

**Towards a Sustainable Future:
Courtyard in Contemporary Beijing**

by
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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

China has become one of the world's economic engines. One major driving force is the rapid urbanization. Such fast development results in resource and energy depletion, pollution and environmental deterioration. The government has recently endorsed green buildings and urged ministries to work out a national action plan. It is predicted that green building will be the next big thing in China. But before importing any foreign green technology and green designs, is there something to be learned from the Chinese ancestors?

In the long history of China, the Chinese have always employed a system of construction with the influences of geography, climate, culture, philosophy, economy and politics deeply rooted in China, making the Chinese traditional architecture distinct. Embedded in the formation of the city, *sibeyuan* 四合院, the courtyard house in Beijing was one exceptional dwelling example that inherited the quintessence of the thousand years of building experiences and knowledge of the ancestors. This traditional urban type not only celebrated the rich and unique cultural heritage of China, it also played an important role in maximizing the natural forces to create a pleasant and comfortable environment for living. Population growth, political and economic reforms over time however have drastically changed the fate of this historical heritage. Especially under the pressure of the fast development and economic boom after the introduction of the *Open Door Policy* in 1978, the traditional courtyards were the first to be demolished due to the lack of modern facilities and the inability to accommodate the growing population. They were often replaced by apartment blocks and high-rise towers – imported types based on planning regulations developed in the West, outside the cultural and environmental milieu of Beijing. As a result, the city is now filled with many energy intensive buildings that eat away both the “city's essence” and the valuable natural resources.

With the current policy and ambition of China, the teardown courtyard sites within the old city wall that are still waiting for development offer the potential to address the remediation and reinterpretation of the traditional typology in a contemporary city. The thesis investigates the essences of the traditional courtyard house and explores the way to apply such qualities to the design of a new courtyard typology in contemporary Beijing. The proposal anticipates a holistic approach on both environmental, social, cultural and economic level, so as to carry out preservation that manifests in experience rather than physical restoration, and to create a project that is truly sustainable.

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In the memory of my grandfather, Guo Peng.

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PG.	FIG.	DESCRIPTION + SOURCE	PG.	FIG.	DESCRIPTION + SOURCE
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Author's Note

All Chinese terms are italicized, except for proper names of people, place, historic periods and dynasties. Chinese terms are written in English using *Pinyin* Romanization and followed by the Chinese original where applicable. Parentheses are used to enclose the English translations of the Chinese terms; or, if the term is given in English, they are used to enclose the original Chinese word.

All English translations of quotations from selected foreign literary work are by the author unless noted otherwise.

All notes are in footnote except for section 1.2 *Beijing Now: a summary* where endnote is used for graphic appearance.



Biology Garden

My Kindergarten

My Home

University Clinic

My Elementary School

Science and Technology Building

Library

Cafeteria & Restaurant

Supermarket

Prelude

In the morning of March 31, 1987, a new life was born in Beijing, the city with two faces – one filled with rich history and cultural traditions, the other strived to embrace rapid development and modernization. Yes, that was me.

My childhood was nothing out of the ordinary. I grew up in one of the apartment blocks in the teacher's quarter of Beijing Normal University (北京师范大学). Like many gated communities in China, my home is located in close proximity to almost every service function needed. Especially being on campus, everything was even more convenient. My kindergarten was about three minutes away. My elementary school was so close that even if I woke up late, I was still able to make it to class on time. A student cafeteria, a restaurant and a supermarket were just around the corner. I remembered as a young kid, I was often sent by my grandmother on an errand to buy food items for lunch or dinner. For leisure, my friends and I would sometimes treasure hunt in the Biology Garden northwest of my home. We would bike endlessly in circles along the car ramps and run tirelessly up and down the monumental steps of the massive, robot-looking Science and Technology Building. Sometimes, we would skate in the big square in front of the library. And other times, we would just roam aimlessly in-between the apartment blocks. The campus was my playground. It was my world back then.

0.0.1
*Map of my childhood home,
Beijing Normal University*

As I grew a bit older, my world expanded a little beyond the walls of the campus. Occasionally, my friends and I would take Route 22 to *Xidan* 西单, the business and shopping district filled with what I considered fascinating things to a child's eyes – shiny glass blocks, massive shopping complexes, and colourful billiard boards featuring brands in different languages. We would explore the different stores and get my favourite McNuggets and McFlurry on the way back. Sometimes, we would travel further to *Wangfujing* 王府井, yet another shopping district with even more modern buildings and foreign brands just to the east of Tian'anmen Square and the Imperial Palace.

From time to time, I would climb up to the top of the Prospect Hill (*Jingshan* 景山), the highest point in the inner historic city of Beijing. I liked this spot a lot, because the city was under my eyelids. I could see far into the distance beyond the Imperial Palace. I was fascinated by the changing scenes every time I visited. It almost became a routine to count the cranes and the new shapes protruding out of the skyline. It was a fun game to kill time.



0.0.2 Looking east from Jingshan with CBD in the distance

In 2001, I said goodbye to my motherland and came to Canada with my parents. I did not find much trouble adapting to the new environment. I had seen the towers, the apartment blocks and the detached houses. I knew a lot of the brands and restaurant chains in the shopping malls. Even the McNuggets tasted just the same as back home. Nothing seemed foreign other than the language and the fact that people had different hair and eye colours.

In school, I was often asked to describe Beijing. I would talk about the grandiose Imperial Palace, the beautiful Summer Palace, the amazing temples and gardens, and of course, all the crazy stuff you can get in the crazy shopping malls everywhere.

“What about ‘sibeyuan’ and ‘hutongs’? Did you live in one? What do they look like?” Someone once asked. I paused and was not able to resume. I was at a loss to respond. What are they? I do not know.



“A sibeyuan is a historical type of residence that was commonly found throughout China, most famously in Beijing.”

“Hutongs are a type of narrow streets or alleys, most commonly associated with Beijing, China. In Beijing, hutongs are alleys formed by lines of sibeyuan.”

– Wikipedia

In the summer of 2006, a break after my first intense year at the School of Architecture, I went back to Beijing for a short visit. I climbed up again to the top of the Prospect Hill. The scene was fresh and intriguing as before. For the first time, my eyes were not attracted to the new additions in the skyline far away. I was drawn to the uniformed landscape of grey roof tiles and occasional greens protruding out of the open spaces – the part that I had always overlooked as a child, the part that was deeply engrained in the formation of the city. If the Imperial Palace is the heart of Beijing, then *sibeyuan* and *hutongs* are said to be the flesh and blood.

Here I stood amidst the historic centre, I found it all rather ironic – for fourteen years that I was in Beijing, I was surrounded by modern towers and shopping complexes. I averted at the famous historical monuments. I thought that was everything about Beijing. I was ignorant of the courtyard houses, the building blocks of the cultural city, not until I went back as a visitor.

In May 2011, I visited Beijing again to search for my thesis inspiration. I knew that I wanted to work with the traditional courtyards, to learn more about the part of Beijing that I was not familiar with. But at that point, I did not know what yet.



0.0.3 Looking north from Jingshan towards the Drum Tower

My grandmother was extremely happy to see me and have me around again after all these years of absence. She always found time to talk to me about anything came to mind whenever I was not out busy exploring. She talked about things she saw on the television, articles from the newspapers, casual gossips around the neighbourhood, and sometimes, she would tell me her stories from the past.

“Your grandfather always wanted to be an architect. I guess his dream will be realized in you.” My grandma mentioned one day.

Grandpa, he passed away when I was three. I have very limited memory of him, but I have always remembered his voice when he was telling his vivid and interesting stories. He was a historian and a professor of ancient Chinese history at the university. I was told that he was a wizard at the subject and a great teacher who can always make the dull history class very fun and lively. He was an old and the only Pekingese in the family who grew up in the rich cultural traditions of Beijing. At home, there used to be many roof tiles and stone carvings he collected from the rubbles of the demolished courtyard districts around the city. I have always imagined how my life would be different if my grandfather were still around. My childhood would probably be filled with his interesting stories on the history of China. He would take me down to the better hutong neighbourhoods and start telling me the symbolisms and cultural importance behind every decoration that we see on our walk. If he were still here, I could acquire more knowledge of the distinct culture and built forms in the city of Beijing, other than the shiny towers and modern plazas.

One day my grandma waved me over mysteriously.

“Take a look, I found this in your grandpa’s bookshelf. You might find it interesting.”

She handed me something heavy. It was a photo album. The wrinkled edges and the discolouration of the paper showed traces of age. Curiously wondering what lied behind the cover of the old album, I carefully flipped open the first page...





0.0.4

To my surprise, here stood my grandfather beside a stone drum (*baogushi* 抱鼓石) typically placed at the entrance of a courtyard house.



0.0.5



0.0.6

Two potted flower tress and a fish tank filled with lotus leaves were placed against the spirit wall, and here my great grandmother sat with a peaceful smile on her face. To the side through a viewing window, my grandfather and his siblings were playing in the side court.

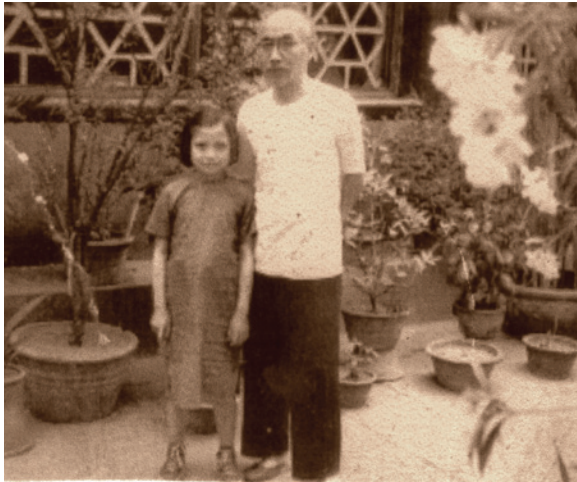


0.0.7



0.0.8

Under the highly decorative festoon gate, my elder great-uncles were lounging on the steps and smiling at the camera. Passing this second threshold, the younger siblings stood in the tranquil family courtyard.



0.0.9



0.0.10

My great-grandfather, a schoolteacher, took great pleasure in planting. The family courtyard was filled with vegetation of various forms, heights, colours, textures and scents. It ought to be a very pleasant experience to lounge under the shades amidst all the greenery.

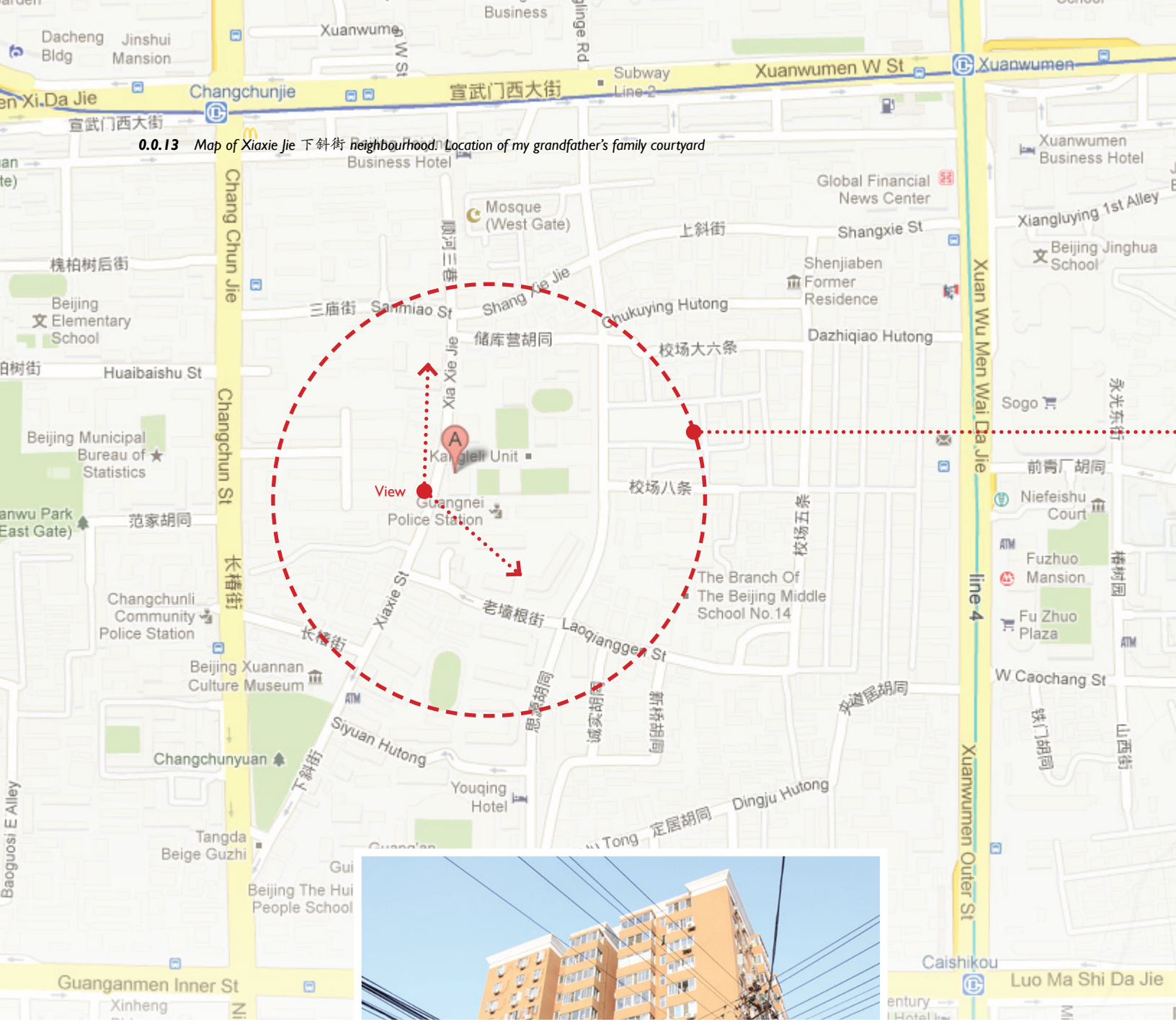


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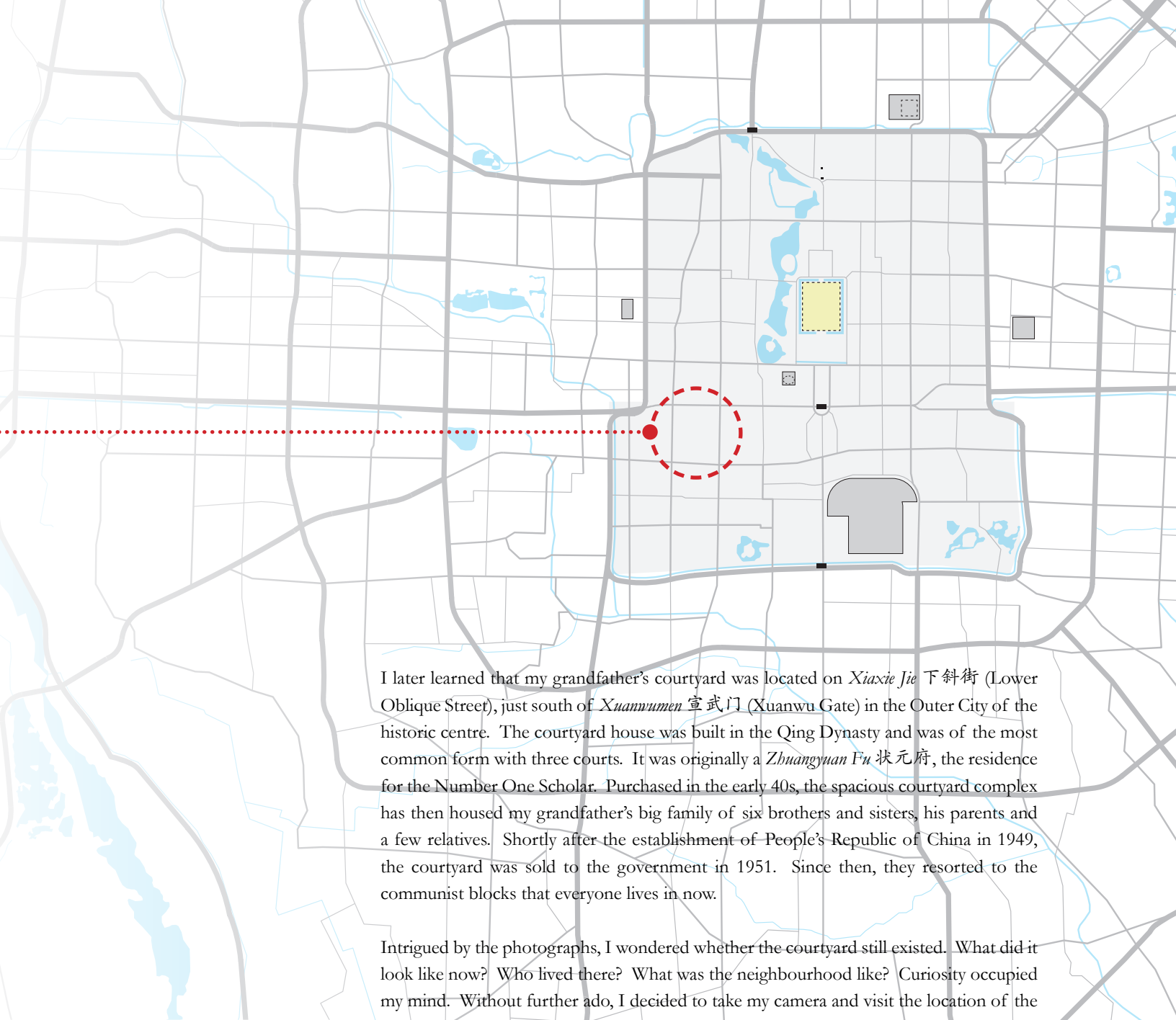
These precious photos of my grandfather's childhood were taken at different locations in the courtyard complex. Every picture told a different story. Looking at these images, I was trying to imagine the spaces with my present knowledge of the courtyard house. I cannot describe how much I wished my grandfather were here to tell me all about it, to take me back in time to experience the life in one of the beautiful courts.



0.0.13 Map of Xixie Jie 下斜街 neighbourhood. Location of my grandfather's family courtyard



0.0.14 Newly built high-rise residential gated community stood on the site where my grandfather's family courtyard used to be.



I later learned that my grandfather's courtyard was located on *Xiaxie Jie* 下斜街 (Lower Oblique Street), just south of *Xuanwumen* 宣武门 (Xuanwu Gate) in the Outer City of the historic centre. The courtyard house was built in the Qing Dynasty and was of the most common form with three courts. It was originally a *Zhuangyuan Fu* 状元府, the residence for the Number One Scholar. Purchased in the early 40s, the spacious courtyard complex has then housed my grandfather's big family of six brothers and sisters, his parents and a few relatives. Shortly after the establishment of People's Republic of China in 1949, the courtyard was sold to the government in 1951. Since then, they resorted to the communist blocks that everyone lives in now.

Intrigued by the photographs, I wondered whether the courtyard still existed. What did it look like now? Who lived there? What was the neighbourhood like? Curiosity occupied my mind. Without further ado, I decided to take my camera and visit the location of the home where my grandfather once lived.

On a sunny Sunday afternoon, I strolled down *Xiaxie Jie* 下斜街 (Lower Oblique Street). What I discovered was sort of a disappointment: my grandfather's courtyard house no longer exists. What replace it are the monstrous high-rise residential blocks spreading into distance. Under the heated sun, the buzzing of the countless air conditioning units and the warm exhaust air from them were making the hot mid-summer afternoon even more unbearable. On the other side of the hutong, a few courtyards are left standing. However, they are dilapidated. The big white Chinese character, *Chai* 拆, is painted on the grey walls, signifying their fate to be demolished and to make way for more high-rise development underway.

In the middle of the hutong I stood. Contemplating the scene reflected into my vision, I think I found my inspiration.





0.1.1 Beijing CBD

0 Introduction





0.1.2 Foreign brands in China



When speaking of China, we refer to a world power in ascendance. China has become one of the world's economic engines. One major driving force is the rapid urbanization. The speed and depth of such spatial urban development are unprecedented. The old and poor China is literally demolished, discarded and replaced by a new and glittering China. The nation is regaining its former greatness after almost two centuries of revolution, trials and turmoil, and is now shining gloriously on the world stage.

The *Open Door Policy*, initiated by Deng Xiaoping in 1978, opened up the secluded country to the world. The tremendous and limitless flow of information, goods and services from abroad exposed the nation to an influx of foreign ideas, symbols, images, styles, concepts, techniques and customs. The Americans brought Windows, iPods, big outlet supermarkets and many fast food restaurants. You can hardly imagine any public space in China without the brand signs of McDonald's, KFC, Pizza Hut, Burger King and Starbucks. Christmas is given more emphasis and attention, as well as Valentine's Day for young lovers. Red wine and perfume from France, fine leather goods from Italy, precision engineering from Germany and Switzerland, as well as dreamy villa estates in Tuscany and "American Dream" houses, the list of the growing number of "Western imports"¹ goes on.

The architecture, urban planning strategies and design concepts seem of Western origin as well. Influenced by the early twentieth century Modernist architects and the dogma formulated in the 1933 *Charter of Athens*, the slab housing construction flourished during the Communist era and can still be seen today. A great number of gated communities filled with tower blocks and linear apartment buildings are constructed to house the emerging middle and upper classes. Suburban villas are also very common on the outskirts of Chinese cities. Suburbia is coming to China! Furthermore, inspired by the North American downtowns, every Chinese mega-city today wants to plan and build a new Central Business District (CBD). The CBDs are filled with skyscrapers in the International Style, and occasionally you can find some architects' creations of Postmodern or even Deconstructivist inspirations.²

¹ Dieter Hassenpflug, *The Urban Code of China* (Basel: Birkhäuser GmbH, 2010), 9.

² Hassenpflug, *The Urban Code of China*, 9.



