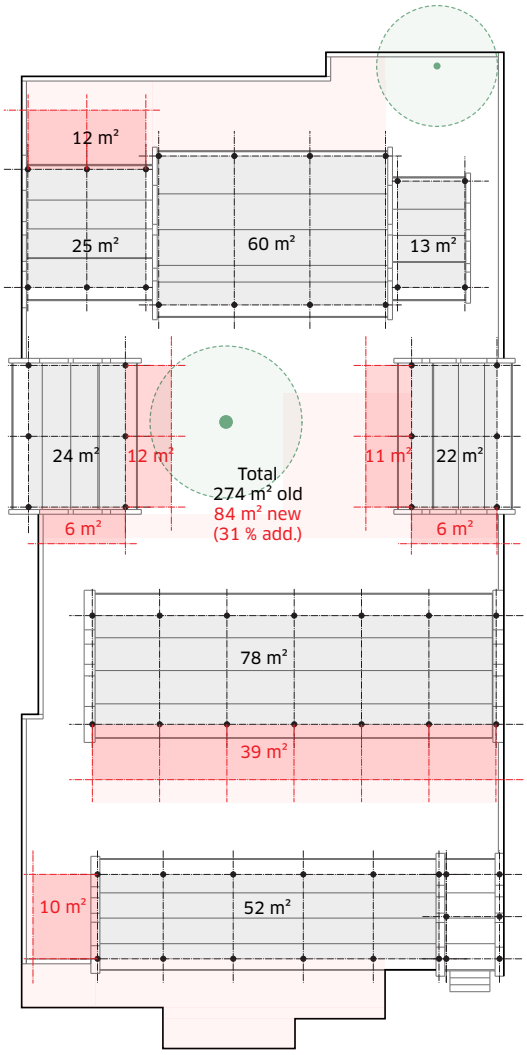
Constrained by the limit test results from solar studies, new horizontal additions are proposed under the guidance of Siheyuan archetype's rules of modularity, proportion, and symmetry. Using the archetype's structural column grid system, new addition was proposed as of growing from the original architecture's grid system by 0.5 of 1 modular volume in each direction where allowed. The total additional depth of addition in north-south or east-west direction should be less than the maximum addition test result marked on previous diagrams.

In the following plan diagrams, red lines and grids represent the proposed new horizontal additions.



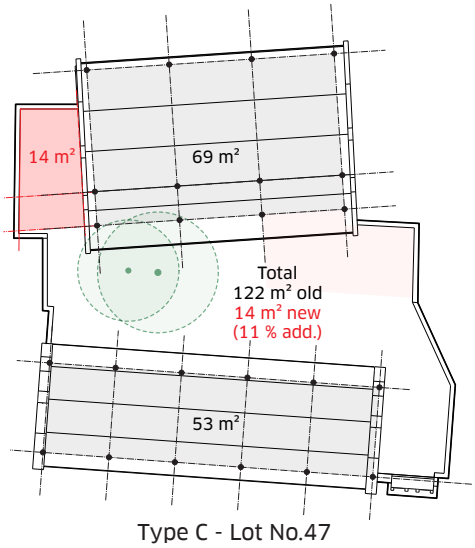
Type A - Lot No.47

Proposed new horizontal construction of lot No. 47



Type B - Lot No.47

Proposed new horizontal construction of lot No. 55



Type C - Lot No.47

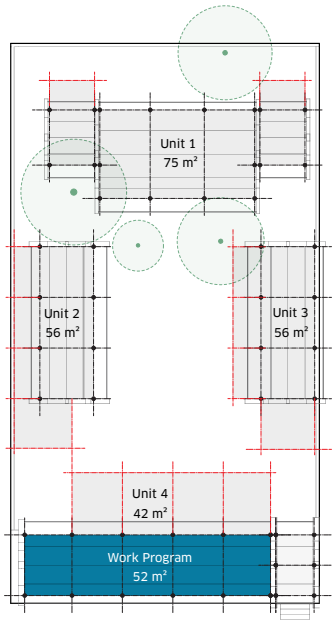
Proposed new horizontal construction of lot No. 9

ReProgramming

With the proposed new additions, each design sample is reprogrammed for two communal dwelling scenarios targeting different density levels. Design scenario A is low density long term multi-family residence. Design scenario B is high density short term rental residence. The central courtyard becomes mainly semi-public social space shared by the Siheyuan residents or in the comibed Siheyuan lots, a courtyard may be open to public.

The major building program is for residential, along with new public or semi-public program located along the hutong-facing buildings.

Siheyuan Type A - Lot No. 47



Design scenario A: 4-unit courtyard complex – long term family residence
Area Target: 15 m²/perpson
Total Residents: 14

Unit 1: Family of 5 = 75 m²
3 bedroom, 2 bathroom, kitchen, dining, living room
Existing: 66 m² Add: 9 m² **Total: 75 m²**

Unit 2: Family of 3 = 45 m²
2 bedroom, 1 bathroom, kitchen, dining, living room
Existing: 28 m² Add: 28 m² **Total: 56 m²**

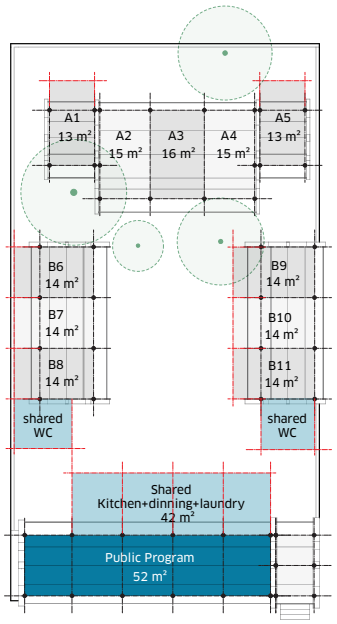
Unit 3: Family of 3 = 45 m²
2 bedroom, 1 bathroom, kitchen, dining, living room
Existing: 28 m² Add: 28 m² **Total: 56 m²**

Unit 4: Family of 3 + Work Program > 65 m²
2 bedroom, 1 bathroom, kitchen, dining, living room + work program* area
*work program: retail, home office, daycare, airbnb
Existing: 52 m² Add: 42 m² **Total: 94 m²**

Proposed low-density design scenarios A of lot No. 47

Design scenario A programs the new Siheyuan as a 4-unit courtyard housing complex for long term family residence with 15 m²/ person area target. Unit 1, family of 5; unit 2 and 3, family of 3; unit 4, since its on the hutong side, is programed as a live plus work unit, taking advantage of its

hutong side location plugging in public work program such as retail, home office, or Airbnb.