Imperial Palace

Hutongs

Dormitory

CBD

High-rise Developments
Beyond 5th Ring Road

Financial Street

High-rise Residential

Dormitory

Beijing, as the capital city of the ever-growing nation, is without a doubt, one of the centres of attention. Striving to be a global city, the volume of new construction Beijing is experiencing at the moment is unprecedented in its long history. Its success in securing the rights to host the 2008 Summer Olympic Games has also served as an important catalyst for many large scaled infrastructural projects as well as the erection of many iconic buildings. Rem Koolhaas, Arata Isozaki, Norman Foster, Herzog and de Meuron, Paul Andreu, PTW, Steven Holl, von Gerkan, Marg & Partner, Zaha Hadid, and many more world-renowned architects left their marks in this historic city.

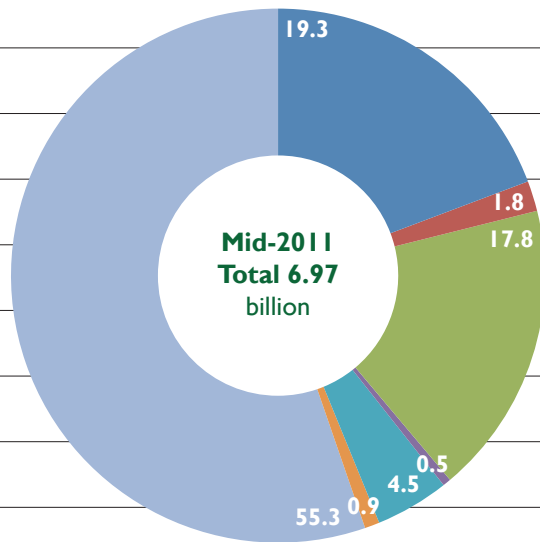
Under the glorious façades of the new architecture showcasing the power of the new China, however, it is a cityscape undergoing significant changes that challenges its pre-existing structures and overall cohesiveness. The city appears to be a mishmash of buildings that have no relation to each other in terms of age, height, size or style. The juxtaposition of the dilapidated historic part of town, the stereotypical socialist blocks from the 1960s and 70s, the low quality high-rise housing of the 80s, together with the starchitect creations and other high spec developments of the younger age, as well as their unlikely close physical proximity, evoke a sense of chaos and randomness, drawing a clear boundary which destroys the once harmonious and continuous urban fabric. The courtyard typology existed in Beijing for more than two thousand years were knocked down as they were considered outdated, unsafe and a symbol of poverty and backwardness in the age of economic boom. As a result, the symbolic part of Beijing's historical urban fabric is disappearing. The 'essence' of Beijing is fading as the city surrenders its identity to the influx of imported typologies in pursuit of modernization and globalization.

0.1.3

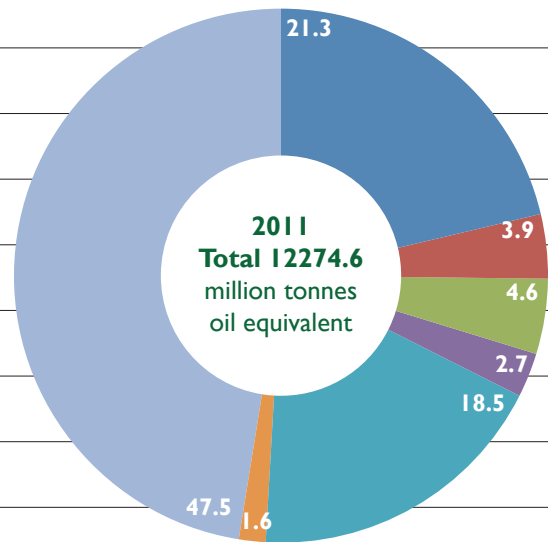
*View of the Forbidden City
and the mixture of buildings
of various age, height, size and
style*

In addition to the loss of local urban and architectural character and cultural identity, such rapid development of imported models poses other inherent problems, namely resource and energy depletion, pollution and environmental deterioration. Because China is such a huge nation with almost one-fifth of the world's total population (*Figure 0.1.4*), its consumption of resource and energy is also substantial (*Figure 0.1.5*). Large amount of energy is needed to run the vast number of vehicles currently in circulation; it is needed to steer the giant cranes that erect tower after tower not only in metropolises such as Beijing, Shanghai and Shenzhen, but other rising cities and towns; it is needed to keep the population warm in a country whose seasonal temperatures can span 60 degree Celsius; and it is in desperate demand to generate electricity swallowed each day by the energy and resource-hungry industrial complexes that manufacture parts required by every other sector, as well as to satisfy the daily living needs of every household in China.

0.1.4 World Population
percentage



0.1.5 World Primary Energy Consumption
percentage

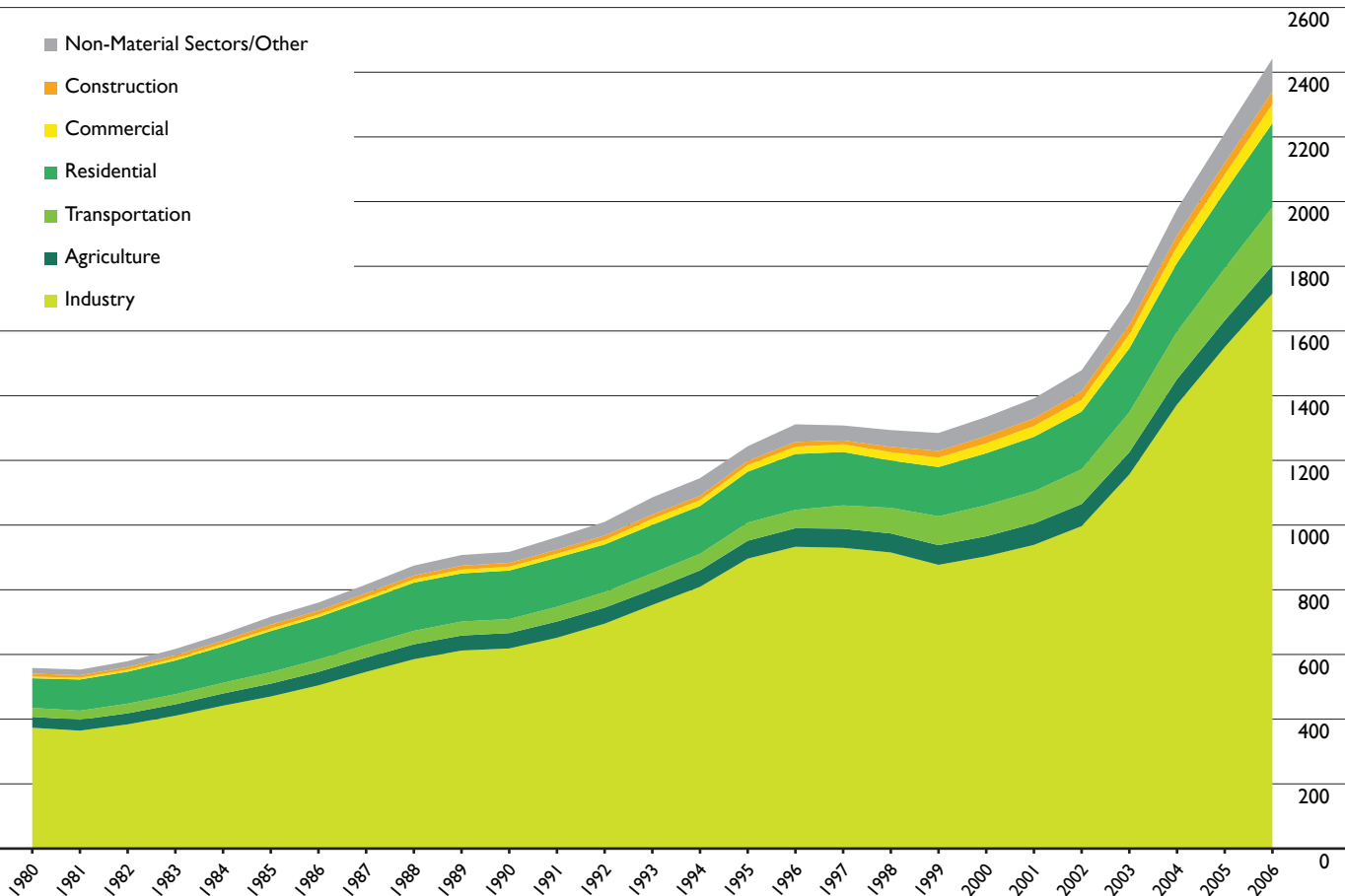


■ China
 ■ Japan
 ■ India
 ■ Canada
 ■ United States
 ■ United Kingdom
 ■ Rest of the World

The thrust behind the terrific growth in the past two decades and the continuation of development in the decades to come is demanding and will continue to demand an even larger injection of resource and power. Looking at the energy breakdown by sector in *Figure 0.1.6*, the industrial sector accounts for nearly three quarters of the total energy demand. Even though residential and construction demand for energy represent a relatively small proportion of the total energy consumption, we cannot ignore the fact that they are expected to rise dramatically as more and more Chinese move to cities and equip their homes with televisions, computers, kitchen appliances, fans, heaters and especially, power-hungry air-conditioning units. The demand for new buildings, infrastructure and electricity therefore requires heavy industrial production, and as a result, increasing the energy use and emission.

But where does the power come from?


0.1.6 China: End-Use Energy Consumption by Sector 1980 to 2006
million tonnes coal equivalent



The significant quantity of energy required in China is derived primarily from fossil fuels, which in turn, puts more stress on the environment. Historically, China has been a country of coal. This is still the case today due to the cost and limited supply of other forms of energy namely natural gas, oil, hydro and so on. With the world's third largest resource base to draw from, coal accounts for nearly 70 percent of China's energy consumption (*Figure 0.1.8*). The rush to open new mines since the growth in coal output has led to a tremendous waste in resources with predictable consequences: destruction of arable and grazing land, the intensification of topsoil erosion and increasing air and water pollution. Without a doubt, coal is a heavy pollutant and a major source of greenhouse gases through its production, transportation and conversion into usable energy.

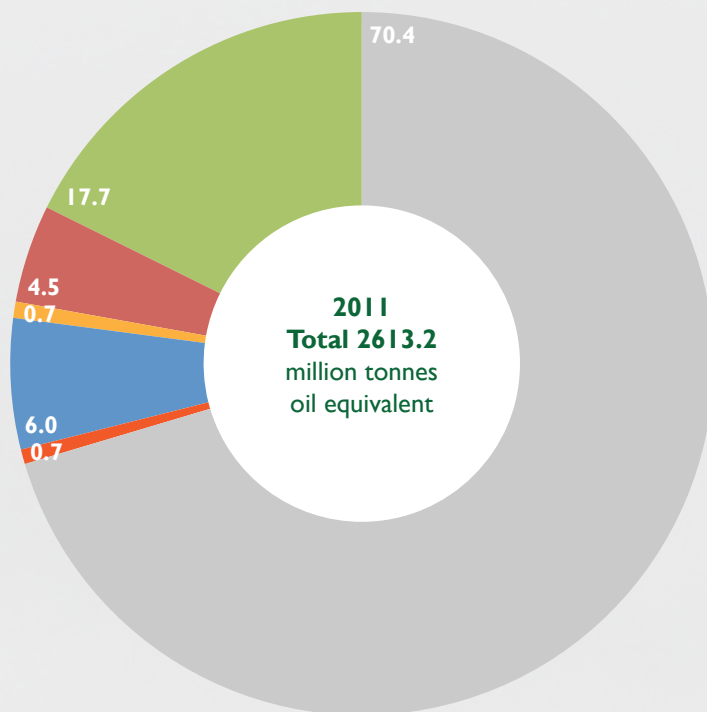
Regardless of the energy source, development must go on. The construction of residential blocks and towers seems endless. However, the stock of buildings is backward in energy efficiency terms: in comparison to developed countries, energy consumption for heat per unit of floor is about three times greater in China.³ Existing studies estimate that over a quarter of total primary energy use in China is consumed by buildings through heating, air conditioning, ventilation, heating water, lighting, cooking, operating appliances and running elevators. The building operations account for on average 80 percent of total building energy use and related emissions while building materials only constitutes about 20 percent with the remaining small portions for maintenance, construction

³ Neville Mars and Adrian Hornsby, *The Chinese Dream* (Rotterdam: 010 Publishers, 2008), 144.

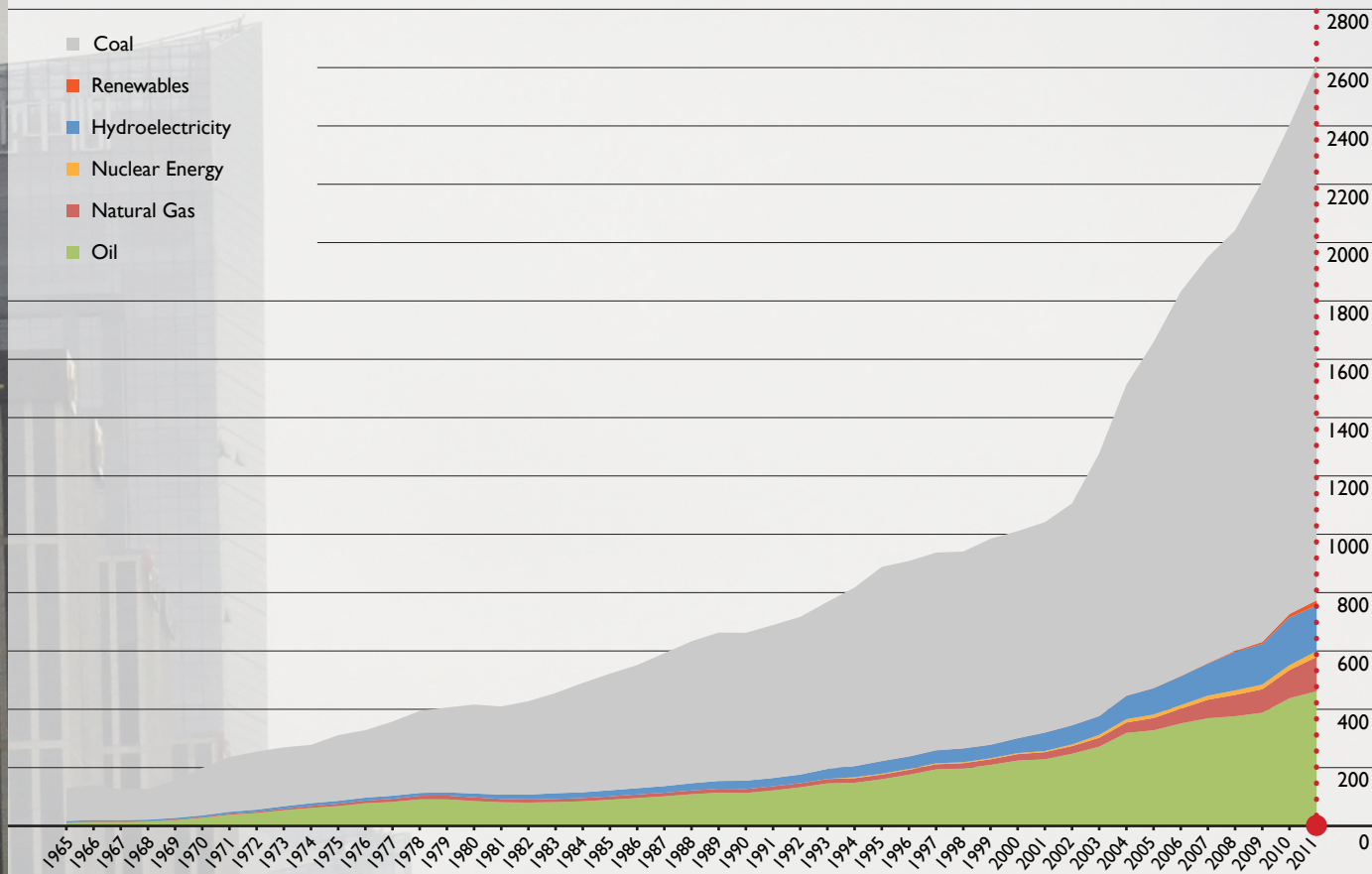


0.1.7 Smoke from chimney contributes to heavy smog in Beijing

0.1.8 China: Primary Energy Consumption by Fuel Type 1965 to 2011
percentage

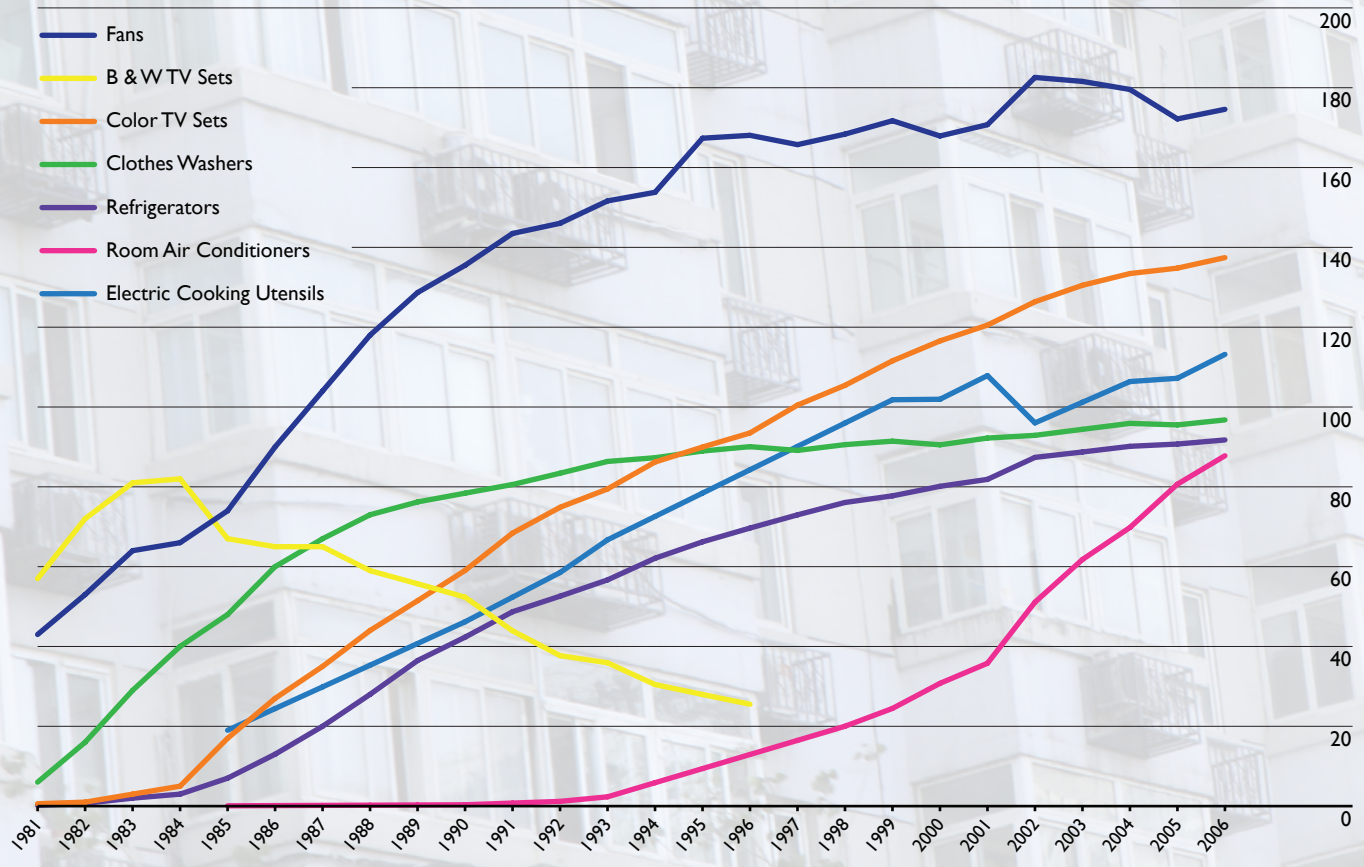



0.1.9 China: Primary Energy Consumption by Fuel Type 1965 to 2011
million tonnes oil equivalent



0.1.10 Building façade filled with air-conditioning units. Almost every room equips with an air-conditioner.

0.1.11 China: Electric Appliance Ownership 1981 to 2006
units per 100 households





and demolition.⁴ Within which, two-third of the total consumed by buildings is from the excessive use of both heating and air-conditioning.⁵ This is because the imported typologies are often applied indiscriminately in locations where the climate, building methods and cultural traditions require something quite different. The designs often ignore solar orientation, through ventilation, environmental quality and human scale. In addition, wall and ceiling insulation and double-glazed windows are not typical features of the old Chinese apartments. The structures are dependent heavily upon air conditioning to provide thermal comfort, and therefore extremely energy intensive.

The seemingly inexhaustible supply of resources has led to one of the highest rates of energy consumption per capita in the world. The lack of basic climate responsive measure in buildings contributes significantly to the excessive use of resource and indirectly drains the environment. Cities in China like Beijing suffer the consequences of becoming one of the most polluted places in the world. It is becoming clear to the Chinese government that a vicious cycle has already formed and years of rampant environmental degradation and neglect will lead to serious long-term damages. It is time to seek solutions that will sustain in the long run.

In March 2011, the Fourth Session of the 11th National People's Congress convened and approved the national economic and social development plan for 2011 and the *12th Five-Year Plan* for China. The *12th Five-Year Plan* provides national development targets between the year 2011 and 2015. It is expected to pick up where the *11th Five-Year Plan* (2006 to 2010) left off in terms of broad policy direction. The *11th Five-Year Plan* was considered a major policy shift for the Chinese government as it moved away from a focus on "growth at any cost" toward a more balanced and sustainable growth pattern, emphasizing environmental protection and green development. At the end of the *11th Five-Year Plan* in 2010, government figures showed that the country achieved a 19.1 percent energy consumption reduction, narrowly missing the 20 percent target.⁶ This has set stone for a more ambitious goal. To meet further reduction targets, the *12th Five-Year Plan* is investing heavily in the low-carbon economy and sustainable development. The new plan includes formalized reduction targets for both energy and climate change, aiming to reduce energy intensity per unit of GDP by 16 percent and greenhouse gas emissions per unit of GDP by 17 percent, over the five years to 2015. This is consistent with China's long-term plan to cut carbon intensity by 40 to 45 percent and to reduce the buildings' energy use by 65% by 2020, relative to 2005 levels.⁷ Not only is this the first plan that involves green energy issues, these issues are mentioned as a top priority. As a result, the new plan calls for a major push towards energy saving buildings and urges the government to revise and set up more green building regulations (*Table 0.1.1*).

⁴ For details see Aden N, Qin Y, and Fridley D "Lifecycle Assessment of Beijing Area Building Energy Use and Emissions: Summary Findings and Policy Applications." 2010.

⁵ Mars and Hornsby, *The Chinese Dream*, 144.

⁶ Genia Kostka and Sarah Eaton, "China's Green Rise: Growing Ambition, Growing Challenges," *Canadian International Council*, November 5, 2012, accessed November 8, 2012, <http://opencanada.org/features/the-think-tank/essays/chinas-green-rise-growing-ambition-growing-challenges-2>.

⁷ KPMG China, "China's 12th Five Year Plan: Energy," accessed June 29, 2012, <http://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Documents/China-12th-Five-Year-Plan-Energy-201104.pdf>.

Table 0.1.1 Significant national legislations and events on green development since 2005.

February 2005	<i>Renewable Energy Law</i> adopted to provide the legal and political support for the application of renewable energy in building energy efficiency. Law in effect as of January 1, 2006.
May 2005	Guideline on the <i>Development of Energy-Saving and Land-Saving Housing and Public Buildings</i> issued.
July 2005	Notice on <i>Accelerating the Development of the Circular Economy</i> published by the State Council.
July 2005	Notice on the <i>Building of Energy-Saving Society in the Short-term</i> published.
January 2006	Regulations on the <i>Management of Energy-Saving in Private Housing 2006 Revision</i> issued.
June 2006	<i>Evaluation Standard of Green Building</i> issued as the first national standard for green buildings.
January 2007	Guideline on the <i>Comprehensive Utilization of Resources during the 11th Five-Year Plan</i> issued.
January 2007	<i>Code for Acceptance of Energy Efficient Building Construction</i> issued as the first building energy code dealing with standards for the acceptance of construction quality to meet building energy efficiency design requirements.
April 2007	<i>11th Five-Year Plan for Energy Development</i> issued.
June 2007	Notice on the <i>Comprehensive Work Proposal for Energy Conservation and Emission Reduction</i> published by the State Council.
October 2007	<i>Energy Conservation Law</i> revised and adopted at the 30th Meeting of the Standing Committee of the 10th National People's Congress. Law in effect as of April 1, 2008.
September 2007	<i>Medium and Long-term Development Plan for Renewable Energy 2007 – 2020</i> published.
December 2007	<i>Provisional Measures on Financial Subsidy and Funding Management for the Promotion of High-Efficiency Lighting Products</i> published.
July 2008	<i>Regulations of Energy Conservation in Civil Buildings</i> and <i>Regulations of Energy Conservation of Public Organizations</i> issued to provide specific guidance for articles related to building energy efficiency under the <i>Energy Conservation Law</i> . Regulation in effect as of October 1, 2008.
August 2008	<i>National Building Energy Standard</i> sets requirement of 50% reduction in building's operation load over 1980s baseline.
August 2008	<i>Circular Economy Promotion Law</i> adopted for the purpose of facilitating circular/sustainable economy, improving the resource utilization efficiency, protecting and improving the environment and realizing sustainable development. Law in effect as of January 1, 2009.
August 2008	2008 Summer Olympics Games in Beijing – “ <i>Green Olympics</i> ” promoting green energy, recycling and sustainable development.
December 2009	<i>Renewable Energy Law</i> amended according to decision of the 12th Meeting the Standing Committee of the 11th National People's Congress.

December 2009	<i>Standards for Energy Efficiency Inspection of Public Buildings and Standards for Energy Efficiency Inspection of Residential Buildings</i> issued.
January 2010	Inauguration of National Energy Committee.
March 2010	Notice on <i>Energy Saving and Emission Reduction for the Traffic Industry</i> in 2010 published.
April 2010	Notice on <i>Accelerating the Promotion of Contract-Based Energy Management and Promoting the Development of the Energy-Saving Service Industry</i> published.
May 2010	Notice on <i>Further Strengthening the Work Efforts to Realize the Goal of Energy Saving and Emission Reduction in the 11th Five-Year Plan Period</i> published by the State Council.
May 2010	Decree on <i>Accelerating the Contract-Based Energy Management and Promoting the Development of the Energy-Saving Service Industry</i> issued.
May 2010	Guideline for <i>Credit to Support Energy Saving and Emission Reduction</i> published.
June 2010	Provisional Measures of <i>Supervision and Administration of Energy Saving and Emission Reduction for State-Owned Central Enterprises</i> issued.
June 2010	Guidelines to <i>Promote the Energy Saving and Energy Reduction in the Tourism Industry</i> published.
August 2010	World Expo 2010 in Shanghai, large scale “green city” and eco-friendly” urban development project promoting “ <i>Better City – Better Life</i> ”.
March 2011	Decree on <i>12th Five-Year Plan</i> issued.
August 2011	Notice on the <i>Comprehensive Work Plan for Energy Conservation and Emission Reduction during the 12th Five-Year Plan</i> published by the State Council.
February 2012	Centre for Renewable Energy Development established by the Ministry of Energy.
June 2012	First meeting of the Centre for Renewable Energy Development conducted to report progress and set goals.
October 2012	The <i>Plan for Energy Conservation and Emission Reduction during the 12th Five-Year Plan</i> approved and issued by the State Council.
October 2012	The <i>Plan for Renewable Energy Development during the 12th Five-Year Plan</i> deliberated and adopted by the State Council.
November 2012	18th Party Congress put environmental issues higher up the agenda than ever before.
November 2012	2012 China International New Technology and New Energy Saving Products Exposition held in Beijing by the China Energy Conservation Association, to promote the rapid development of energy saving, and to make contribution in achieving the energy-saving emission reduction goals outlined in the <i>12th Five-Year Plan</i> .

0.1.12 Tongzhou international new city master plan



0.1.13 Aerial rendering of Beijing ONE in Tongzhou, advertised as China's chief low carbon regimen building.



0.1.14 Night rendering of Beijing ONE mixed-use tower



0.1.15 Beijing ONE under construction, 2011

For the city of Beijing, the driving force behind the sustainable development was, without a doubt, the 2008 Summer Olympic Games. Under the spotlight of global attention, the 2008 Olympics was being promoted as a “*Green Olympics*”, which aimed to align the new city image with the principles of green energy, recycling and sustainable development. China’s expression to the world of its “eco-spirit” did not simply end with the Games. Under the theme “*Better City – Better Life*”, the 2010 World Expo in Shanghai again showcased China’s ambition for a “green city” and an “eco-friendly” urban development. Needless to say, green building will be the next and probably is already the big thing in China.

The current trend in urban development around Beijing, however green it may be marketed as, still has a long way to go before reasonable claims of sustainability can be met. Tongzhou district about 13 kilometres east of CBD, for instance, is to be a modern international new city. The planning and construction highlights are low carbon, environmental friendly and sustainable development. During my research trip, I visited one of the residential projects in the downtown of Tongzhou, Beijing ONE. The project is advertised as “China’s chief low carbon regiment building” featuring many internationally prospective high-tech environmental protection technology. The system is said to be very efficient so that the interior will maintain a desirable temperature and humidity throughout the year without the help of air conditioning units. And the building is well ventilated, so inhabitants do not need to open their windows for fresh air. Appealing as it may sound, the design relies heavily on advanced technology to achieve efficiency, which is often of foreign origin. Building projects like Beijing ONE are labeled “green” for using energy efficient HVAC systems, high performance glazing systems, photovoltaic panels, super insulated façades, lighting fixtures, dual flush toilets and other sustainable products. However, the cost and embodied energy are often overlooked; and the built forms are still based on the import models, paying no regards to the unique local conditions. Ultimately, the end product might not be as “green” as everyone thinks they are. If the designs were more considerate of the tradition and climate conditions, enormous contributions to energy efficiency could be made. These improvements would significantly lower energy intensity and lessen the negative impacts on the environment, leaving our future generation a better place to live.

In the case of cities like Beijing, especially developments within the historic centre where the thousands-year-old heritage lies, sustainability cannot simply stop at the environmental level. It is more than reducing energy and protecting the Mother Earth. The protection and promotion of economic vitality, social well-being and cultural identity are equally important in achieving a true sustainable society.

In the long history of China, the Chinese have always employed an indigenous system of construction with the influences of geography, climate, culture, philosophy, economy and politics deeply rooted in China, making the Chinese traditional architecture distinct. Embedded in the formation of the city, *sibeyuan* 四合院, the courtyard house in Beijing was one exceptional dwelling example that inherited the quintessence of the thousand years of building experiences and knowledge of the ancestors. The built form maintained a harmonious relationship with nature in providing thermally comfortable shelters for performing the functions of daily living in a balanced and protected environment, as well as creating a sense of community in between the narrow lanes. It was thus widely considered to be a model of low-energy design and a responsive typology for the making of sustainable cities. However, the inability to meet the demands of higher density and the standards of modern living has led to the inevitable downfall and disappearance of the courtyard houses under the growing Western imports.

In which form can the traditional typology survive in a fast-growing and changing metropolis? A question many developing historic cities may face. The current policies and ambition of China in pursuing sustainable development pose interesting and promising opportunities in remediating and reinterpreting the dilapidated housing type. Intending to create a proposal that may have a meaningful impact on the rebuilding and expansion of historic cities on a global scale, the thesis investigates the essences of the traditional courtyard house and explores the way to apply such qualities to the design of courtyard in contemporary Beijing.



The following is a brief outline of the structure and components of the thesis:

Chapter One – City: the changing capital, introduces Beijing’s urban morphology and its impacts on the changing fate of the courtyards: how did the pleasant home turn into a dark undesirable slum. It is then followed by an overview of the city now revealing some of the current conditions and problems.

Chapter Two – Courtyard: the traditional typology, offers a brief history on the development of the traditional Chinese courtyard, how did it take its form after thousands of years of adaptation and elaboration. Then the research delves into the design details to uncover the essences of such typology.

Chapter Three – Site: Sanmiao Jie, the Third Temple Street, is a site analysis covering the site history, its current state and the surrounding conditions.

Chapter Four – Design: courtyard in contemporary Beijing, establishes a design response as a holistic approach to reinterpret the traditional typology in the context of contemporary Beijing.

The final chapter, *Chapter Five – Reflection + Projection*, then concludes with speculations about further implications for the remediation and reinterpretation of traditional typology in the modern world.



0.1.16
Rooftops of siheyuan with additions in Dongcheng District, 2012. The spacious courtyard spaces no longer exist.

1.0.1 View to Beihai Park from Jingshan in 1860 and 2011

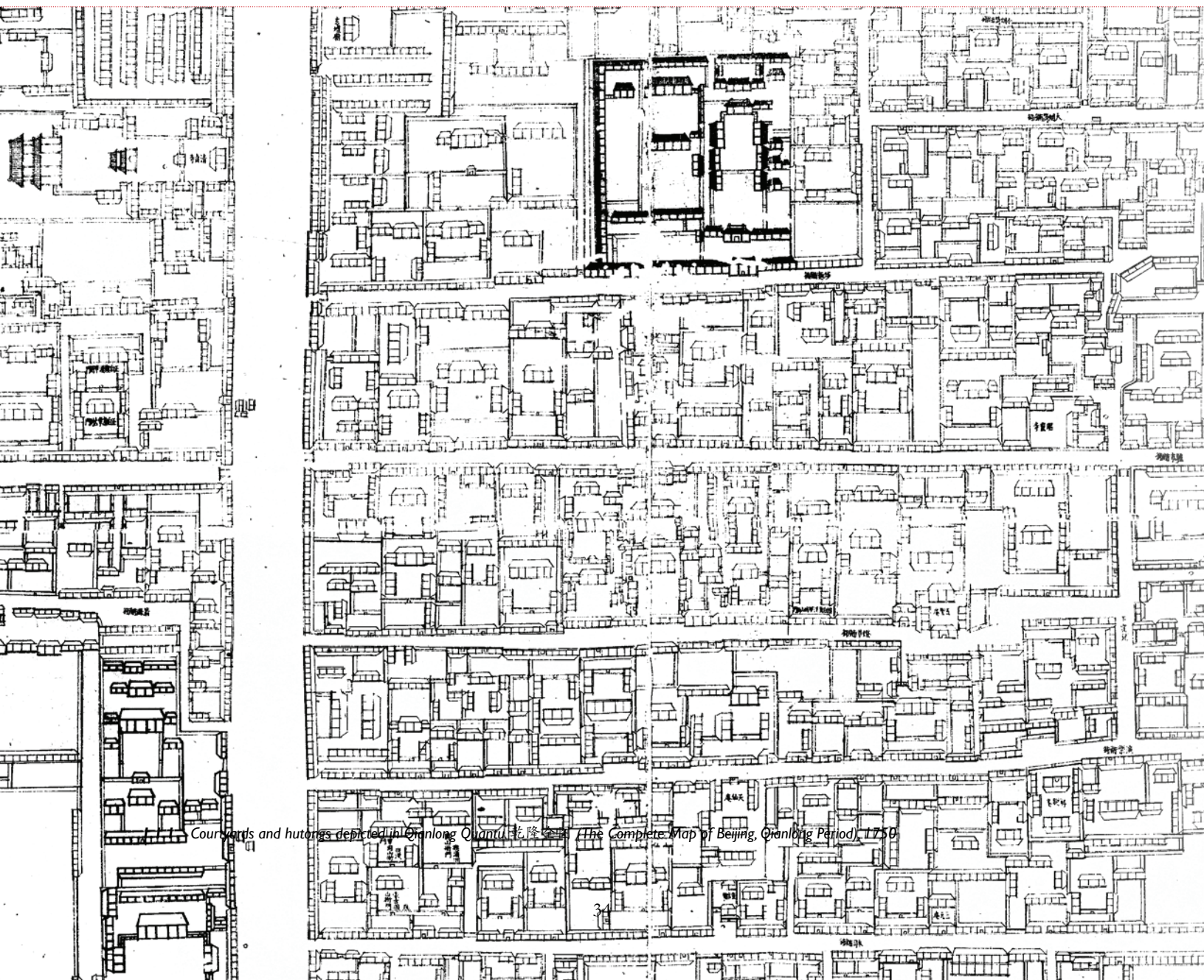
14.



1 City: the changing capital



1.1 Beijing Urban Morphology: the changing fate of courtyard houses



Courtyards and hutongs depicted in *Qianlong Quanfu* (乾隆全圖) (The Complete Map of Beijing, Qianlong Period), 1750

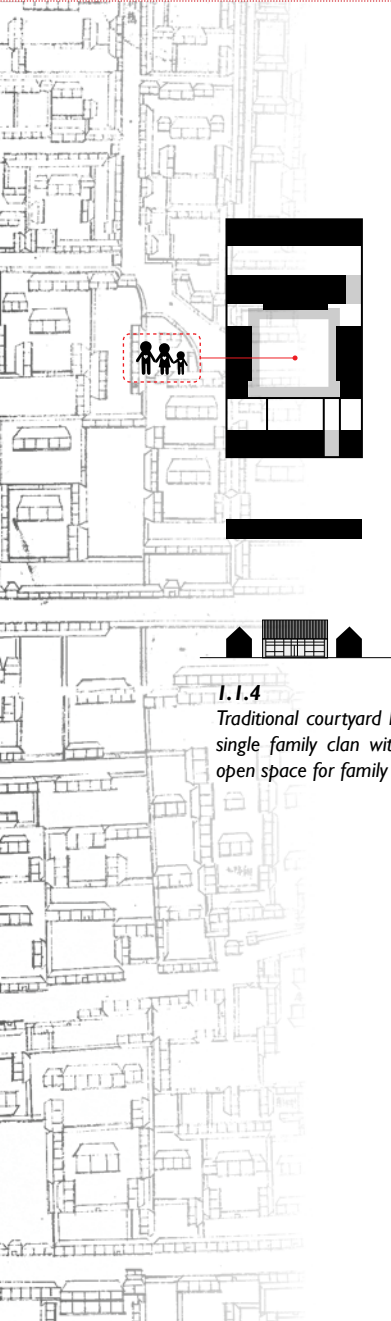


1.1.2 Traditional courtyard house in Beijing



1.1.3 Playground in a protected open space

Imperial Beijing prior to 1840

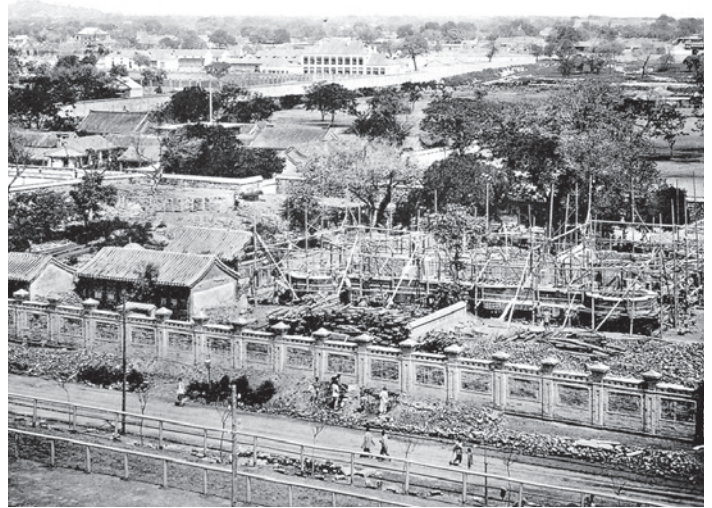


1.1.4
Traditional courtyard houses one
single family clan with pleasant
open space for family activities.

Beijing as a settlement has existed for more than three thousand years and has served as a capital for various dynasties such as Jin, Yuan, Ming and Qing. The urban layout of Beijing's historic city now visible is based on the thirteenth century Yuan capital and its elaboration during the Ming and Qing Dynasties. The most impressive aspect of its historical form is the coherent urban fabric. The buildings were laid out according to principles based on hierarchy. The size, height, colour, roof form and decoration details were strictly regulated. The Imperial Palace, housing the emperor, was the most grandiose and was placed in the centre of Beijing. Surrounding the palace is the uniform urban landscape consisting of courtyard houses bound by the gridded network of arterials with smaller lanes within, called *hutong* 胡同. The hutongs usually ran east-west, subdividing a superblock framed by perimeter streets into narrow strips. These strips were then further divided into smaller lots, which could be possessed by one household. Within this framework, dwellers built their own courtyards. According to their social status and needs, the lot could be subdivided further to accommodate more households with smaller courtyard; or, the dweller could acquire adjacent lots for expansion without disrupting the neighbourhood fabric. In either case, adequate area was ensured for the existence of a pleasant open space framed by the basic building units in the east, west, south and north of the courtyard complex. The courtyard provided a window to the sky – a conduit for air and light in the midst of the crowded urban fabric, while ensuring visual and spatial privacy. Such configuration offered a climatically controlled space from many of nature's unwanted forces, and it was essential to the supply of lighting and ventilation of the house, which in turn, reducing energy consumption. In the age with no electricity and other advanced means of lighting, heating and cooling, the courtyard typology was able to provide a comfortable living environment during the hot summers and harsh winters.



I.1.5 Ruins of courtyard houses after the war, 1901

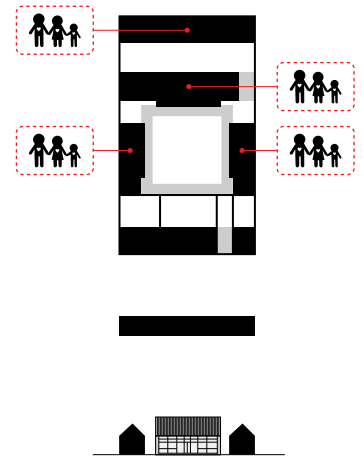


I.1.6 View of Chongwenmen from the northwest, 1902

Fall of Imperial Beijing

1840 - 1948

The fate of the traditional courtyards followed that of the Qing Dynasty. The wide spread typology reached its culmination after over two thousand years of development and began heading downward as the imperial system collapsed at the beginning of the twentieth century. The Invasion of Eight-Powers and the Japanese war altered the Chinese society dramatically and took their toll on Beijing's cultural heritage. During the time, China was experiencing financial crisis nationwide due to inflation on both currency and commodities. Many courtyard dwellers were no longer able to afford the maintenance of the entire complex. As a result, rooms were rented out in exchange for living expenses. Non-autonomous households began to occupy the courtyard houses, which originally housed one single family clan. Even though no alteration was made to the built form, the nature of the dwelling type began to change.



I.1.7

Non-autonomous households began to live within one complex, sharing the central courtyard space.

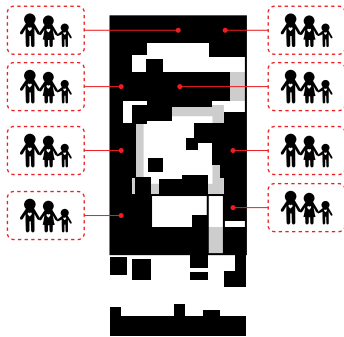


1.1.8 Street expansion in Xidan during the 60s



1.1.9 The number of meters installed indicates the number of families living within one courtyard house

Communist Beijing 1949 - 1965



1.1.10

As more families moved in, informal extensions were built into the courtyard space.

The rise of communism in China in 1949 changed the traditional society in many ways. With the declaration of a new nation and new approaches for development, Beijing became an industrial city. Modernization was the top priority as the country tried to step away from its former self. The urban fabric within the historic city was therefore modified to support the greater emphasis on production and the expanded needs of a modern metropolis in the twentieth century. The narrow streets were widened to improve the flow of goods and raw materials to and from the city. The historic outer wall was demolished in the 1950s to make way for the high-speed Second Ring Road. As a result, the courtyard districts suffered as the neighbourhoods were cleared away for such development to occur.