Design scenario B: 11-unit courtyard complex – short term rental residence
Total Residents: 22

Unit Type A: Private Bathroom Unit (2 person max.)
1 bedroom, 1 bathroom, living/study area
Target Area: 20 m²
Vertical Addition Required

Unit Type B: Shared Bathroom Unit (2 person max.)
1 bedroom + study area
Target Area: 15 m²

Shared Residential Program
kitchen + dinning + laundry
Target Area: > 30 m²

Public Program
suggested program: retail, office, cafe, library, restaurant

Proposed high-density design scenarios B of lot No. 47

Design scenario B programs the new Siheyuan as a 11-unit courtyard housing complex for short-term rental residence accommodating the young mobile population. Unit type A is private bathroom unit and unit type B being the shared bathroom unit. as moving closer to hutong, the rooms are programs more public. The row of new addition being the semi-public shared kitchen,dinning, laundry space. The hutong side South Hall can be repurposed for new public program such as restaurant, cafe, or book store. All the new public program plugging into the Siheyuan dwelling complex need to be carefully selected, control the level of noise and promoting local cultural industry.

Siheyuan Type B - Lot No. 55

Design scenario A: 7-unit courtyard complex – long term family residence

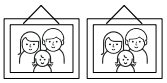
Area Target: 15 m²/perpson
Total Residents: 22

Unit 1: Family of 5 = 75 m²
3 bedroom, 2 bathroom, kitchen, dining, living room
Existing: 73 m² **Total: 59 m²** Vertical Addition Required

Unit 2: Family of 2 = 30 m²
1 bedroom, 1 bathroom, kitchen, dining, living room
Existing: 25 m² Add: 12 m² **Total: 37 m²**

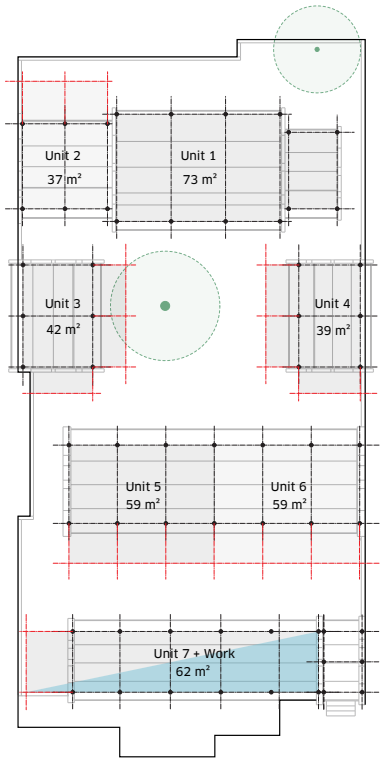
Unit 3: Family of 3 = 45 m²
2 bedroom, 1 bathroom, kitchen, dining, living room
Existing: 24 m² Add: 18 m² **Total: 42 m²** Vertical Addition Required

Unit 4: Family of 3 = 45 m²
2 bedroom, 1 bathroom, kitchen, dining, living room
Existing: 22 m² Add: 17 m² **Total: 39 m²** Vertical Addition Required



Unit 5 & 6: Family of 3 = 45 m²
2 bedroom, 1 bathroom, kitchen, dining, living room
Existing: 39 m² Add: 20 m² **Total: 59 m²**

Unit 7: Family of 3 + Work Program > 65 m²
2 bedroom, 1 bathroom, kitchen, dining, living room + work program* area
*work program: retail, home office, daycare, airbnb
Existing: 52 m² Add: 10 m² **Total: 62 m²**



Proposed low-density design scenarios A of lot No. 55

Design scenario B: 12-unit courtyard complex – short term rental residence

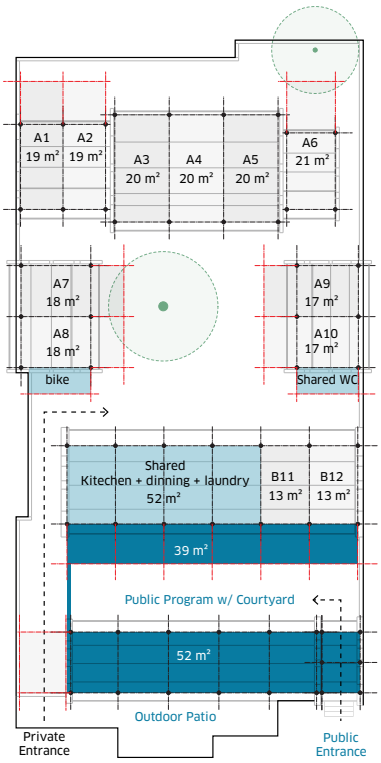
Total Residents: 24 + one public courtyard

Unit Type A: Private Bathroom Unit (2 people max.)
1 bedroom, 1 bathroom, living/study area
Target Area: 20 m²
Vertical Addition Required

Unit Type B: Shared Bathroom Unit (2 people max.)
1 bedroom + study area
Target Area: 15 m²
Vertical Addition Required

Shared Residential Program
kitchen + dinning + laundry
Target Area: > 30 m²

Public Program
suggested program: retail, office, cafe, library, restaurant, daycare

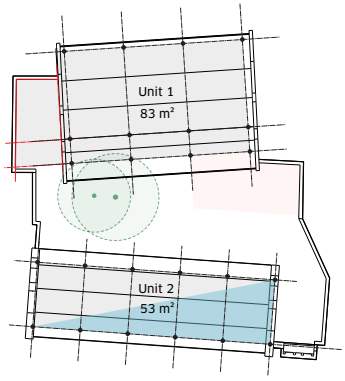


Proposed high-density design scenarios B of lot No. 55

Lot No. 55 is a two courtyard combined Siheyuan. so its design scenario B is taking the opportunity of turning one courtyard into public space joining the hutong.

Siheyuan Type C - Lot No. 9

Lot No. 9 is a small lot with buildings located on the north and south side of the courtyard. Because of its small lot size, no public program is proposed.