To further facilitate industrialization, a massive influx of migrant population gravitated towards the capital, causing a shortage of housing. In combination with the government's reluctance to invest too much money on consumptive goods such as housing, one temporary solution was to pack more families into a courtyard house than was originally intended. With the building heights remained predominately single storey, people improvised and constructed informal sheds within the open space, permanently disfiguring these houses. Only a few courtyards remained intact, and they were mainly residences of the famous and the influential such as novelists, opera actors, founding members and political figures of the Communist Party. Unfortunately, many houses of the common people did not escape the fate of alteration. The once bright, airy and spacious courtyard became dark and cramped, losing all of its environmental benefits.



I.1.11 Kindergarten in Xiaotianshui Hutong, 1956



I.1.12 Slab construction, 1978

Communist Beijing 1949 - 1965

Furthermore, many privately owned courtyard houses became public property after the establishment of People's Republic of China. No longer owned by individuals, some courtyards were converted into government offices, medical clinics, kindergartens, factories or other public functions. The traditional typology was unable to meet the conflicting requirements of the new functions. There were generally two resolutions, namely renovation or reconstruction. Certain functions saw the benefits of the safe and pleasant environment created within the bustling city. Such functions were kindergartens, neighbourhood committee centres, and sometimes, restaurants. For them, only minor modifications and interior renovations were adequate to update the old typology, and many sustainable features of the traditional home were preserved and improved. However not all conversions were ideal, reconstruction continued to be the primary solution for many projects. This is simply because rebuilding was cheaper and easier than renovation, and was able to create more useable spaces on the same amount of land. Instead of accommodating the built form, the architecture was reconstructed to fit the needs of the occupants, causing more destruction underway.



1.1.13 Poster for the campaign to destroy the Four Olds

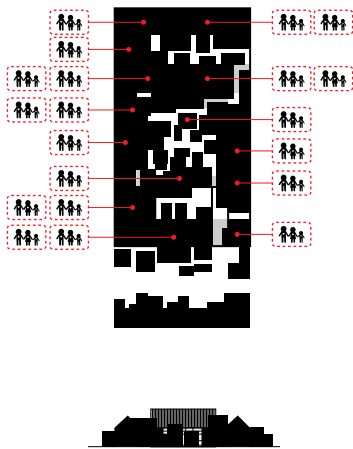


1.1.14 Courtyard in ruins



1.1.15 Informal extensions built in the courtyard
1.1.16 "Dangerous housing! Do not approach!"

Beijing during the Cultural Revolution 1966 - 1976

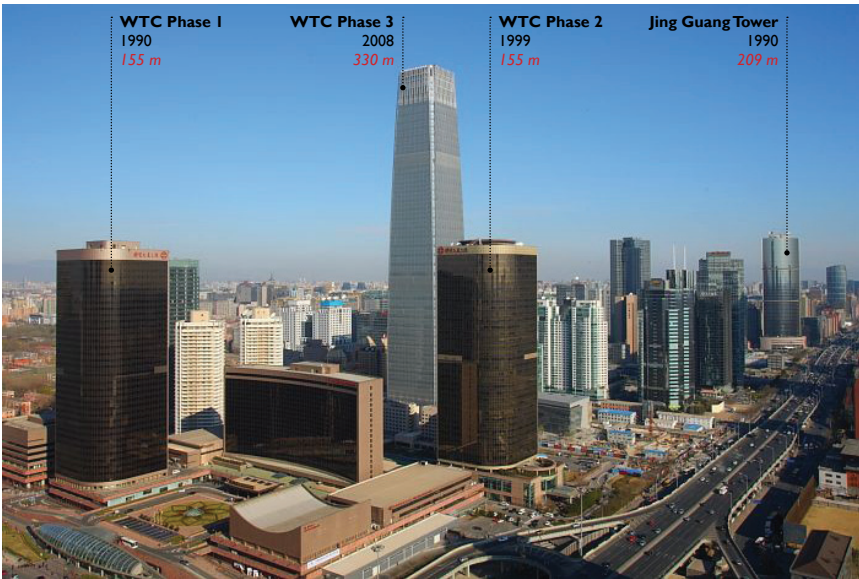


1.1.17
Courtyard filled with more families and informal extensions. The once pleasant open space has ceased to exist.

Another assault on Beijing's cultural heritage occurred during the Cultural Revolution, which lasted for ten years from 1966 to 1976. The traditional courtyard houses did not escape the rampage following the campaign to destroy the Four Olds, namely "Old Customs, Old Culture, Old Habits and Old Ideas". Many precious decorative elements such as carvings, wall paintings and stone sculptures commonly found in the courtyards were either damaged beyond repair or destroyed completely. Rarely any survived from the Red Guards. Again, mainly the courtyards of the commoners suffered, while houses of the influential people were under protection. Even though the campaign to destroy the Four Olds was devastating, the Red Guards did not have the capacity to extinguish everything from the old age. Some literati and enthusiasts of the old tradition managed to save a few remnants of the decorative pieces, and some went all the way to retrieve the remains in the aftermaths and tried to restore them back to their original state.

Later during the movement to prepare for war, people dug air raid shelters throughout the city, causing more irreparable damages to the historic typology including the basic layout and the once effective drainage system.

The situation was worsened by the earthquake suddenly struck Tangshan in 1976. Beijing was directly affected with more than 28 000 buildings collapsing. In addition, roughly 100 000 buildings were damaged and classified as dangerous. To avoid further casualties from the aftershocks, the already overcrowded courtyards were filled with temporary quakeproof shelters. However, with the rapid population growth, these temporary structures became permanent.



I.1.18 High-rise towers in CBD area

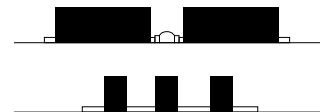
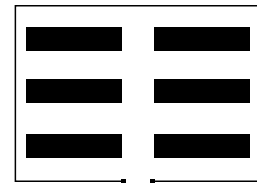


I.1.19 Weigai project near Dongbianmen, 1995

Beijing after the Open Door Policy
1978 - 2001

In 1978, China adopted the *Open Door Policy* initiated by Deng Xiaoping. The economic reform transformed China from a planned economy to a market economy, which opened the country up for an influx of investments from abroad. Beijing, as the capital, attracted many foreign architects to work on high profile projects. In 1990, the city's first steel and glass skyscrapers by American and Japanese architects: the Jing Guang Tower and the phase one tower of the World Trade Centre were completed. Many massive modern buildings were also erected along Chang'an Avenue, the major east-west axis across the historic centre of Beijing. The iconic buildings that were of Western origin often had large setbacks and paid no respect for its surrounding context. Although these projects gathered a great deal of attention, they were counter to the coherent historic fabric.

Enduring through the past events that have completely changed the face of the courtyard houses, the traditional typology was considered outdated, unsafe and a symbol of poverty and backwardness in the new age. To facilitate the redevelopment of the decaying courtyard districts, *Weigai*¹ 危改 (reconstruction of dangerous and old housing) was implemented. Under this regime, residents of the dilapidated buildings were relocated elsewhere, the old buildings were knocked down and the sites were redeveloped. Unfortunately, *Weigai* took place without any reference to conservation planning. Property developers have free reign to redevelop former residential areas, as long as they re-house the original occupants adequately. To maximize profit, many developers chose to situate relocation housing far from the city centre where land is cheap. Clearing out the historic



I.1.20
New high-rise gated communities replace traditional courtyard complexes.

¹ Short form *weijufang gaizao*, 危旧房改造.



THEN
NOW



1.1.21 Southern entrance to Wangfujing Street in the 50s
1.1.22 Southern entrance to Wangfujing Street in 2009



THEN
NOW



1.1.23 Fuxingmen neighbourhood before 1940s
1.1.24 Financial Street in Fuxingmen neighbourhood, 2009

compounds without the slightest hesitation, the profit driven developers redeveloped the sites from ground zero where land is precious and market value is high. Most demolished courtyard districts were replaced with skyscrapers of either residential or commercial functions. Developments such as the Oriental Plaza² in 2001 (Figure 1.1.22), Financial Street³ between 1992 to 2008 (Figure 1.1.24) and *Jiaodaokou* Flats⁴ in 2001 all stood on the sites of ancient courtyard neighbourhoods. Shifted from its original aim to provide safe and modern housing for residents, the emphasis of *Weigai* turned into a drive to redevelop Beijing's most valuable land, which also damaged the historic character of the ancient capital. According to statistics, a total of 4.2 million square metres of old housing was demolished between 1990 and 1998. The total area occupied by the courtyard houses has shrunk from 17 million square metres to just three million. Of the 3000 or so remaining compounds, only 539 are in cultural and historical conservation areas.⁵ In addition, the relocated residents now live far from their daily workplaces and services. Many now need to commute, which put further pressure on Beijing's traffic system and contributed greatly to pollution.

² Oriental Plaza 东方广场, completed in 2001, is located in *Wangfujing* commercial district inside the 2nd Ring Road. Covering an area of approximately 100 000 m² with building area of 800 000 m², it is one of the largest commercial complexes in Asia. The development was controversial in terms of its height and close proximity to the Imperial Palace, the clearing of the courtyard neighbourhoods and the relocation of the hutong residents in the area.

³ Financial Street 金融街, covers an area of 1.18 km² inside the 2nd Ring Road between Fucheng Gate (阜成门) and Fuxing Gate (复兴门). It is part of the city's strategic plan to transform the district into an international business and financial centre. The project began in 1992 and completed in 2008. The traditional courtyard neighbourhoods were wiped out and 64 *hutongs* had disappeared during the process.

⁴ *Jiaodaokou* Flats 交东小区, located to the east of The Drum and Bell Tower area, covers an area of 118 100 m². Fifteen six- to eleven-storey residential blocks replaced the original courtyard neighbourhood.

⁵ Lian Zheng, *Housing renewal in Beijing* (Montreal: McGill University, 1995), 17.



I.1.25 National Grand Theatre of China by Paul Andreu protrudes out from the uniformed historic fabric of the Forbidden City.



I.1.26 Galaxy Soho by Zaha Hadid replaces the open sky viewed by the hutong neighbourhood traditionally.

The Beijing Olympics and Beyond after 2001

When Beijing secured the right to host the 2008 Summer Olympic Games in 2001, a plethora of public works were underway in preparation to showcase the world this magnificent global metropolis. The speed of development was unprecedented in its long history. Numerous iconic buildings were erected – Herzog and de Meuron’s National Stadium or commonly known as the “Bird’s Nest”, Rem Koolhaas’ CCTV Tower, Paul Andreu’s National Grand Theatre of China, and so on. Many high spec towers and commercial districts were constructed as if they appeared overnight. In addition, six new subway lines were opened in time for the Olympics. The face of Beijing changed drastically just in a few years’ time. The development did not simply end with the Games. Up until now, fourteen subway lines are up and running. All but two were built within the past decade. More iconic buildings and starchitects’ creations, along with new roadways, rail lines, parking and other infrastructures are under construction. These developments, however, all pay scant regards to the surrounding context, causing further detrimental effects on the coherence of the existing historic fabric. Hutong photographer Xu Yong remarked wryly: “*When I photographed the hutongs in 1989, Beijing still had over 2000 hutongs. Now, there are only 200 honest-to-goodness hutongs left.*”⁶

Despite the continuation of the rapid growth in the capital, another trend slowly emerges amidst the remaining ancient courtyard districts. As these reminders of a bygone era become rare, their capacity to evoke nostalgia for the traditional environment begins

⁶ Jaime A. FlorCruz, “China’s capital still getting kick from 2008 Olympic party,” CNN, July 2, 2012, accessed November 21, 2012, <http://www.cnn.com/2012/07/02/world/asia/china-florcruz-olympics/index.html>.



1.1.27 Dilapidated courtyards are reconstructed as high-valued real estate properties for modern families.



1.1.28 Traditional architectural elements are preserved and integrated into the new built form in the commercial redevelopment of Qian'men Street.

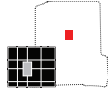
to grow. Holding a deep love for the traditional culture, many oversea Chinese and those who are wealthy begin to purchase old courtyard houses within the historic centre. They either renovate or reconstruct the dilapidated housing, equipping it with modern facilities such as heating and cooling systems, sewage, kitchen, washroom and luxurious interior finishes, while maintaining its traditional exterior. These courtyard houses are then restored to their former state with a pleasant and spacious garden, and back to be a property occupied by one single family. As more and more tourists visit Beijing and admire at its magnificent architecture, the courtyard districts regain its importance. Real estate investors begin to find potential market in these courtyards, as they invest their money for the transformation of the old blocks and the development of the new high-end residences of national style. The government also took action to address the need for balance in integrating cutting edge modern development into Beijing's unique ancient heritage. The municipal government adopted *Conservation Planning of 25 Historical Areas in Beijing Old City* in March 2002 and *Conservation Planning of Historical and Cultural City of Beijing* in September 2002, along with the *Cultural Asset Protection Law* of 1987, outlining the guidelines in terms of development within the historic centre. Restorations of the old neighbourhoods begin almost immediately. Many pilot projects are also implemented; one example is the commercial redevelopment of Qian'men Street 前门大街 (Figure 1.1.28). A surge of reviving the traditional courtyards is surely welling in Beijing.

1.2 Beijing Now: a summary

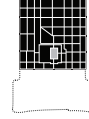
Liao



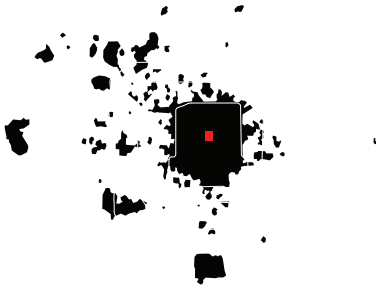
Jin



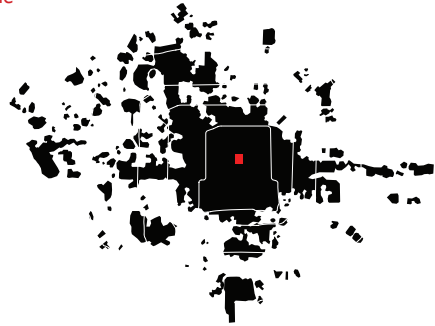
Yuan



1951
2.03 million people



1959
6.84 million people



1991
10.9 million people



2000
13.6 million people



Ming



Qing



in the last 1000 years...

in the last 60 years...

1983
9.50 million people

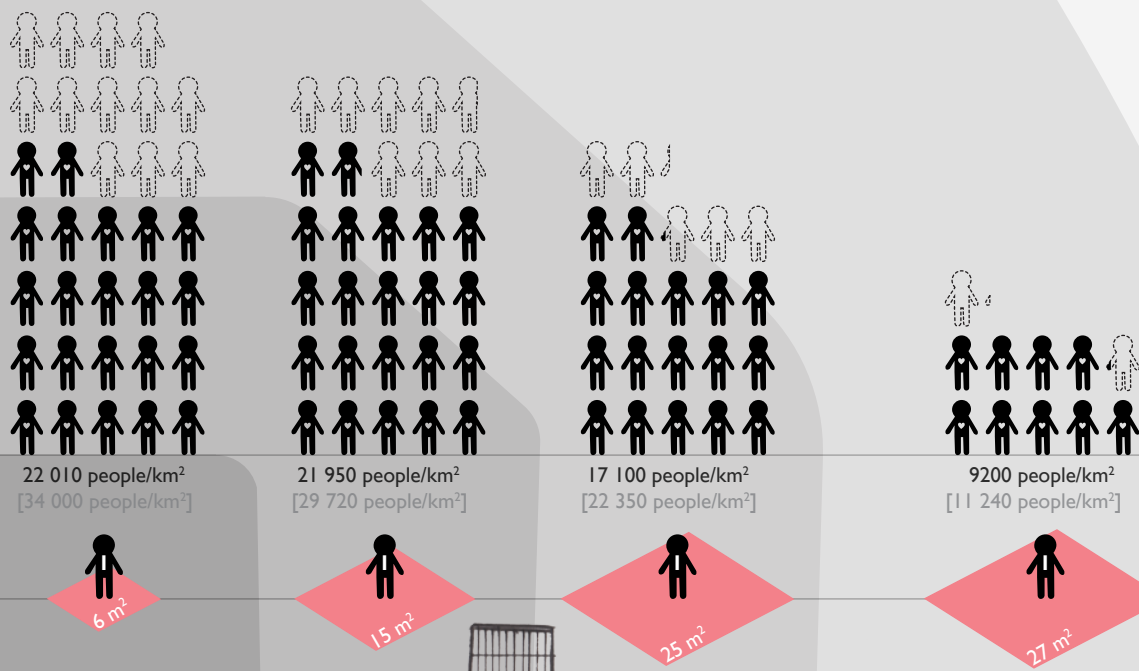


2011
20.2 million people



1.2.1
Urban Growth in Beijing: expansion of the urban built up area

1.2.2 Density and Living Quality Study by Ring Roads



2nd Ring

3rd Ring


4th Ring


5th Ring

A Density Paradox Population distribution in the city of Beijing is extremely uneven. Density and building height in areas bounded by each ring road form a counterintuitive pattern: from the centre outwards, buildings get bigger and taller, however, density drops.

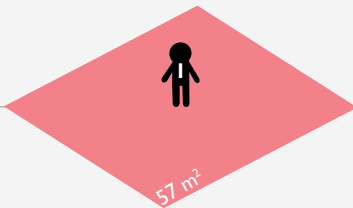
* The data are based on the number of permanent residents collected during the *Sixth National Population Census* in 2010. Permanent residents include local *hukou*¹ residents, non-local *hukou* residents who lived in the district for more than six months, undetermined *hukou* residents (registered floating population and pocket-*hukou*² holders) who lived in the district for more than six months, and residents who are not in their *hukou* district for less than six months. According to the 2010 Census, there are approximately 12.57 million people held a Beijing *hukou*. An additional 7 million inhabitants were migrant workers who had been living in the city for more than half a year and who are therefore also classified as permanent residents. However, the official data did not reflect the actual population in Beijing, because it did not account for the number of unregistered floating population, which was estimated to be at least 3 million. Due to the nature of this group, accurate data is difficult to obtain. It is important to note that the floating population constitutes a large portion of Beijing's total population, especially within the 2nd Ring Road where majority of the group resides. Thus, in reality, the population density would be much greater than the diagram showed, and the living space per capita in certain districts within the 2nd Ring Road could be as little as 2 to 3 m² per person.



 = 1000 people
[floating population]