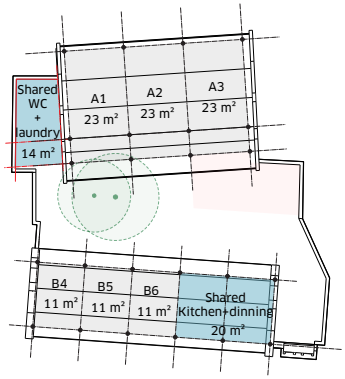


Design scenario A: 4-unit courtyard complex – long term family residence
Area Target: 15 m²/perpson
Total Residents: 8

Unit 1: Family of 5 = 75 m²
3 bedroom, 2 bathroom, kitchen, dining, living room
Existing: 69 m² Add: 14 m² **Total: 83 m²**

Unit 2: Family of 3 + Work Program > 65 m²
2 bedroom, 1 bathroom, kitchen, dining, living room + work program* area
*work program: retail, home office, daycare, airbnb
Existing: 53 m² **Total: 53 m²** Vertical Addition Required

Proposed low-density design scenarios A of lot No. 9



Design scenario B: 11-unit courtyard complex – short term rental residence
Total Residents: 12

Unit Type A: Private Bathroom Unit (2 people max.)
1 bedroom, 1 bathroom, living/study area
Target Area: 20 m²

Unit Type B: Shared Bathroom Unit (2 people max.)
1 bedroom + study area
Target Area: 15 m²
Vertical Addition Required`

Shared Residential Program
kitchen + dinning + laundry
Target Area: 20 m²

Proposed high-density design scenarios B of lot No. 9

The higher density scenario is demonstrated to accommodate the area's half floating population. But I do believe that the lower density scenario should take place in at least half of the hutong neighborhood lots because the long-term families are the back bones of the community's cultural heritage preservation. Here, we are not just seeking higher density or more dwelling areas. In this one of a kind neighborhood, again, it is a matter of balance, the harmony of many aspects, the historical, cultural, social, and economic values. Seeking balance is the goal.

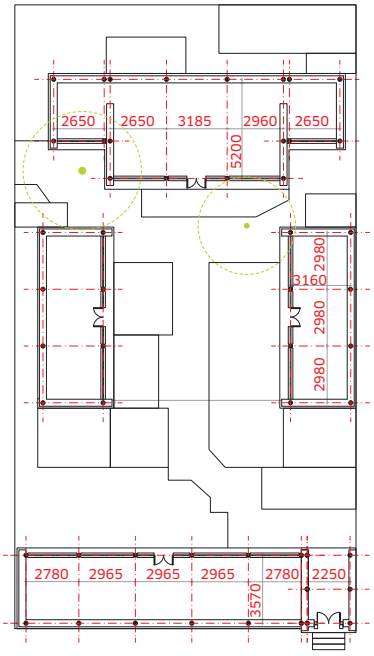
Design Example

Design scenario A of lot No. 47 is further designed as an example demonstrating the materiality and dwelling quality of the proposal. Refer to page 71 for previous design steps and reprogramming plan. This design scenario proposed a 4-unit courtyard complex for long term family residence with public program placed along the south hutong side.

Current Site Condition

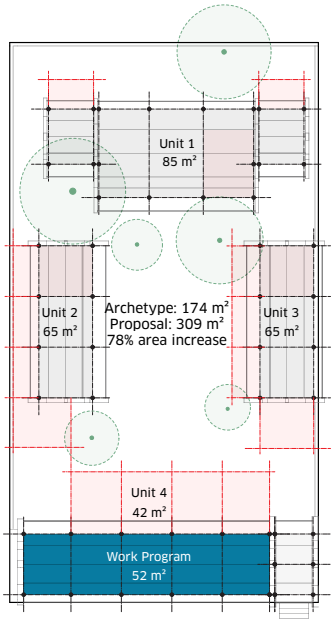
Photos showing the current courtyard condition of lot No. 47, overcrowded with shed infills

Roof plan diagram showing the current condition of lot No.47



Plan diagram showing dimensions of jian(rooms) of the original Siheyuan archetype components

Design Proposal



Design scenario A Proposal: 4-unit courtyard complex – long term family residence

Total Residents: 14
Total Floor Area: 309 m²

Unit 1: Family of 5 (area target: 75 m²)
Design proposal: existing 66 m²
horizontal addition 9 m²; vertical addition 10 m²
total: 85 m²

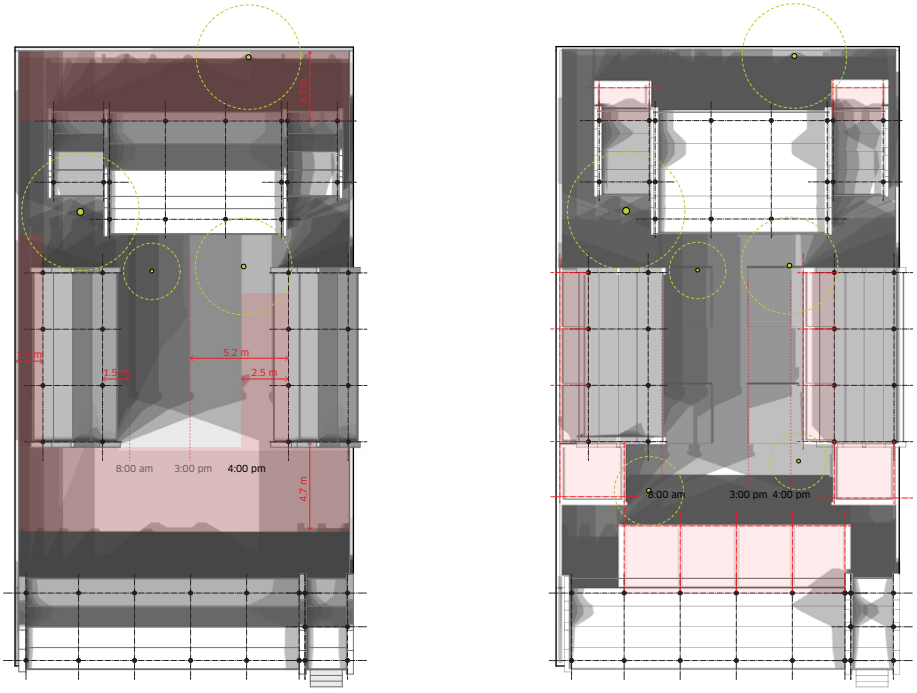
Unit 2: Family of 3 (area target: 45 m²)
Design proposal: existing 28 m²
horizontal addition 28 m²; vertical addition 9 m²
total: 65 m²

Unit 3: Family of 3 (area target: 45 m²)
Design proposal: existing: 28 m²
horizontal addition 28 m²; vertical addition 9 m²
total: 65 m²

Unit 4: Family of 3 + Work Program > 65 m²
Design proposal: existing 0 m²
horizontal addition 42 m²
total: 42 m²

Public Work Program (retail, home office, daycare, airbnb)
Design proposal: existing 52 m²

Lot no. 47 design proposal's program and floor area schedule

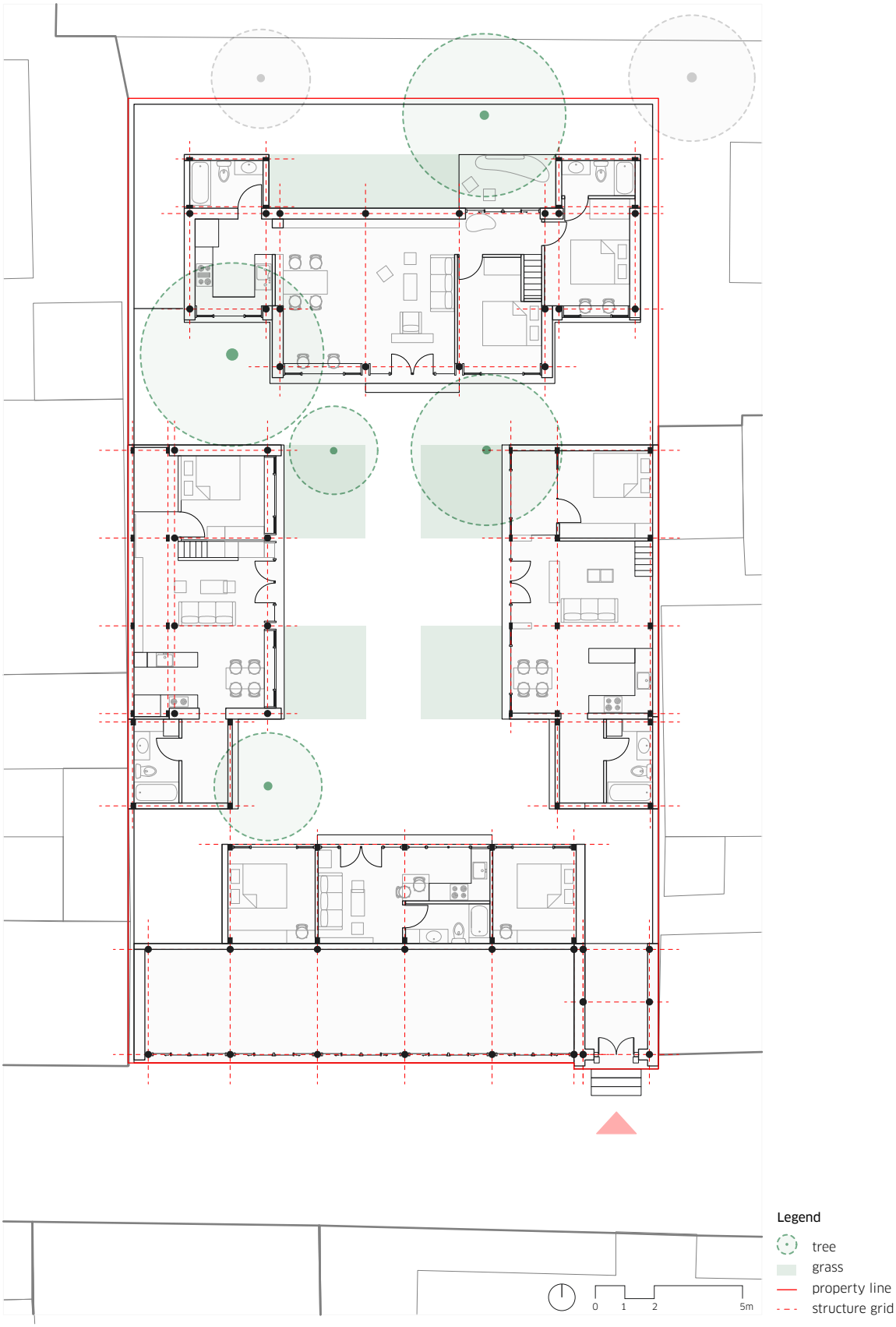


archetype

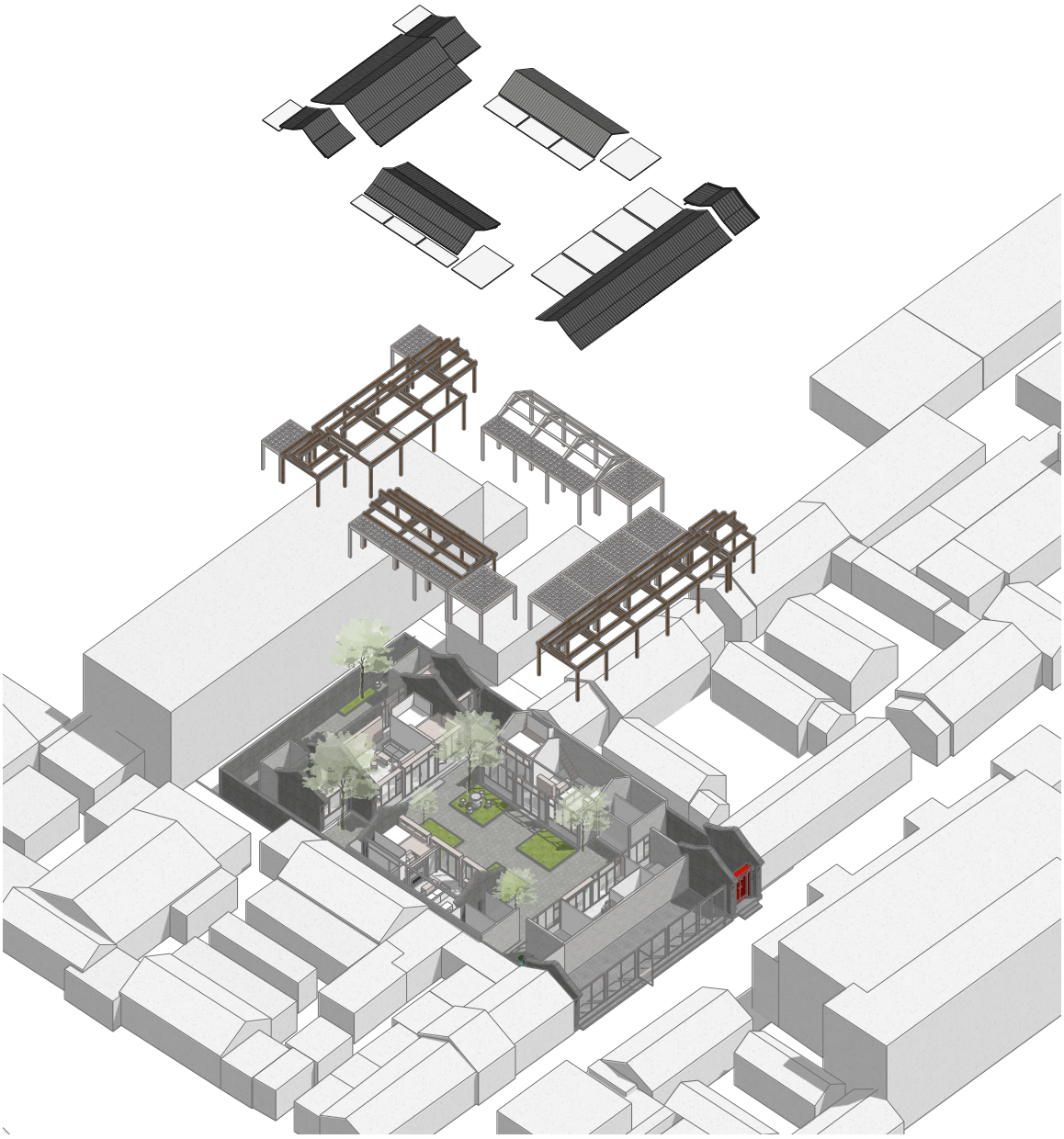
proposal with additions

Equinox day shadow diagrams comparing between the archetype and design proposal with additions

Site plan of design proposal with new additions



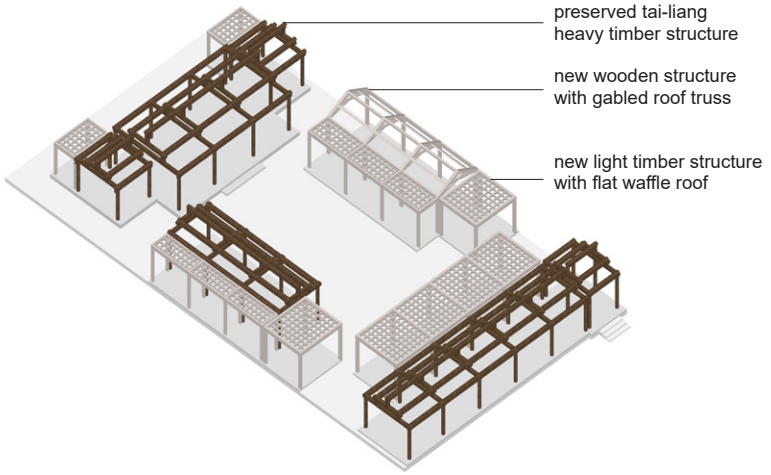
Lot No. 47 design scenario A ground floor plan



Axonometric site drawing of proposed design

The existing heritage wooden structure is preserved in unit 1, unit 2, and the hutong side building. Assuming the existing structure of unit 3 is in dangerous condition, new structure is proposed following