 = 1000 people
permanent residents*

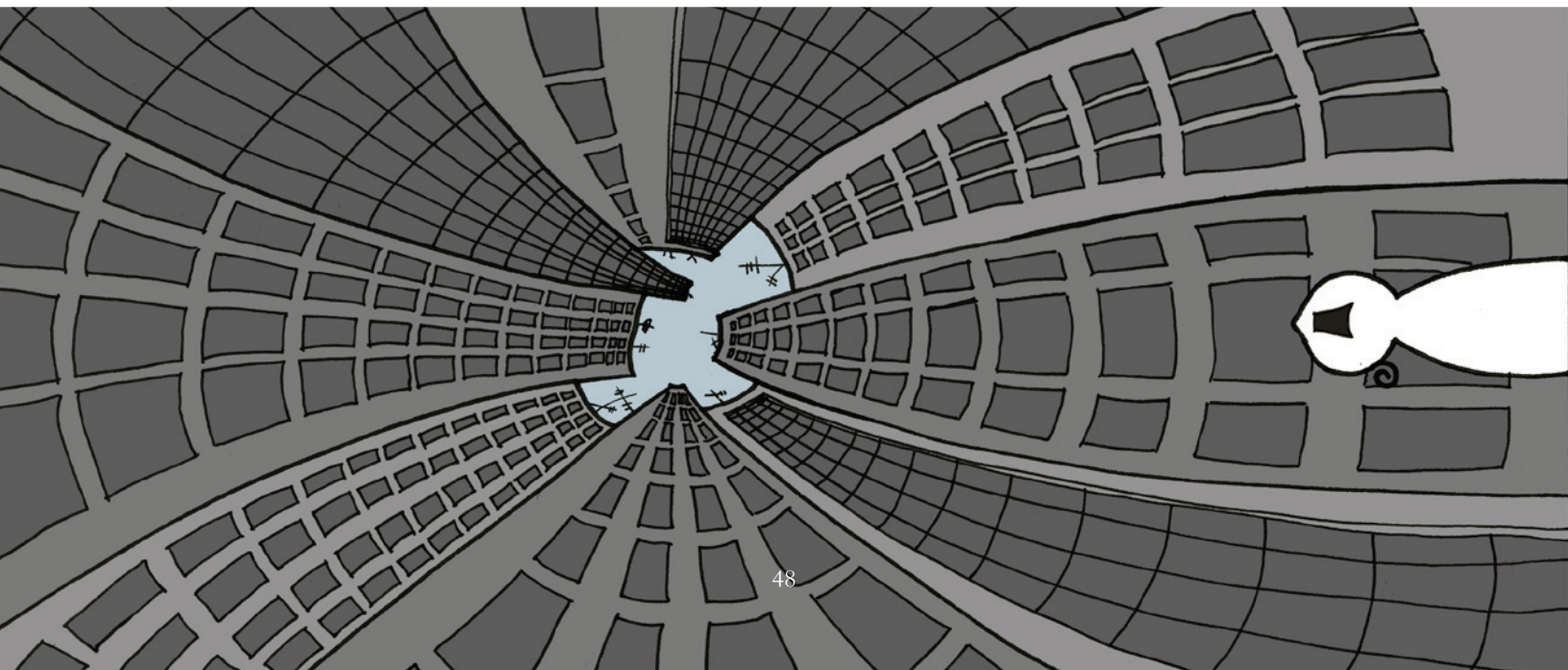
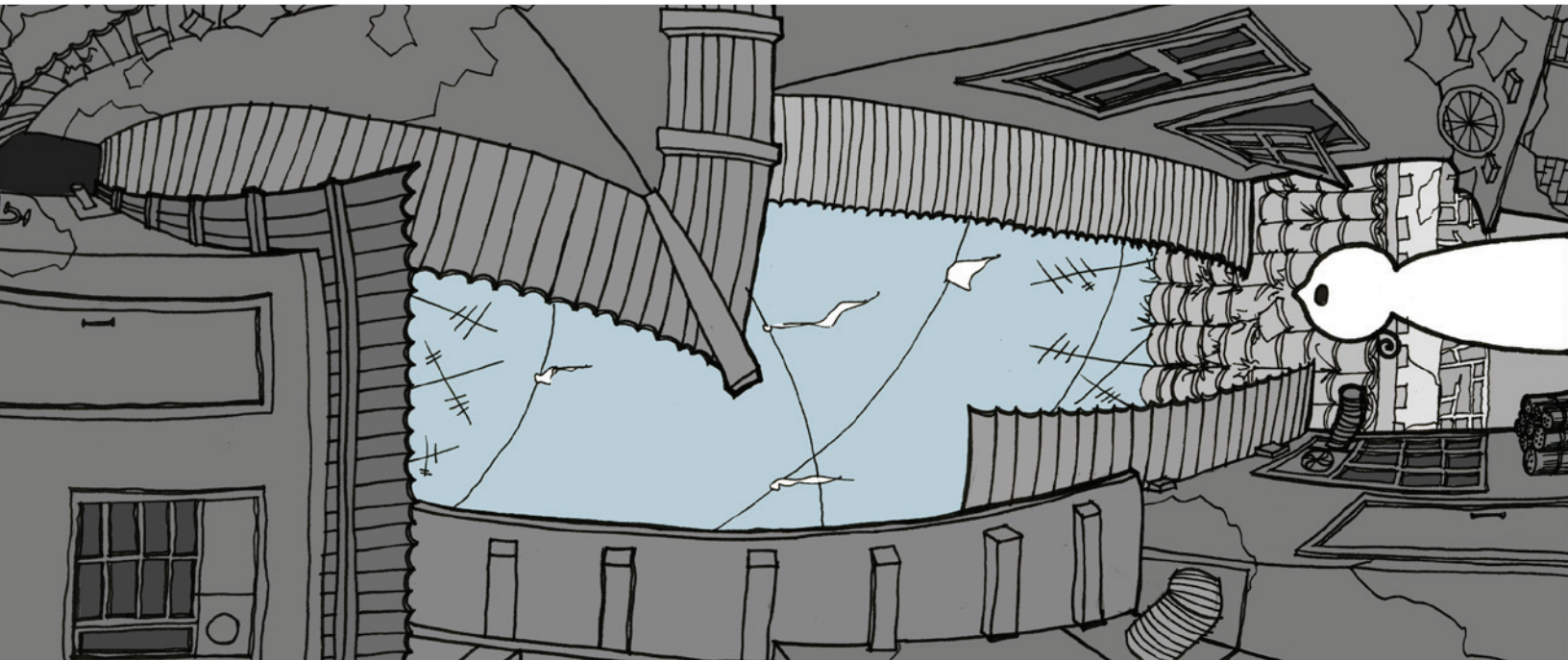
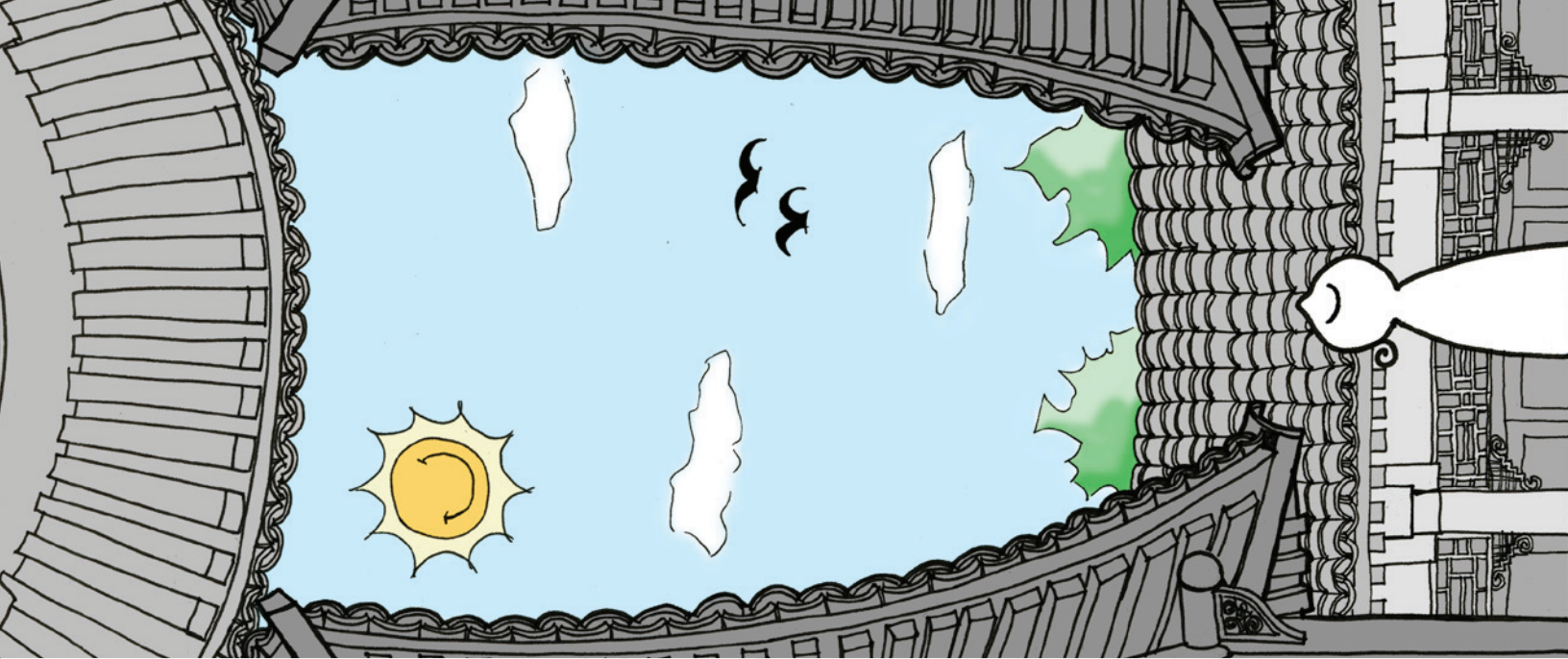
Population Density

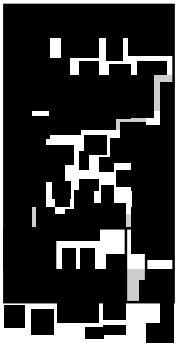
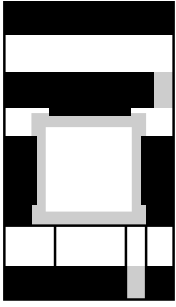


Living Space per Capita

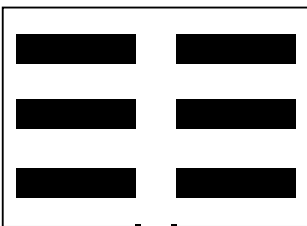


6th Ring





A Metaphor of the Sky As buildings get taller and bigger, people get less sociable space. The size of communal space can almost be compared to the amount of sky we see: big, wide-open courtyards versus the blue pinhole framed by the surrounding towers.



1.2.3
Metaphor of the sky

THEN + NOW

MODE OF TRANSPORTATION



By Bicycle

1.2.4



By Car

1.2.5

TRAFFIC



Clear

1.2.6



Congestion

1.2.7

POPULATION



Empty

1.2.8



Overcrowded

1.2.9

THEN + NOW



Courtyard

1.2.10



High-rise Tower

1.2.11

BUILDING TYPOLOGY



Open

1.2.12



Filled

1.2.13

BUILT FORM



Pleasant

1.2.14



Slum-like

1.2.15

SPATIAL QUALITY

THEN + NOW

西单 XIDAN



宣武门 XUANWUMEN



长椿街 CHANGCHUN JIE



牛街 NIU JIE



THEN + NOW



XIBIANMEN 西便门



CHONGWENMEN 崇文门



DONGBIANMEN 东便门



XIZHIMEN 西直门

I.2.32 Beijing CBD **I.2.33** Downtown Toronto



I.2.34 Villa village outside the 5th Ring Road, Beijing

I.2.35 Villa village outside the 5th Ring Road, Beijing

I.2.36 Suburb, Thornhill, GTA

A Lost Identity In the letter to Claude Debussy on June 6, 1910, Victor Segalen³ wrote “*We landed in China from the middle of the English territory, Hong-Kong. Good, but that was not it. We departed again; we arrived in Shanghai, still annoyed. Now that it was a bit like America. We went upstream of the Yangtze River on a comfortable house-boat; we believed we could ‘travel deep into the yellow continent’, and here is Hankou, which is the capital city of the province. To the other side of the river, it is again English, German territory, with a familiar feeling. We boarded the express train to Beijing (30 hours) and finally, finally, we are really in China, an encounter with the whole China; only if we knew how to look at it.*”⁴

If Segalen were to see Beijing today, what would he say?

BEIJING CBD



1980s 1.2.37



2004 1.2.38



2012 1.2.39



2016 1.2.40

¹ *Hukou* 戶口, a record in the system of household registration required by law in China.

² Pocket-*hukou* 口袋戶口, refers to people who live in the district during the Population Census, but have no *hukou* registered under any district authorities. One example of such group is the college/university graduates who have yet to find employment.

³ Victor Segalen (January 14, 1878 – May 21, 1919) was a French naval doctor, ethnographer, archeologist, writer, poet, explorer, art theorist, linguist and literary critic. He travelled and lived in China from 1909 to 1914 and in 1917, where he drew inspiration for majority of his work. He is the author of a collection of prose poems, *Stèles* (1912); the novels *Les Immémoriaux* and *René Leys* (1922); and *Equippée* (1929), an account of an imaginary expedition. Because of his deep connection with China and the Chinese culture, he was sometimes called the Chinese Poet from France.

⁴ Selected phrase from the letter to Debussy on June 6, 1910, found on page 113 of *Segalen et Debussy* published by Éditions du Rocher, 1962. The original phrase in French is “On aborde en Chine au moyen de l’Angleterre, Hong-Kong. Beau, mais ça n’est pas ça. On repart, on arrive à Chang-hai, toujours irrité. Maintenant c’est un peu d’Amérique. On remonte le Yang-tzeu sur de confortables house-boats, on croit « pénétrer le continent jaune », et voici Han-Keou, qui bien que flanqué d’une capitale de province, en face, sur l’autre côté du fleuve, recommence l’Angleterre, l’Allemagne, et les airs connus. On prend l’express pour Péking (30 heures) et enfin, enfin, l’on est vraiment en Chine, au rendez-vous de toute la Chine, seulement, il faut que l’on sache voir.”

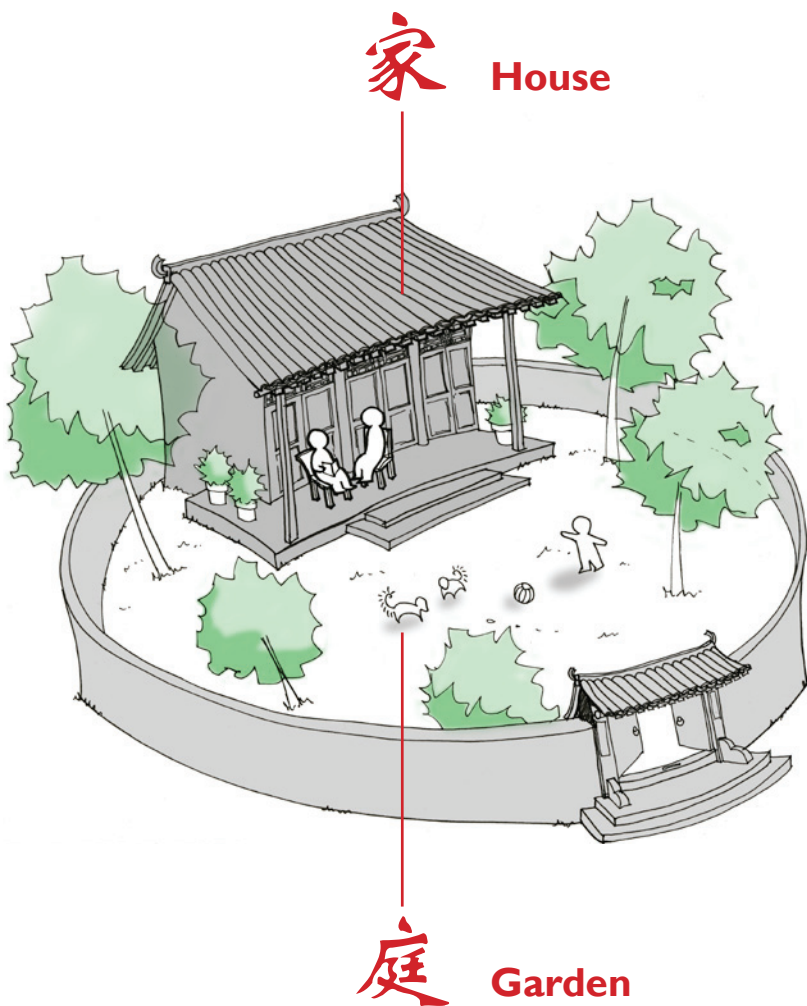


2 Courtyard: the traditional typology



2.0.1

View of the courtyard in the home of opera actor Cheng Yanqiu 程砚秋



2.0.2

The notion of home

HOME = House + Garden:

A balance between private and public life

Jiating 家庭 means family in Chinese.

Jia 家, means house; it is the place for living.

Ting 庭, means garden; it is the open space.

Daily activities and social events normally occur in the open space.

家庭 (house + garden) basically means that a place called home should have at least some open space. Though, nowadays, it is not the case.

*To the older generations of Chinese, houses on four sides frame an open area in the middle is the form of a typical family; also known as courtyard. This open area is different from the other spaces outside, because it is an exterior space that filters out strangers, noise, and dust.**

* Zhao Guangchao, *Chinese Wood Architecture* (Hong Kong: Joint Publishing (H.K.), 2000), 12.

“不听老人言，吃亏在眼前” *Buting laoren yan, chikui zai yanqian*

Those who do not heed the advice of an elder will suffer losses

This is the phrase that I have heard over and over again as a child.

I guess like everyone else, I was curious at everything as a kid. I was always tempted to try out things that I have never done before, even though I was warned by my parents about the consequences of such doings. Then I regretted not listening.

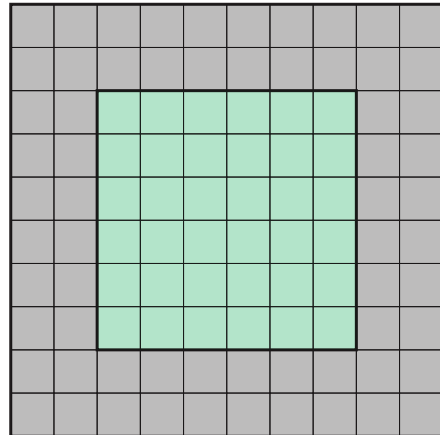
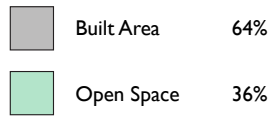
This phrase is a famous Chinese proverb that serves both as a piece of advice and warning or an after-the-fact teaching. The Chinese believes that people who are older are inclined to have more experience. Therefore, before someone sets out to do something, that person should heed the opinion from an older and more experienced person; if not, that person is bound to suffer some losses and setbacks.

Courtyard house has been a popular type of dwelling not only in Beijing, throughout China, but also in many ancient cities around the globe. Why did the ancestors favour the courtyard as the primary form of dwelling? The form is uniquely conducive to daily life. The central court is like a multipurpose room where most of the family activities take place. It blends patterns of culture with rhythms of nature, meets the requirements of function and the demands of climate, and balances the values of community with the need for privacy. Chinese architectural historian Hou Youbin (侯幼彬) once did a detailed analysis, and believed that the existence of an open interior domestic space provides a pleasant microclimate with regard to temperature, humidity and ventilation, reducing the negative effects caused by many of nature's unwanted forces. In the summer, the form can effectively shade and cool the space; while obtaining enough light and heat in the interiors and providing protection against the harsh wind in the winter. The open space also allows unobstructed cross ventilation to ensure the fresh and healthy air quality. In addition, the courtyard facilitates drainage and rainwater collection, and embraces nature as a private interior garden full of trees, shrubs, flowers and fountains. An enjoyable microclimate full of greens is thus created, suitable for human habitation.¹

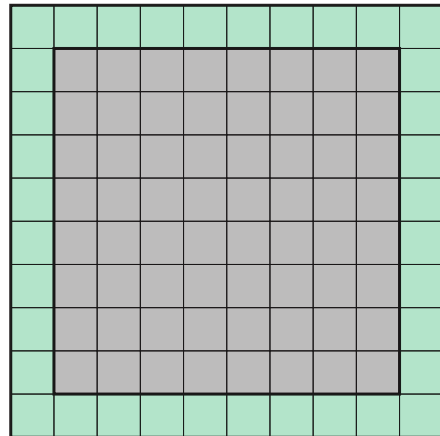
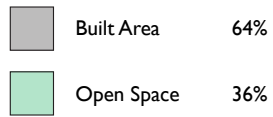
¹ Hou Youbin, *Aesthetics of Ancient Chinese Architecture* (Harbin: Heilongjiang Science Technology Publishing House, 1997), 78.

2.0.3 Spatial analysis between built area and open space in different scenarios.

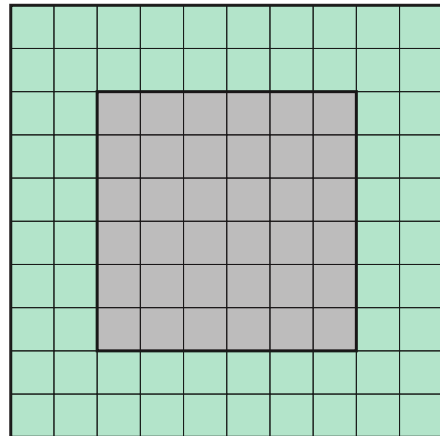
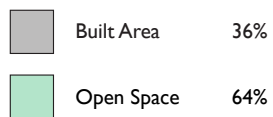
A



B



C



This generic form also offers the efficient and maximum use of land as scholars analyzed the differences between the courtyard typology and the single detached housing typology. If we overlay a 10 by 10 grid over a square-shaped land, we can obtain the following possible arrangements of built objects and open space (*Figure 2.0.3*) – built objects enclosing a central open space (Scheme A), or open space surrounding a central built object (Scheme B and C). According to Scheme B, there are 64% of built area and 36% of the surrounding open space. The building occupies the majority of the site, leaving four long and narrow strips of land around. These areas are deemed very inefficient and sometimes unusable. Scheme C, a modified version of Scheme B, features an increased land area of 64%, which is more usable. However, the consequence is the reduction of the built area to 36%. The smaller building size is not an ideal solution for real estate developer, to whom every square metre of building area counts towards the revenue. Scheme A contains the same amount of built area (64%) and open space (36%) as Scheme B, however, with a twist in the plan, its configuration is far superior in land use than both Scheme B and C. Because the open space is centrally focused than scattered, it is more efficient and usable than the side yard arrangements. By enclosing the courtyard, the building area is also maximized. To put in Chinese terms, the courtyard typology is an ideal configuration for “one action, two gains”² (*yiju-liangde* 一举两得), where it allows for the most efficient and maximum land use, but at the same time, providing a decent and pleasant garden space within.

The courtyard house in Beijing is a good example of the close relationship between man and nature, providing an earthly paradise in the centre of family life, a more sustainable lifestyle, and an identity unique to the city of Beijing. To the Chinese, this dwelling type is one of the most successful and easily achievable architectural means to mediate between open and closed, inside and outside, social constraints and environmental requirements, and between nature and culture. Because of the particular culture in China, the ancient masters cherished the good the past has bequeathed and passed it on to future generations in an unadulterated form. Even though the differences were subtle, the courtyard typology was under constant adaptation and renewal based on the needs, demands and unique situations particular to each era. It is thus of particular interest to see what we – from the architect’s viewpoint – can learn today from the “elderly” vernacular typology that is special to the identity of Beijing. Maybe it is prudent to consult and “heed the advice” now before investing heavily on new and foreign approaches to increase density, improve quality of life and achieve sustainability, which are often ignorant of the local conditions. Of course, it is not to say that people should revert back to the way of living and building centuries ago. However, as architects, we should learn and extract the good aspects from the existing structure, modify and adapt base on the changing needs and expectations, and integrate current innovations to create something of now. So the past is not merely a frozen image but is representative of ongoing historical processes that remain incomplete. This approach privileges neither past nor present, but recognizes that both must be considered for the future of the built environment.³

² “One action, two gains”, *yiju-liangde* 一举两得, is a famous Chinese proverb meaning to solve two problems with one single action or to gain two advantages by a single move. The phrase implies that the action performed is very efficient.

³ Brian Edward, Magda Sibley, Mohamad Hakmi, and Peter Land, ed., *Courtyard Housing: Past, Present & Future* (Oxon; New York: Taylor & Francis, 2006), 185.

2.1 On History: courtyard in transformation

6000 BC

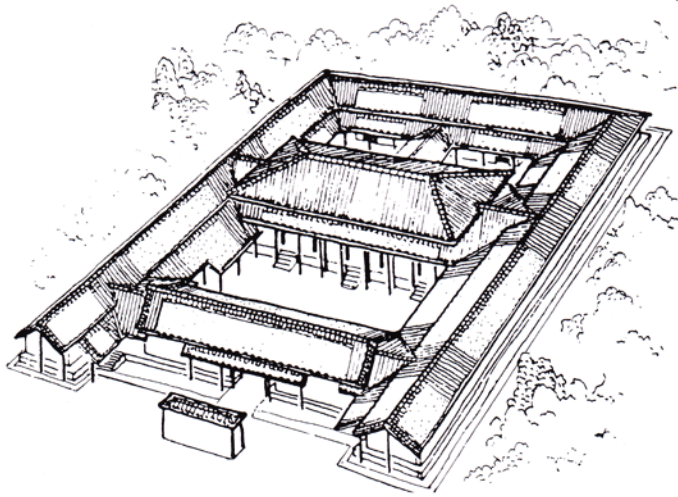
Three Sovereigns and Five Emperors
2500 BC - 2100 BC

Xia
2100 BC - 1600 BC

Due to its simple spatial ingenuity and environmental adaptability, the courtyard house has endured as one of the most widespread architectural forms, transcending regional, historical, and cultural boundaries. Prehistoric examples have been documented at archaeological sites around the world in Anatolia, Syria, and Mesopotamia from as early as 6000 B.C.¹ This particular dwelling form also has a quite long history and has appeared in many different regions in China – a roughly three-thousand-year-old built form embodied the rich history and bright regional culture of the traditional Chinese identity. In the beginning, the logic behind the courtyard plan was mainly to provide a protective area from the harsh and dangerous outside forces. Over time, it has developed into a solid, logical configuration that maximizes the built-up area in the urban context and allows controlled sunlight and ventilation.

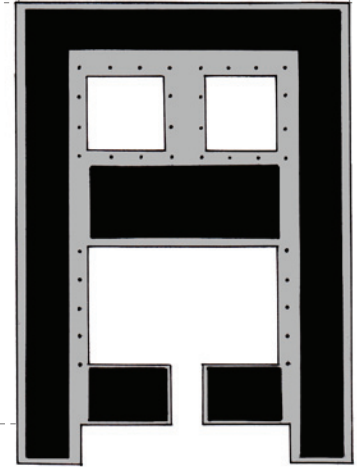
Courtyard house, as the name suggests, is a complex containing rooms in the east, west, south and north as the basic units that frame the courtyard in the centre. It can develop in depth and on both sides, suitable for families of different sizes and adaptable to the designs of palaces, temples, government offices, and so on.

¹ James Mellaart, “Earliest Settlements in Western Asia from the Ninth to the End of the Fifth Millennium B.C.,” and “Anatolia before 4000 B.C.” in vol. 1 of *The Cambridge Ancient History* (Cambridge: Cambridge University Press, 1970), 248 – 326.



2.1.1 Drawing of Qishan Fengchu Village of Shanxi Province (陕西岐山凤雏村)

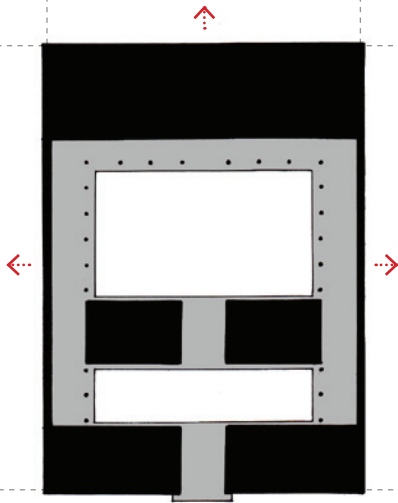
Shang
1600 BC - 1046 BC



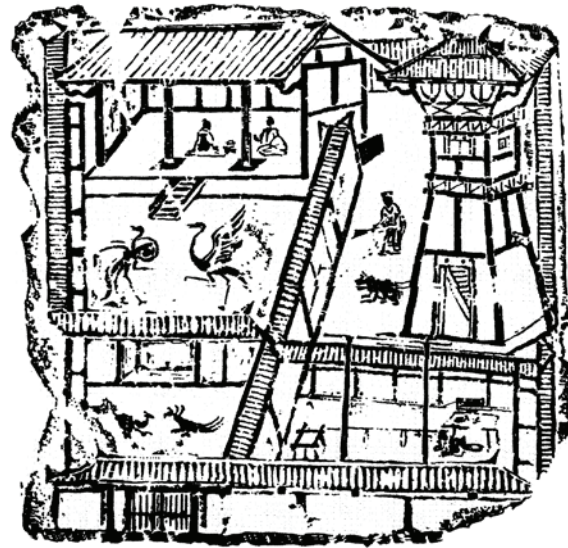
2.1.2 Typical layout during the Shang Zhou periods

Zhou 1045 BC - 256 BC **Qin** 221 BC - 206 BC

When speaking of the courtyard house in Beijing, people generally relate to the establishment of the capital city and the formation of hutongs during the Yuan Dynasty (元, 1271 – 1368). However, the history of the courtyard typology can be traced back as early as the 16th century B.C. during the Shang-Zhou Periods. On the basis of analysis of extant data about the cultural relics, there were several housing construction projects surrounding the courtyard on the old site of the royal court and palace in the ancient capital city of the Shang Dynasty (商, 16th to 11th century B.C.). The archeological site in *Qishan Fengchu Village* of Shanxi Province 陕西岐山凤雏村 (Figure 2.1.1) demonstrated the earliest courtyard construction in China discovered to-date. The complex featured a rectangular plan with entrance doorway, front yard, front hall, rear yards and rear hall aligned on the north-south axis. The front and rear halls were connected by a covered corridor, which divided the rear courtyard into two. The subordinate wings framed the outside edges of the courtyards forming *huilang* 回廊 (a cloister). As described in ancient literatures, the front courtyard and its main hall were used for social occasions and gatherings; the rear hall was the principal living quarter of the master, and the subordinate wings on the east and west were for the other family members. The distinction between the inner and outer courts was clearly defined, and the hierarchical order of the family was clearly demonstrated as well in the design.



2.1.3 Typical layout during the Han Dynasty



2.1.4 Courtyard life depicted in brick relief from the Eastern Han Dynasty

Han
206 BC - 220

Three Kingdom
220 - 280

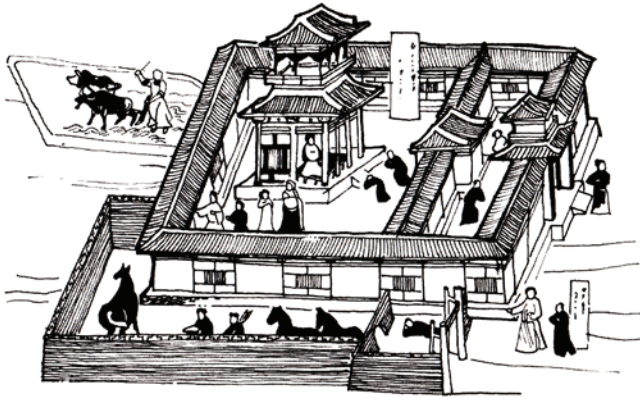
Jin
265 - 420

Southern and Northern Dynasties
420 - 589

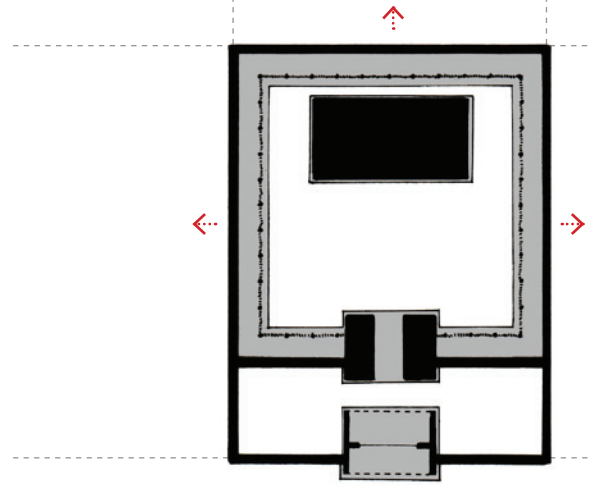
In the Han Dynasty (汉, 206 B.C. – 220), the development of such typology was wide spread. According to the size, social status and wealth of the family, expansions in all four directions were possible, which produced dwellings of various forms. However, the basic design principle continued to be house around a courtyard. Many pictorial bricks of the Eastern Han Dynasty depicted the living scenes in the courtyard houses.

The brick relief discovered in Chengdu, Sichuan demonstrated one family with multiple courtyards enclosed by building blocks and cloisters (*Figure 2.1.4*). The main entrance is off-centre to the west. The head of the house and his guest are sitting in the spacious main hall, chatting and enjoying the cranes dancing in the central courtyard. In the separate court, a person is doing the daily chores with a broom, and a dog is lying nearby. To the east, a lookout tower is erected, assuming its function of safeguarding the little kingdom within. Of course, the woman in the house is living peacefully in the secluded courtyard at the southeast corner. The courtyard house is like a fortress protected from intrusion by strangers and harsh weather conditions. It balances the social interactions and the need for privacy. The whole family lives inside in harmony and happiness with a sense of safety, oblivious of the chaotic world outside the walls of the courtyard.

Because of the protection this particular configuration offers, the form was adapted widely during the turbulent periods of Wei (魏, 220 – 226), Jin (晋, 226 – 420), and Southern and Northern Dynasties (南北朝, 420 – 589). The courtyard typology continued to develop and became the primary form of residential dwelling in China since then.



2.1.5 Courtyard housing during the Tang Dynasty depicted in Dunhuang murals



2.1.6 Typical layout during the Sui Tang periods

Sui
581 - 618

Tang
618 - 907

Five Dynasties and Ten Kingdoms
907 - 960

Liao
907 - 1125

Jin
1115 - 1234

Depicted in drawings, paintings, ceramics, murals, fabric arts, and many other forms of artifacts, the information was sumptuous and rich in the Sui (隋, 581 – 618) and Tang Dynasty (唐, 618 – 907), periods of great progress and stability.

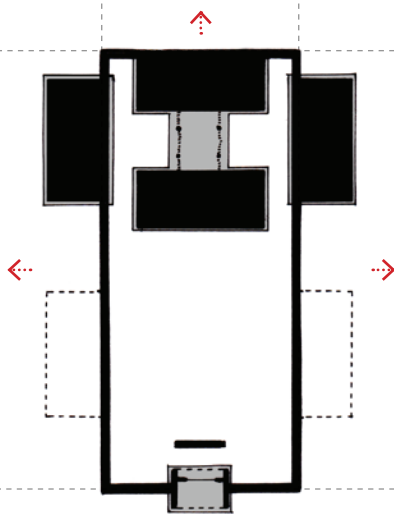
Tang architecture further developed the models from the preceding dynasties and set examples for the eras to come. The layout consisted of a narrow front court and a spacious squared rear court (Figure 2.1.5). Cloisters remained a favourable configuration by the ancient masters. However, instead of the open colonnades found in earlier residences, the Tang builders closed the cloister with *zhilingshuang* 直棂窗 (vertical mullioned window frames) to form interior corridors surrounding the courtyard.



2.1.7 Vertical mullion window in Imai cho, Nara, Japan.



2.1.8 Vertical mullion details and cloisters in Meiji Jingu, Tokyo, Japan. Due to the influences from the Tang Dynasty, many Tang architectural details can be found in traditional Japanese buildings.

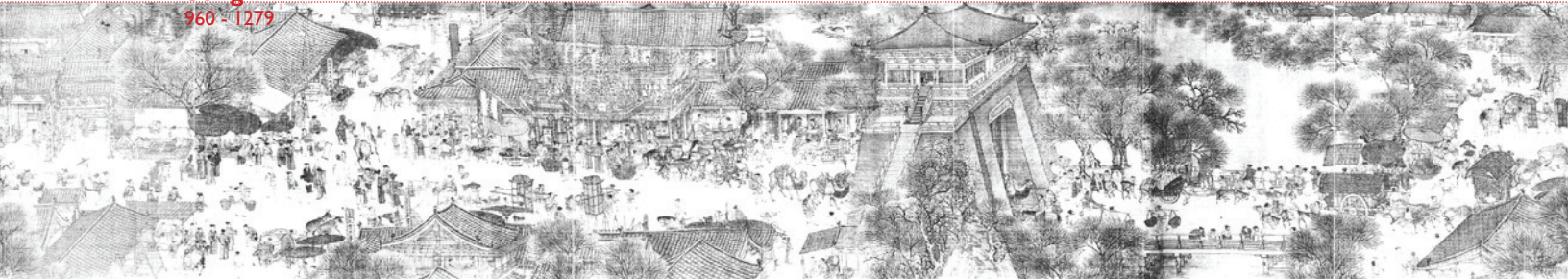


2.1.9 Typical layout during the Song Yuan periods



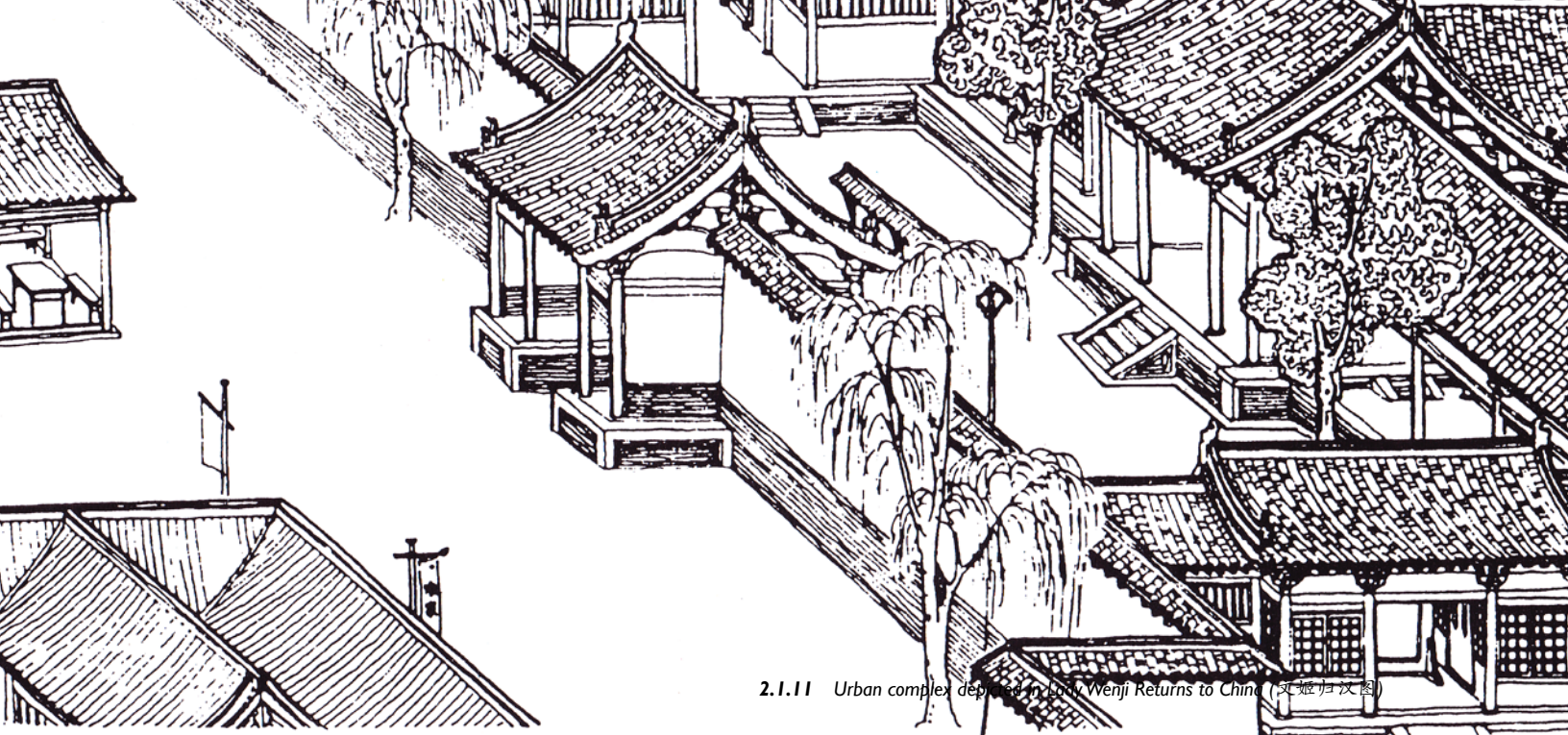
2.1.10 Rural courtyards depicted in *A Thousand Li of Rivers and Mountains* 千里江山图 by Wang Ximeng 王希孟, Song Dynasty

Song
960 - 1279



Many famous painting scrolls of the Song Dynasty (宋, 960 – 1279) also documented the different types of courtyard houses in greater detail. There were the smaller rural configurations in *A Thousand Li of Rivers and Mountains* 千里江山图 by Wang Ximeng 王希孟 (Figure 2.1.10); as well as the larger urban complexes depicted in *Along the River During the Qingming Festival* 清明上河图 by Zhang Zeduan 张择端 (Figure 2.1.12) and in *Lady Wenji Returns to China* 文姬归汉图 (Figure 2.1.11). Regardless of either rural or urban settings, the courtyard houses were configured in similar fashions – a “gong 工” shaped plan, where the main building is connected with the rear building by a single corridor.

To better utilize land area and increase habitable space, *langyu* 廊庑 (veranda in front of the building block) slowly replaced the *huilang* 回廊 (cloisters). A screen wall was placed immediately after entering the front gate. Other changes affected only details. For instance, the protective robust mullion windows since the turbulent warring period of the Three Kingdoms were transformed into a more decorative element. The window featured operable latticework in the upper half and solid panels below, offering excellent shading and ventilation benefits. Protection against the environment was thus emphasized more than the protection against human destruction.



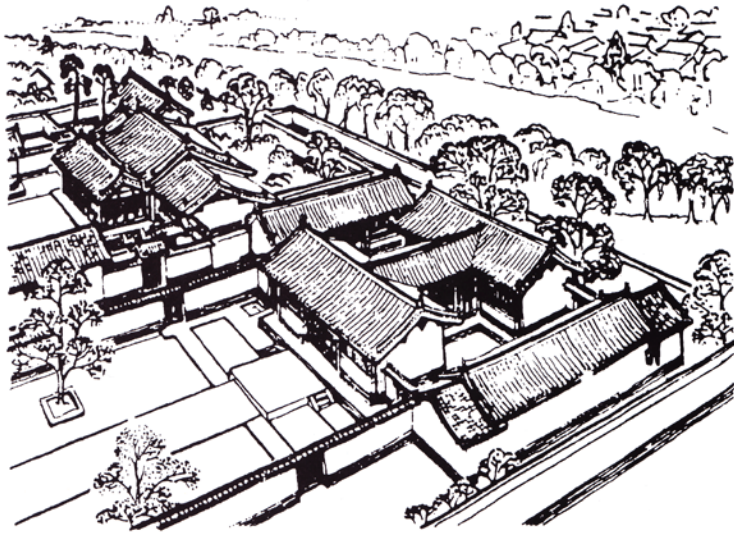
2.1.11 Urban complex depicted in *Li Wenji Returns to China* (文姬归汉图)



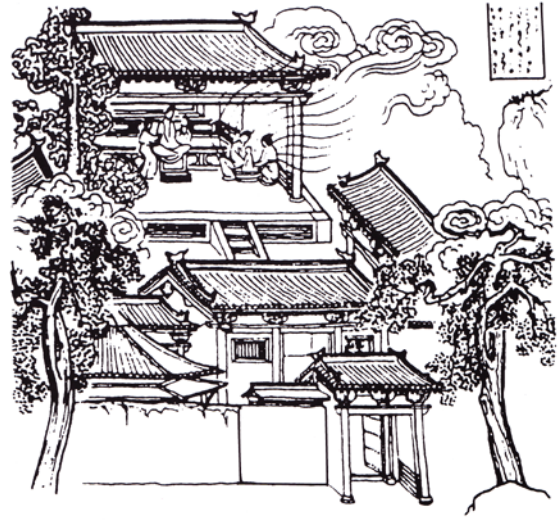
2.1.12 Zhang Zeduan 张择端, *Along the River During the Qingming Festival* 清明上河图, Song Dynasty

Aside from the art pieces, the famous and the oldest existing technical manual on Chinese architecture, *Yingzao Fashi*² 营造法式 (*Treatise on Architectural Methods* written in the 12th century) by Song architect Li Jie 李诫, also documented the detailed constructions and craftsmanship of the traditional typology. From the myriad historical relics, it is evident that the formation and development of courtyard house has a long and vivid history in China.

² The book is published during the Song Dynasty in 1103 to provide a unified set of architectural standards for builders, architects, and literate craftsmen, as well as for the engineering agencies of the central government. Some of the materials are from pre-existing architectural writings, but most of the documentations are the inherited traditions of craftsmen and architects passed down by the word of mouth.



2.1.13 Drawing of Houyingfang residential site 后英房元代住宅遗址 in Yuan Dadu



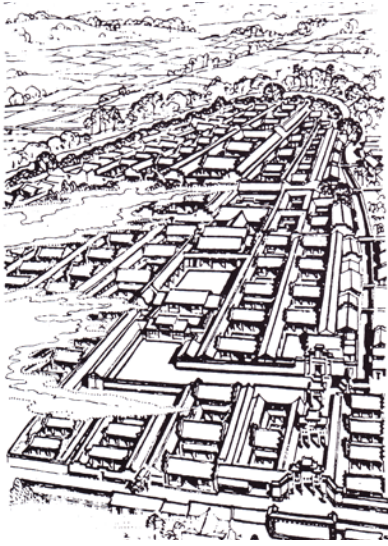
2.1.14 Courtyard life depicted in Yuan mural discovered in Shanxi

Yuan 1271 - 1368

The particular courtyard typology in Beijing that we see today took form in the Yuan Dynasty (元, 1271 – 1368) when Kublai Khan established the capital in Beijing, known as *Dadu* 大都 at the time. Since Beijing was formally founded as the capital, the city underwent massive urban construction and transformation. Planning rules were set, and the city was laid out based on cosmological principles. The palaces, residential courtyards, streets and alleyways were all built simultaneously. In 1276, the first emperor of Yuan, Kublai Khan, summoned the nomadic residents from the old Mongol cities to settle in the new capital Dadu permanently. From then on, the Mongols gave up the temporary Mongolian yurts and assimilated many aspects of the Han Culture. Courtyard typology from the Song Dynasty was the chosen form of residential architecture. In Kublai Khan's planning laws, eight *mu*³ (approximately 5333.36 m²) of land were allocated to every wealthy nobles and government officials. Adhering to the rules, the people started to build and settled in their permanent courtyards, ending the nomadic era. The pedestrian networks of narrow alleyways were laid out in between courtyard complexes, and were later known as hutongs.