the archetype's grid with new material and roof truss design in order to reduce the lumber size and intervention to roof volume.

The structure of additional constructions is proposed as light timber, with flat waffle roof. Light timber material is easy to acquire and flexible to construct on site.



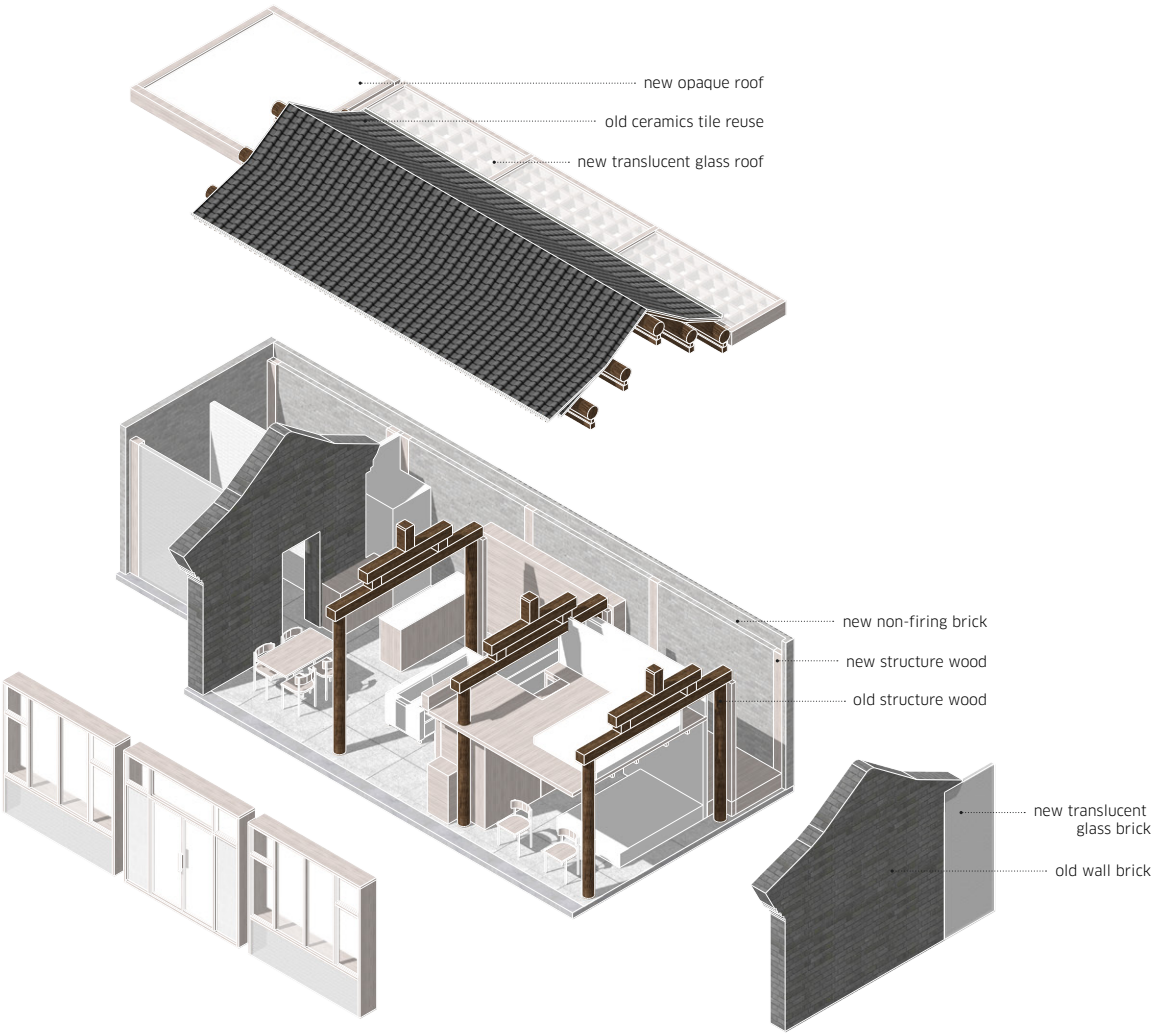
Structure diagram showing the old and new structure system

The courtyard elevation material is carefully selected in order to achieve both the natural lighting and privacy demands. Translucency is critical in this design. Translucent brick, glass, and PVC+xuan paper are proposed for differnt areas of the building elevation.

Perspective image showing the courtyard elevation of Unit 2

Unit 2 courtyard elevation material diagram

The new interior work is finished by light colored materials, wood, paint, and floor tiles. Light color materials both brighten the room and set off the darker color preserved materials.



Axonometric drawing of unit 2 showing proposed building materials.

Unit 2 interior render

Unit 2 interior render

North-south section

East-west section

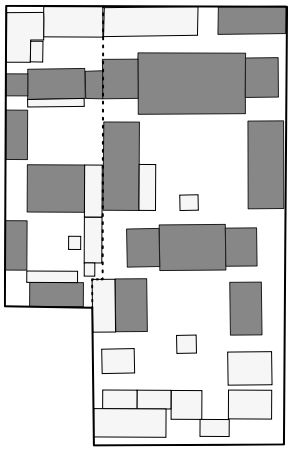
Shared courtyard render

Unit 1 backyard render

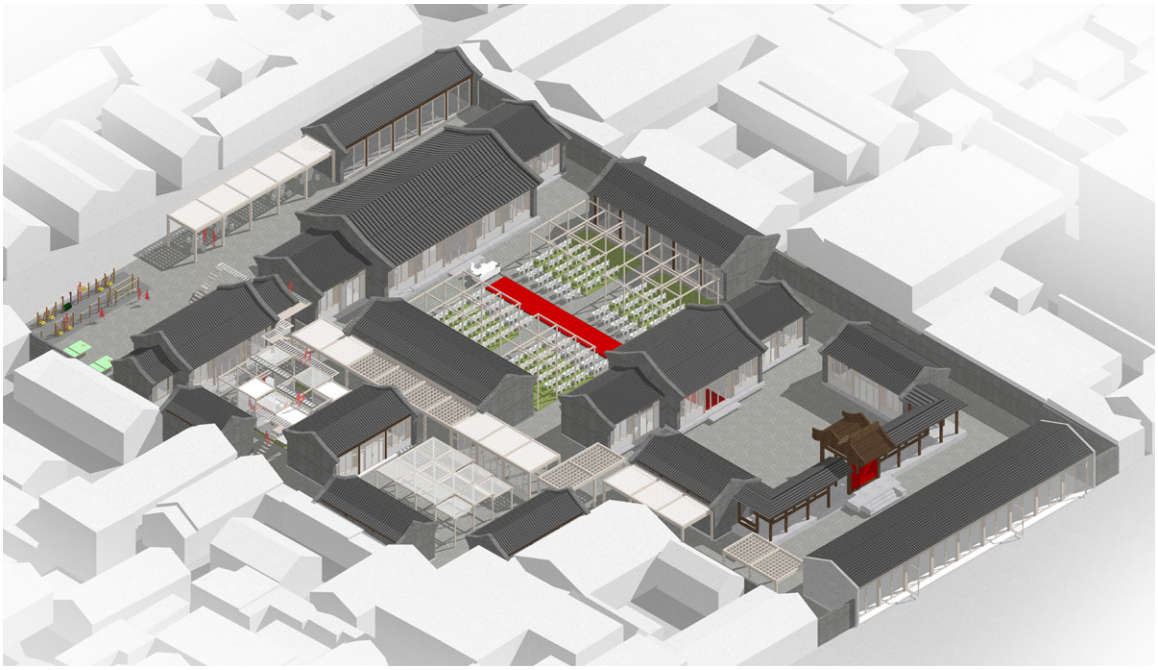
Shared courtyard render

Type D - Public Community Center

Sample Lot No. 12 of Type D is a medium scale parallel combined courtyard complex, composed by four major courtyards with its South end connecting to the major street. Since this type of medium scale Siheyuan complex is not common in the hutong. I programmed it as a public communal and cultural centre, offering new opportunities of transformation at the neighborhood scale to better adapt today's lifestyle.



Plan diagram of lot No. 12 showing existing buildings



Site axonometric drawing of proposed design

Set Back Pocket

With density higher than the original model, hutong needs such set back pocket counterpoint the density increase. Hutongs are currently quite narrow, the enlargement of hutong in a certain rhythm would serve as reference points for the community, in the same time, giving public activity space.

Height Addition

With the set back and longer distance between builidngs, building height addition could be possibly tested.

Courtyard Structure

Since this complex is a fully public building, the usage of courtyard space would be more intense. Building light structure inside the courtyard would increase a sense of dwelling and gathering of social activities. Similar as the archetype the temporary summer shade structure.

Program Themes

The four courtyards along with hutong set back plaza can each host a different program theme.