Unfortunately, there are no surviving examples of courtyards from the Yuan Dynasty in Beijing nowadays. The only reference remaining is the archeological remains of *Houyingfang* residential site 后英房元代住宅遗址 (Figure 2.1.13) in Yuan Dadu. The remains reflected a layout, scale and style very similar to that of the previous eras. Instead of introducing a whole new typology that is Mongolian in nature, the Yuan architects adapted the existing “*gong* 工” shaped plan and form of the courtyards from the Song Dynasty, continuing the thousands-year-old tradition. Even many construction details were very similar to the methods documented in the Song architectural treatise, *Yingzao Fashi* 营造法式 (*Treatise on Architectural Methods*).

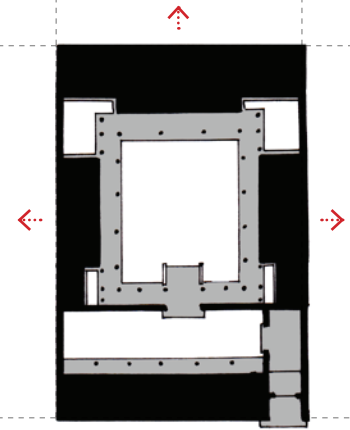
³ *Mu* 亩, is a Chinese unit of measurement. 1 *mu* = 1/15 hectare = 666.67 m², 15 *mu* = 1 hectare = 10 000 m².



2.1.15 The Ming city layout



2.1.16 Courtyard life depicted in wood carving from the Ming Dynasty



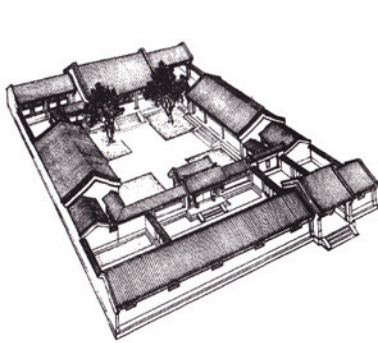
2.1.17 Typical layout during the Ming Qing periods

Ming 1368 - 1644

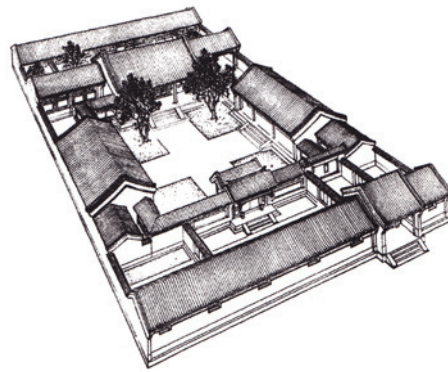
Moving on to the Ming Dynasty (明, 1368 – 1644), a time of orderly government and social prosperity, the stable society facilitated the rapid growth and economic boom, as well as the development in urban planning and architecture. To maintain the order of the feudal society, design rules were set for different types of architecture. Elements such as scale, style, form, colour and symbols were strictly controlled and designed distinctly for different social classes. As a result, an orderly and unique city fabric was achieved. Because the capital city of the Ming Dynasty was initially established in Nanjing, many southern influences were brought into the design of the courtyard houses when Yongle (明成祖 永乐), the third emperor of the Ming Dynasty relocated the capital north to Beijing. Elements in the classical gardens of Suzhou (苏州园林建筑) were integrated into the new courtyard constructions, such as ponds, connecting verandas, viewing windows and many decorative features. The courtyard of some wealthy noblemen also contained a garden of its own, resembling closely to the gardens of the *Jiangnan*⁴ regions. Of course, because of the harsher northern climate in Beijing, the southern elements were altered to better adapt to the new environmental conditions such as the different wind direction, amount of precipitation, temperature and solar exposure. Features like the size of the courtyard space, the slope and height of the roof, the amount of overhangs, the connection between buildings by means of verandas, and even the choices of vegetation were reconsidered in the design of the courtyards in Beijing. A new and unique typology was thus born.

Though well preserved functional Ming courtyards are rarely seen in present day Beijing, many famous Ming literatures such as *Sancai Tubui* 三才图会 (*Illustrations of the Three Powers*) and *Luban Jing* 鲁班经 (*The Treatise of Lu Ban*) document them well. From the illustrations, remnants of Yuan can be seen in the layout and design of the Ming courtyards.

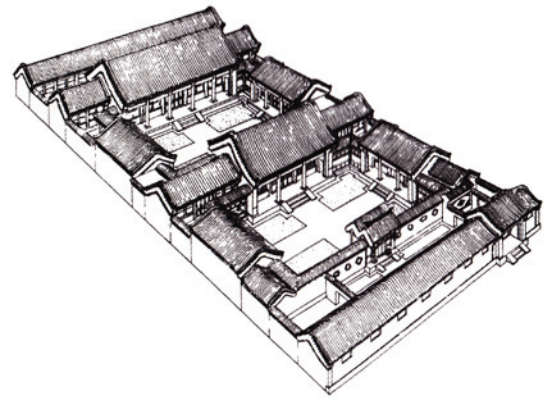
⁴ *Jiangnan* 江南, geographic area in China referring to lands immediately to the south of the Yangtze River (长江).



2.1.18 Typical two-court configuration



2.1.19 Typical three-court configuration

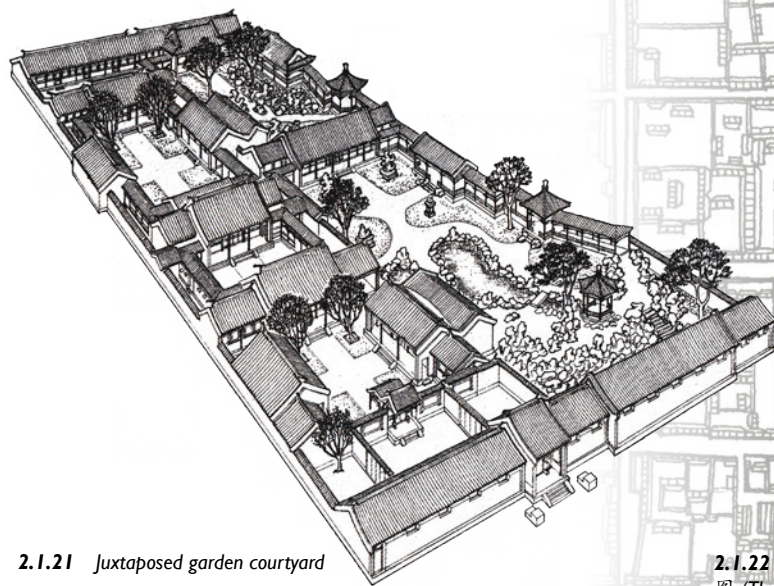


2.1.20 Typical four-court configuration

Qing 1644 - 1911

When Manchurians established the Qing Dynasty (清) in 1644, they assimilated the Han Culture just like the Mongols during the Yuan Dynasty. Instead of wiping out the Ming city, the Manchu people inherited and developed on the existing plan of Beijing, as well as the courtyard typology. The adaptations in style, layout, scale and structure fully embodied the features of the previous era. The courtyard complex contained living and dining area, master room, servant room, storage and so on. The complex also did not limit itself to a single court. Based on the wealth and social ranking, the courtyards can expand horizontally in depth or on both sides, containing two, three or more courts to emphasize the owner's power and status.

Seemingly unchanged, the Ming Qing courtyards were quite different from their Yuan predecessor. The major differences were presented in the changes of the court layout, the disappearance of the “*gong 工*” shaped plan, and the reduction of site area. In *Houyingfang* archeological remains 后英房元代住宅遗址 of the Yuan Dynasty, the front (outer, public) courtyard was bigger than the rear (inner, private) courtyard; whereas in Ming Qing courtyards, the front court shrank in size and was long and narrow in shape. The rear courtyard, on the other hand, increased in area, which provided a better and more efficient space for daily family routines. The “*gong 工*” shaped layout formed from connecting the front and rear hall with a single covered corridor was replaced by rooms in the east, west, south and north linked by veranda around the courtyard. The new configuration utilized the court space more efficiently and allowed a better daylight and ventilation control. Furthermore, the Ming and Qing Dynasties were known as periods of great order, stability and prosperity, thus the city observed drastic population growth over time. According to historical records, there were only 48 000 people living in Beijing



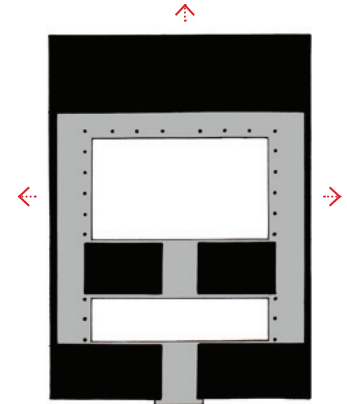
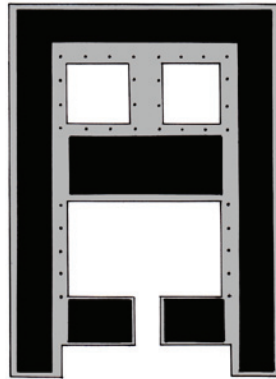
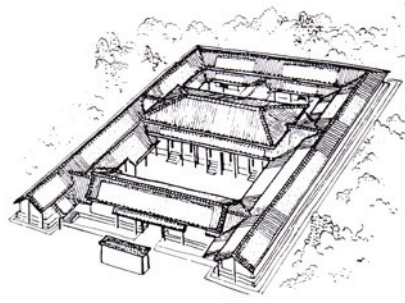
2.1.21 Juxtaposed garden courtyard



2.1.22 Courtyards and hutongs depicted in *Qianlong Qudiku* 乾隆京城全图 (The Complete Map of Peking, 1750)

in 1369, one year after the founding of the Ming Dynasty. By 1375, the population increased to 323 000. The rate of growth was even faster after the Ming Emperor Yongle (明成祖 永乐) moved the capital from Nanjing to Beijing in 1420. By the end of the Qing Dynasty in 1911, there were more than one million people residing in Beijing. The land was tight, and the original eight *mu* (approximately 5333.36 m²) per household of land distribution in Yuan Dadu was no longer feasible in the growing centre. As a result, the site area shrank greatly during the Ming Qing periods. The smaller courtyards occupied only one *mu* (666.67 m²) of land. Half *mu* (333.33 m²) complexes were also typical. Even the big ones were no larger than three to five *mu* (2000 m² to 3333.33 m²) in size, with exceptions of the residences of a few princes and government officials.

The social, political, economic and cultural conditions were vastly different in every shifting dynasty. Such changing conditions were evident in the layout, style, form and materiality of the courtyard design. The development reached its climax in the Qing Dynasty as the construction, craftsmanship and passive strategies reached maturity. Many Qing courtyards are still in use today, and they are the important makeup of the historic fabric in the old cultural centre of Beijing. Therefore, the following section mainly focuses on design details of the courtyard house from the Qing Dynasty, digesting the design elements and related sustainable features, as it is one of the most representative examples of traditional Chinese dwellings that fully embodied the essences of the knowledge and building experience of our ancestors.



2.1.23
Summary of courtyard house transformation over time.

Shang / Zhou

Han

SCALE

Larger Lot

PURPOSE

Protection against invasion, robbery and human destruction

ELEMENTS

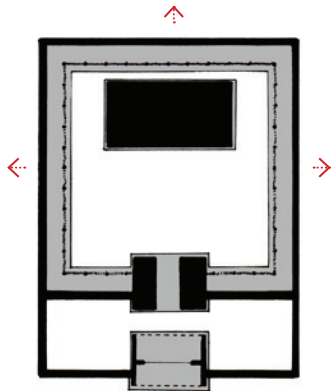
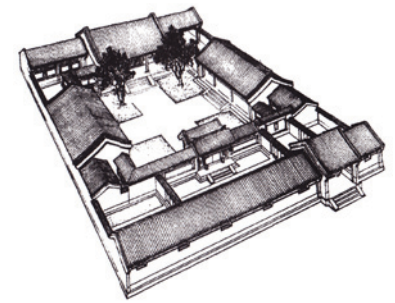
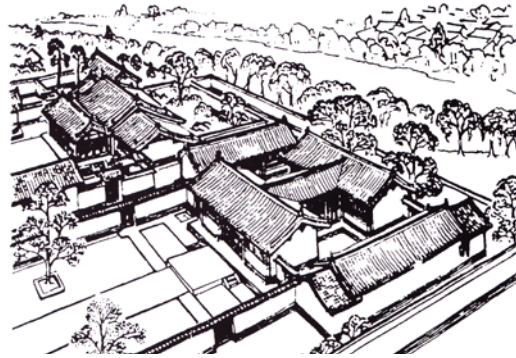
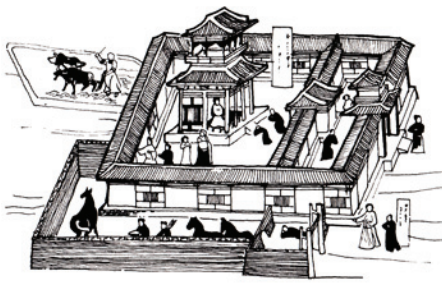
Protective

FEATURES / MAJOR CHANGES

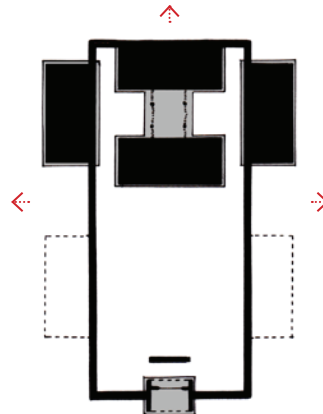
- Cloister frames the central court.
- Open corridor connecting main hall and rear building.
- Mullioned windows with fixed robust bars.



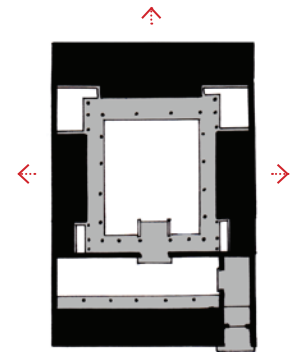
- Open cloister frames the central courtyard.
- Fortified manor houses.
- Open corridor connecting main hall and rear building.
- Introduced watch tower for safeguarding the property.
- Design principles based on Feng Shui.



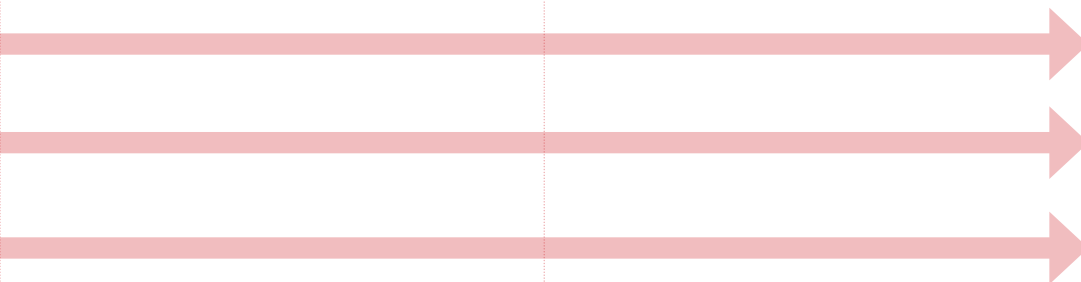
Sui / Tang



Song / Yuan



Ming / Qing



Smaller Lot

Protection against the natural environment

Decorative

- Closed cloister surrounding courtyard and main building.
- Closed corridor connecting main hall and rear building.
- Narrow front court; large squared rear court
- Vertical mullion window frames with corridor behind.

- Veranda / portico replaced cloister to increase habitable area.
- Corridor or galleria connecting main hall and rear building.
- Large front court; narrower rear court.
- Introduced more decorative and operable window and door elements - latticework in upper half and solid panels below.

- Cloister style disappeared. Veranda / portico is place in front of building blocks.
- Buildings on four sides framing the courtyard.
- Narrow front court, bigger rear court.
- More usable spaces.



2.2.1 Courtyard complex of Prince Zheng

2.2 On Essence: the lessons from ancestors

“The aspects of things that are most important for us are hidden because of their simplicity and familiarity.”¹

- Ludwig Wittgenstein

Our ancestors probably lived a more sustainable life than us the modern generations; sustainable not only in term of the environment, but on a more holistic level as the courtyard house also addressed the different social, cultural and economic conditions in each era. One could say that there are several essential features making this typology unique, which are discussed in detail on the following pages:

- Siting: design decisions based on local conditions;
- Layering: the hierarchical relationship; and
- Interlacing: aesthetics, functions and nature.

Unlike other published texts on the same subject that are comprehensive in every building detail, the aim of this thesis is not to reproduce the same technical report on the courtyard house in Beijing. Rather only the essences of the traditional typology are emphasized.

So now, let us uncover the lessons from the ancestors.

¹ Ludwig Wittgenstein, *Philosophical Investigations*, 3rd ed., trans. G.E.M. Anscombe (New York: Basil Blackwell & Mott, Ltd., 1958), 50e, section 129.

Siting: design decisions based on the local conditions The traditional builders were keen on how light is received, how wind moves and how water flows. Great considerations of the geographical and climatic conditions resulted in the particular building orientation, window pattern, roof shape, tile layout and so on. In current terms, these are effective passive design strategies that minimize energy loads and demands before the introduction of any active system. The minimal reliance on extensive active systems, thus, puts less stress on the environment.

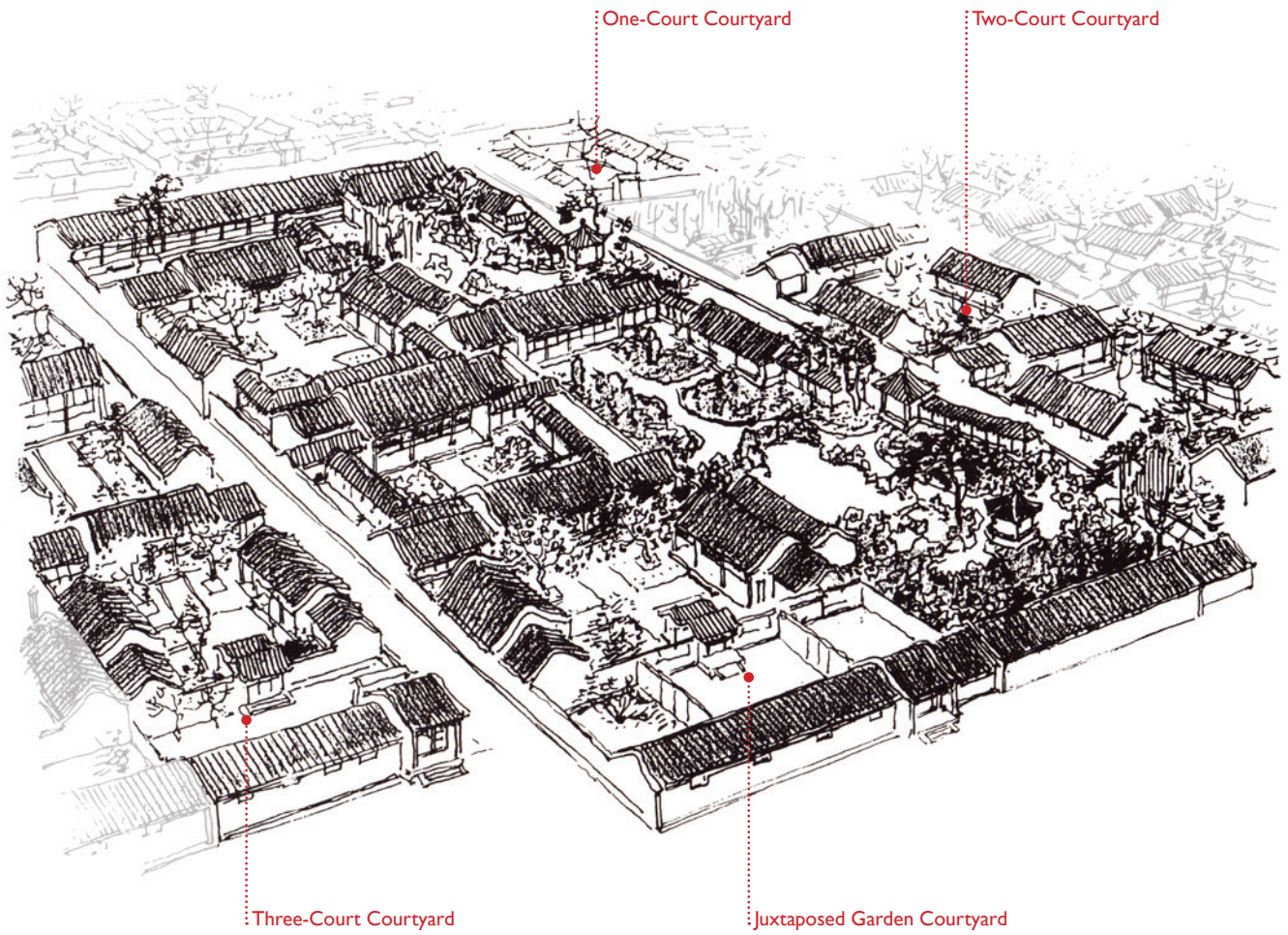
Beijing is situated at the northern tip of the North China Plain, which opens to the south and east of the city. Mountains to the north, northwest and west shield the city from the encroaching desert steppes and feature a sloping terrain down to the southeast region. It has a rather dry, monsoon-influenced humid continental climate with four distinct seasons. Winter is generally cold, windy and dry with prevailing winds from the northwest. Summer is hot and humid with heavy rainfalls and prevailing winds from the southeast. Spring can bear witness to sandstorms blowing in from the Mongolian steppe. Only autumn is pleasant with little rain and crispy air, but short in duration. There is a great disparity between the winter and summer temperature with ranges exceeding 60 degree Celsius. Precipitation averages around 570 mm annually, with the majority of it falling in the summer months. Thus the climatic design priorities are shading and using natural ventilation for summer cooling, and keeping the heat in and cold temperature out during the winter.