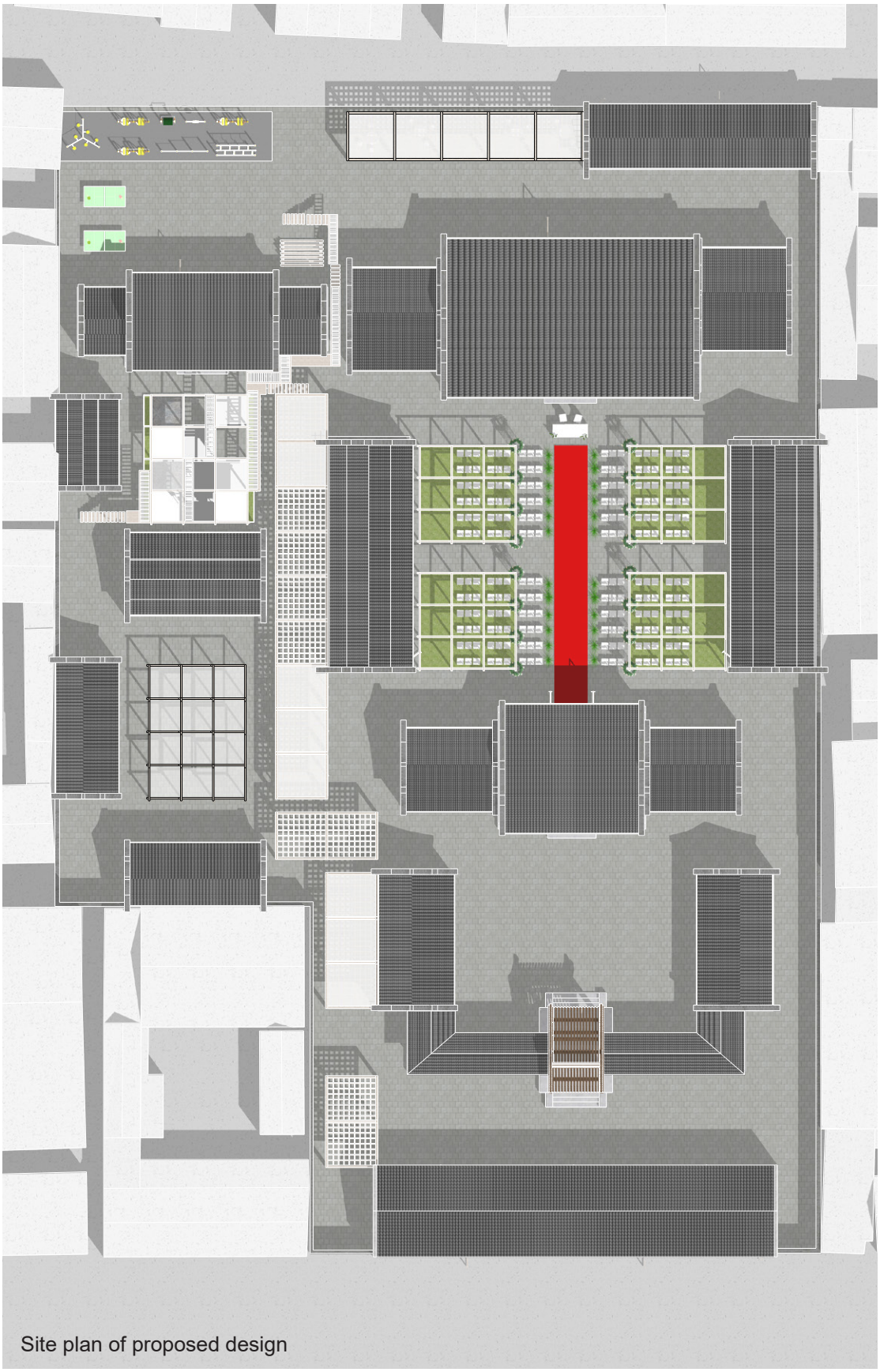
Hutong set back area: fitness plaza

courtyard 1: children’s playground

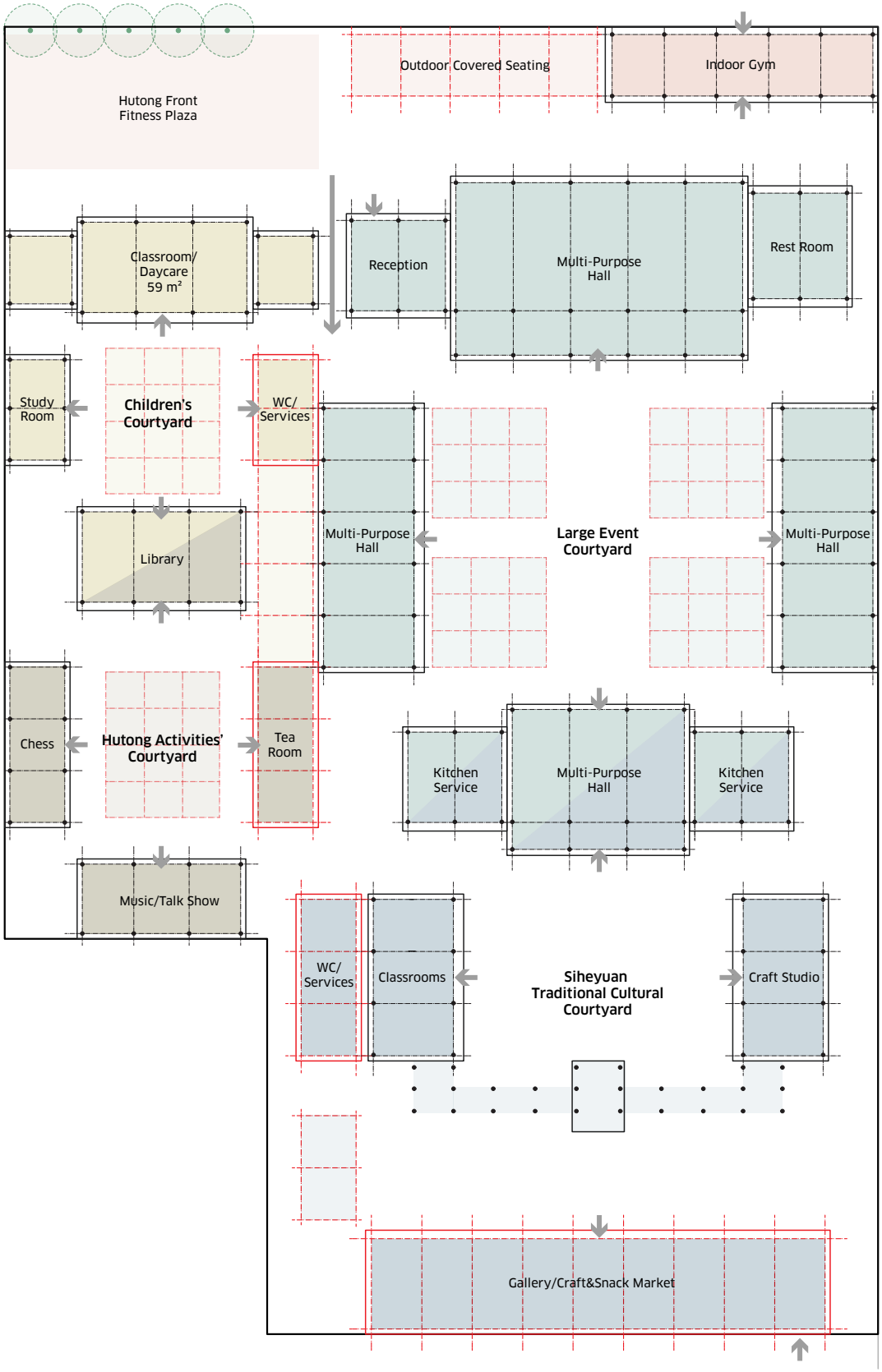
courtyard 2: hutong featured activities

courtyard 3: large events

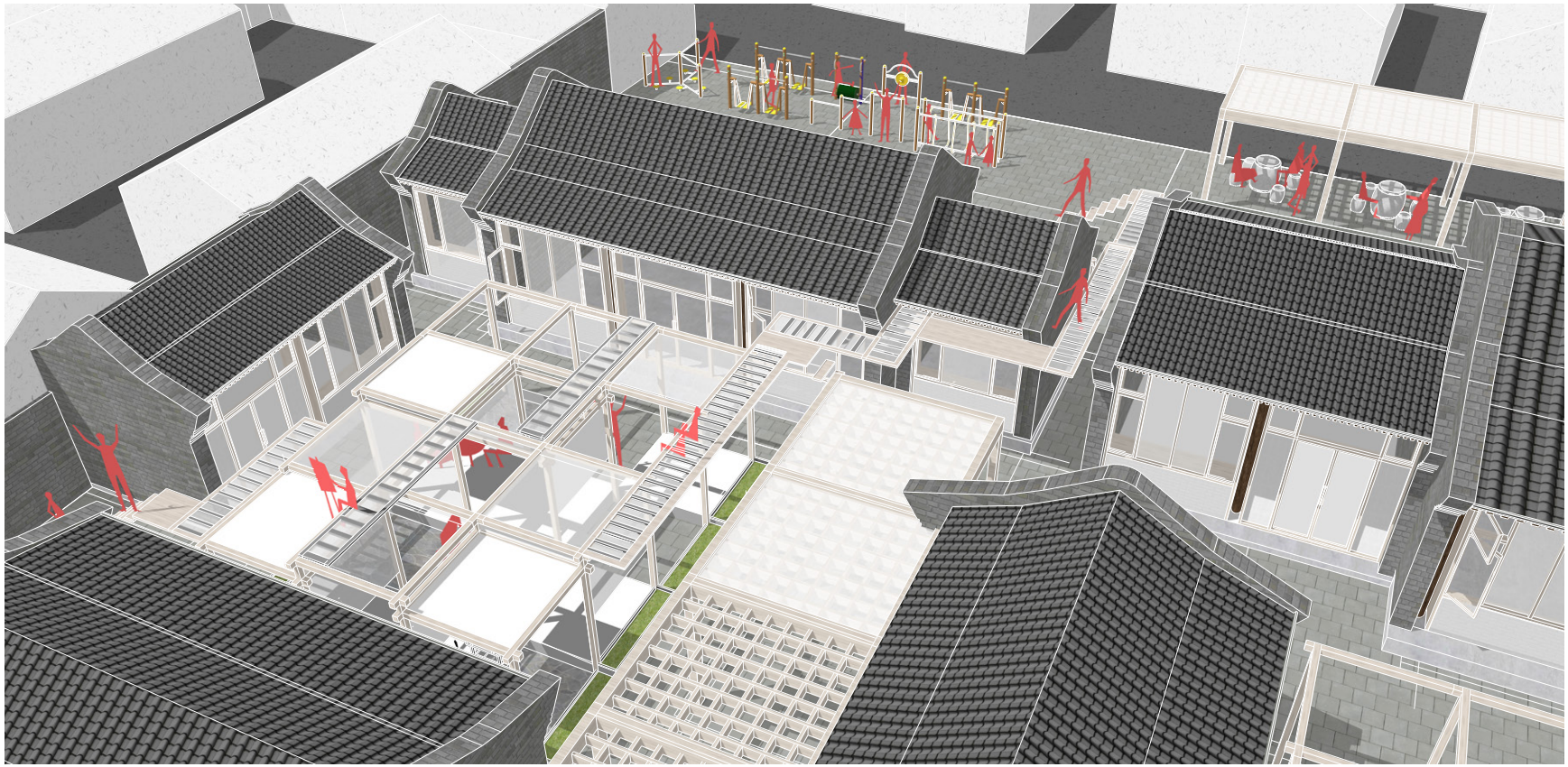
courtyard 4: Siheyuan traditional cultural themed



Site plan of proposed design



Program plan of proposed design



Birdeye view drawing showing hutong fitness plaza and children’s courtyard

Hutong front fitness plaza

Wedding event

Chapter 7: Conclusion

> Throughout much of the post-Second World War era, urban renewal and the whole-sale replacement of old dilapidated city precincts with entirely new and different types of structures was quite acceptable. Today, by contrast, in most parts of the world, it is clear that traditional urban patterns of settlement are to be valued not only for their strict historical significance, but also for their aura. In the urban-architectural realm of cities, concerns about appropriate expression must inevitably acknowledge this tension between “old” and “new” and, in many cases, strike an appropriate balance. (Rowe 1999, viii)

The basis of this thesis project starts from the idea of archetype. From a theoretical perspective, architectural typology explores both the uniformity and diversity of the built environment, especially in the process of urban renewal and development. It provides effective cognitive tool and problem solving approach in terms of how to preserve the important heritage while integrating modern time living into the historical civilization and cultural tradition. This thesis studies the Siheyuan archetype to understand the uniqueness and adaptability of the traditional courtyard houses in Beijing Old City. It takes the archetype as a guide to be able to change and evolve with modern times as the approach in search for a harmonious balance between preservation and development.

We regrettably see that the physical amount of Siheyuan buildings and urban fabric have been diminishing, and the aura of courtyard culture and people’s community attachment is being lost. The replaced uniform urban towers is not the solution for Beijing Old City. This thesis aims to find a more sustainable and cultural solution.

With most central and urban location in Beijing, the value of Siheyuan settlement should not be beaten by today’s economic land price; population density should

not overweigh quality of life. There is significant value for preserving Siheyuan despite its lower density. This thesis explores possibility of density increase under the balancing limitations.

Vegetation counts a peerless portion in the traditional urban Beijing planning. The fine contact and complementarity blended beauty of nature into the built forms. Trees were planted throughout the city. Every hutong and courtyard exist green life. This thesis aspire to recover such lost breathing pockets and recreational spaces, which make Beijing's urban life truly utopian.

The ideas and strategies put forth by this thesis might be extended to other Siheyuan neighborhoods in Beijing, avoiding them to be demolished. This thesis believes the communal transformation of Siheyuan is positive, but it need to be according to the archetype's own language. Having into account Siheyuan archetype's attributes as the tools, it aims to keep the lively quality of community space while increase density under limitations. It shall be a communally transformed neighborhood but with the same harmonious atmosphere.

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