Due to the special characteristics of the local climate, hutongs are usually laid along the east-west axis, which are perpendicular to the direction of the prevailing winds. The continuous wall of the adjoining houses then provides an important barrier against the intrusion of the harsh winter wind. A study has shown that when a 5 m/s northwest wind is blowing outside a wall of 2 m tall, the wind speed within most part of the courtyard is less than 1 m/s at the 1.5 m level, which will cause no disturbance on daily living. Thus, this typology creates a very efficient and effective wind barrier.

Furthermore, *zuobei-chaonan* 坐北朝南, “sitting north and facing south” has come to be obligatory for Chinese dwellings in order to obtain the best advantages of the regular path of the sun across the sky and the direction of the prevailing winds. This phrase simply recommends the builders to place the principal building on the north side, so that its south-facing front receives the most sunlight; whereas buildings that receive the least sunlight are usually service or storage spaces. Therefore, complexes placed on the north side of the east-west running hutongs are the most ideal for orientation and logical organization of each building element. However, due to the different sizes of courtyards and direction of the hutongs, it is impossible to always build on the north side. As a result, modifications are made to the layout of courtyards on the south, east and west side of the street in order to obtain the design principle of “sitting north and facing south” (Figure 2.2.3). Not sticking to any strict rules, such modifications are flexible and are based purely on the specific location and site conditions.





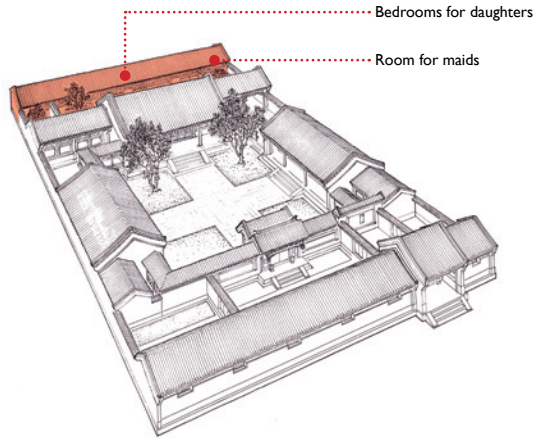
2.2.4 Courtyard types within the neighbourhood

Layering: the hierarchical relationship Unlike many courtyard typologies around the world, the traditional courtyard in Beijing is not simply a rectangular building with a hollow court in the middle. It is a complex containing rooms in the east, west, south and north that frame the courtyard in the centre, forming a unitary place of seclusion. The built objects and the courts are never treated individually within the complex, but are viewed as a whole and are treated such that they are interrelated in a particular manner. It can develop in depth and on both sides, suitable for families of different sizes and adaptable to the designs of palaces, temples, government offices, and so on. The sizes of courtyard house vary greatly depending on the wealth, size and the taste of the family, and there are myriads of different built examples. However, the basic principle remains the same – the architecture is not any individual building but a group of buildings encircled by a wall, framing an inner courtyard or a series of courtyards.

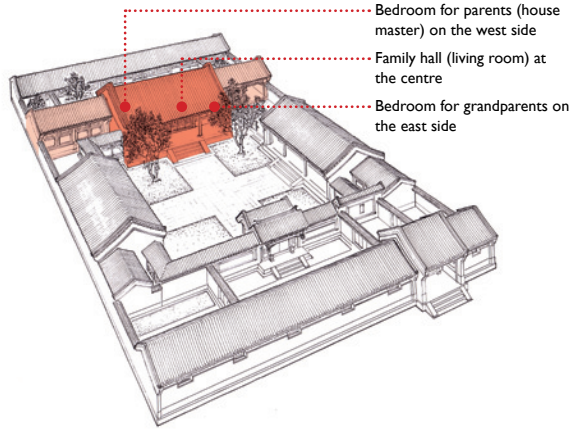
Because the traditional courtyard house is always viewed as a collective entity consisting of a series of buildings and open spaces, a unique spatial relationship is achieved through the play between scale, depth, height and form. Rooted in the culture, the Chinese love to create a modest and implicit environment that provides rich sensual and spatial experiences. The built environment is never expressed in a simple and straightforward fashion. Buildings are juxtaposed. Height is carefully manipulated. The viewer cannot take everything in one glance, but has to venture deeper to get the full taste of the space. The scene changes with every movement, one can always discover something different and new due to the collective nature and the special interplay between objects. On a larger urban scale, the subtle differences of the rooflines weaved the unique cityscape that gave Beijing its identity.

Hutong /
Back Street

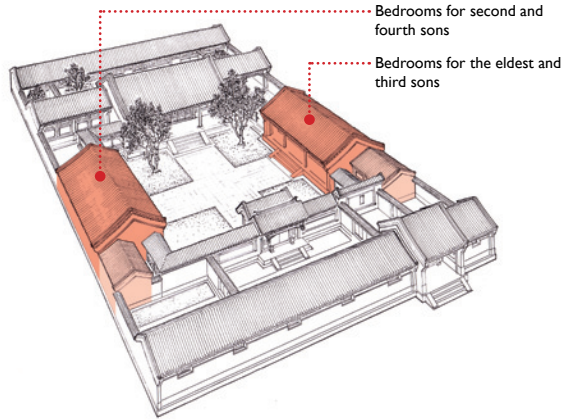
Backside Building
houzhaofang, 后罩房



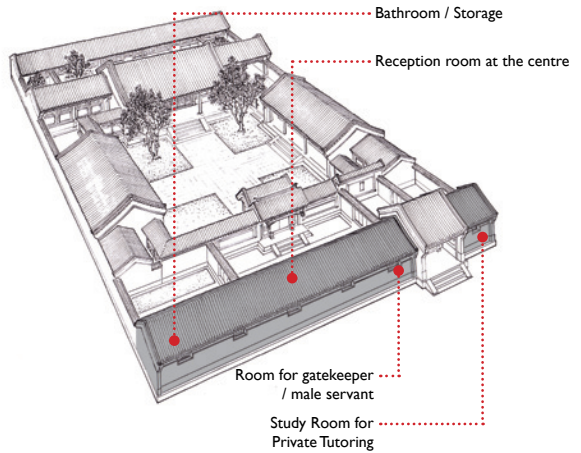
Main House and its Subordinates
zhengfang, 正房 + *erfang*, 正耳房



Wing Houses and its Subordinates
xiangfang, 厢房 + *erfang*, 厢耳房



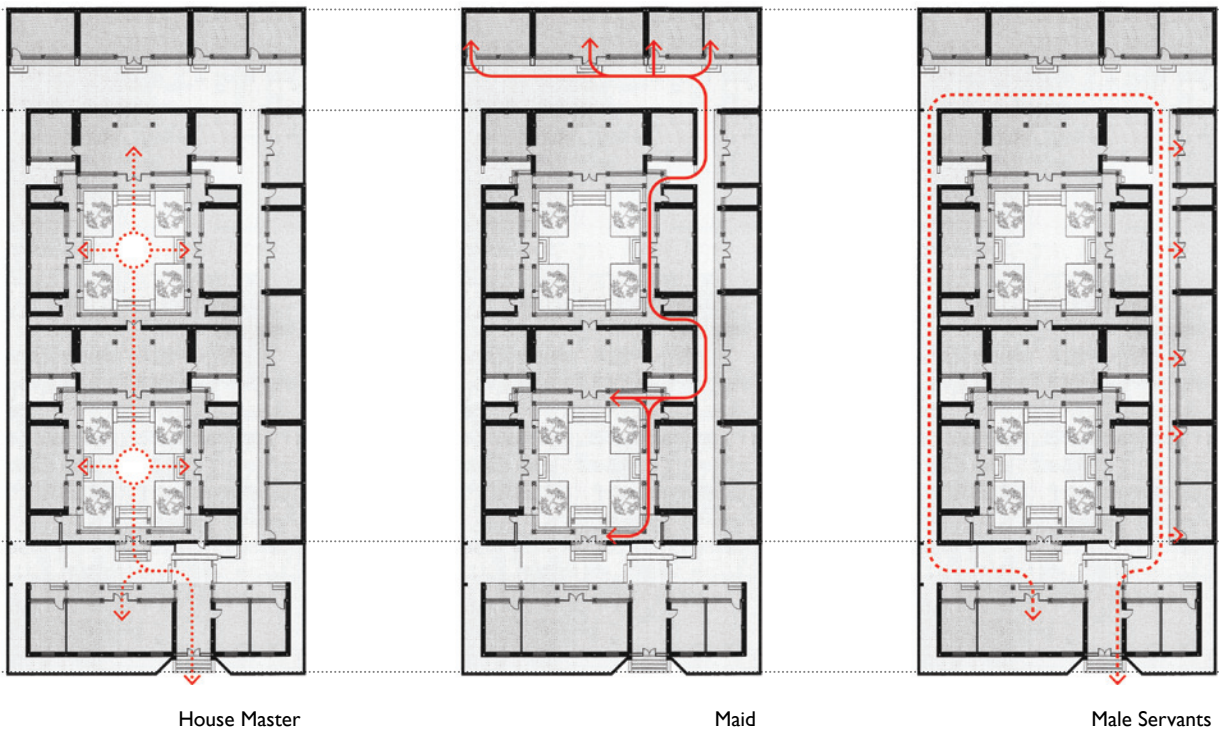
Opposite House
daozuofang, 倒座房



Hutong /
Front Street

Social Hierarchy

The scale, depth, height and form of each building are different based on its environmental and social importance. Because of such differences, each building is able to enjoy the sunlight free of obstruction, maximizing solar exposure and daylighting. The hierarchy of the social pattern can be read from the structural design as well and is reflected in both plan and elevation. The building positioned to the north and facing south is *zhengfang* 正房 (the main house). Because it receives the most sunlight, the main house is the tallest and most elaborated structure within the residence, and it serves as the living room and bedroom of the head of the family. The buildings adjoining the main house and facing east and west are *xiangfang* 厢房 (the wing houses). They are traditionally for the children or less important members of the family, thus are smaller in relation to the main house. Sometimes subordinate houses are added on both sides of the main house; and when area allowed, they can also be added to the wing houses. They are generally extensions of the main building and are smaller in scale like ears attach to the head, thus getting its Chinese name *erfang* 耳房, “ear house”. The building that faces north is known as *daozuofang* 倒座房 (the opposite house). In the past, the opposite house is for the servants or as a reception room, because it receives the least sunlight. The entrance is usually positioned at the southeast corner facing a spirit wall.

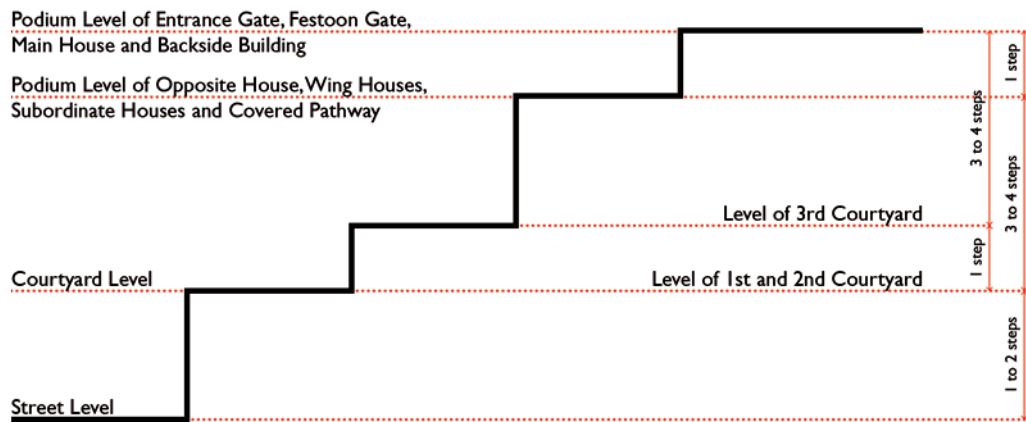


2.2.6 Access route within the courtyard complex

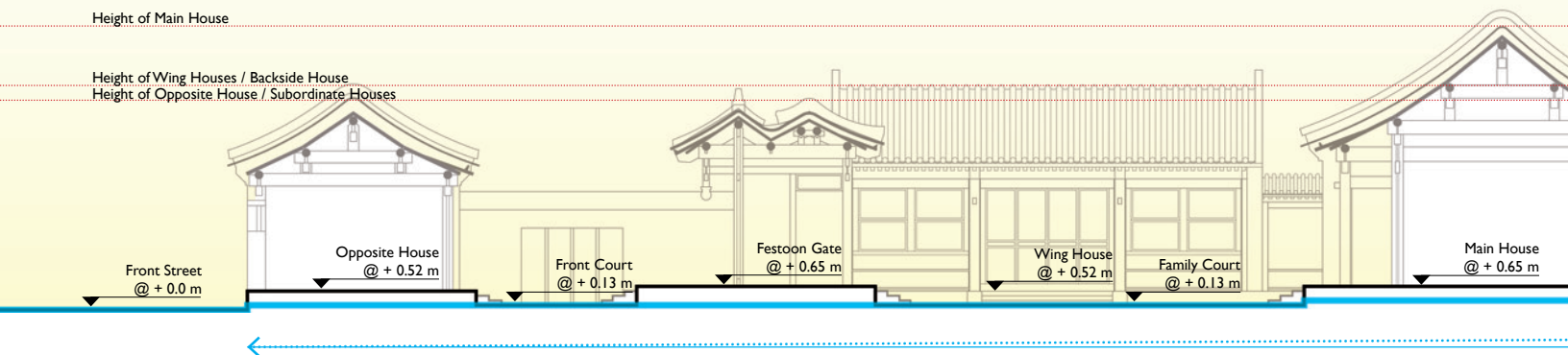
2.2.5

Composition of a typical three-court courtyard housing

Like most traditional Chinese architecture, the buildings in courtyard dwellings are built on elevated foundations or podiums, roughly 50 to 60 cm high. The podium is made up of tamped earth covered with stone slabs for protection. The main house is always placed on the highest platform with other elements step down respectively. In smaller dwellings with one or two courts, the main house, entrance gate and festoon gate are constructed on the same level. The remaining built elements are placed lower, usually by one step, 13 cm to 15 cm. This difference in ground level creates an order within the complex, placing more emphasis on the main house and the thresholds.



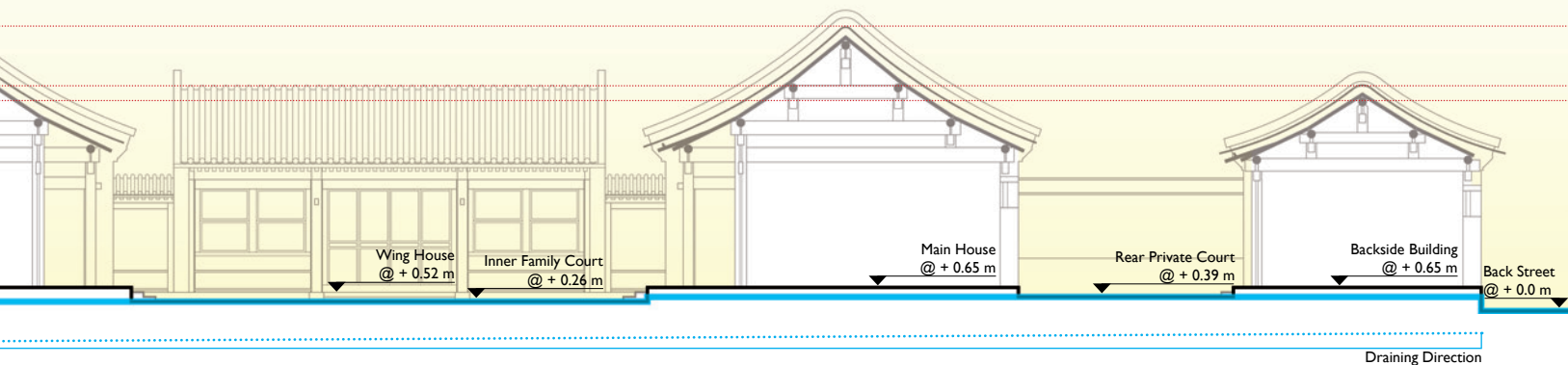
2.2.7 Level change illustration



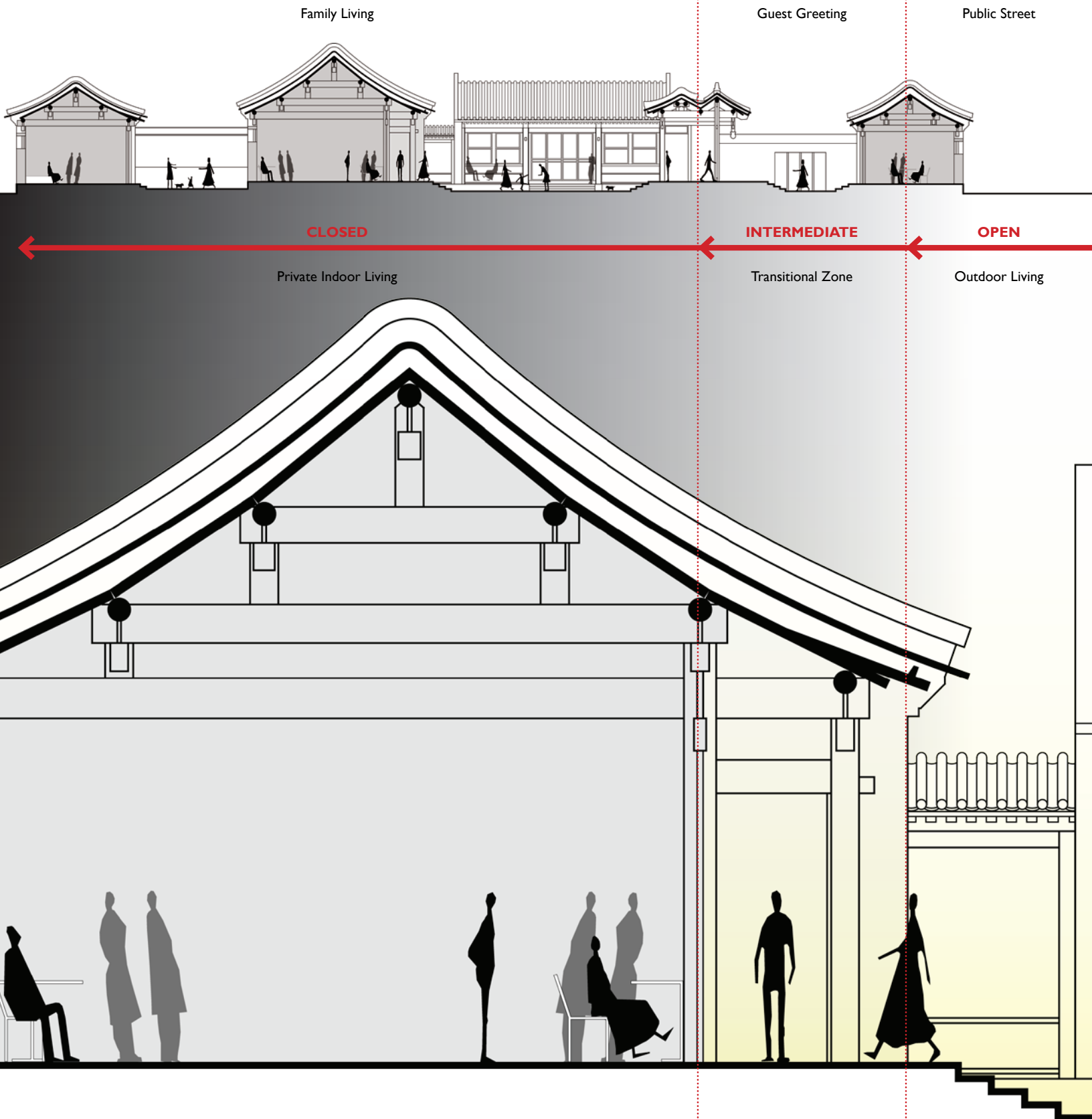
2.2.8 Hierarchical relationship between building elements as well as its contribution to drainage direction

The function of the podium is not only to create the hierarchical emphasis in the dwelling, an often overlooked but very important function deals with moisture and water drainage. Traditional Chinese architecture is known for its wooden structure. Wood is a versatile material, however, it is weak against water damages. Through capillary actions, the moisture can easily travel in the columns and walls, and consequently weaken the structure due to rotting. In an effort to reduce the absorption of soil moisture by the walls, the builders raised the houses on podiums. Coupled with troughs and sometimes underground conduits to drain water, the podiums provide a dry foundation for the courtyard buildings. This stone base is sometimes extended beyond the wall line but kept within the roof line to further mitigate the flow of water from the roof, and is raised above the ground level to protect the lower wall from water damages, as splashing of water that flowed from the roof or from driving rain would otherwise, over time, substantially wear away the vulnerable wooden structure. Because the roof overhangs are usually extensive, the extension of the podium is wide enough to form a veranda space. Seating and vegetation are sometimes added, further enhancing the courtyard aesthetics.

Because majority of the courtyard layouts are sitting north and facing south, rainwater must be drained away from the main house and courtyard at the north end. The water is normally directed out to the street from the southeast where the entrance gate or the least important building is located. To ensure smooth and effective drainage, the courtyard ground is always slightly sloped and roughly one to two steps higher than the street level. In complexes with several courts, the grade raises gradually as one ventures further into the more private quarters. The innermost courtyard is at the highest grade. This elevates the rear yard buildings respectively in comparison to those in the front yards.

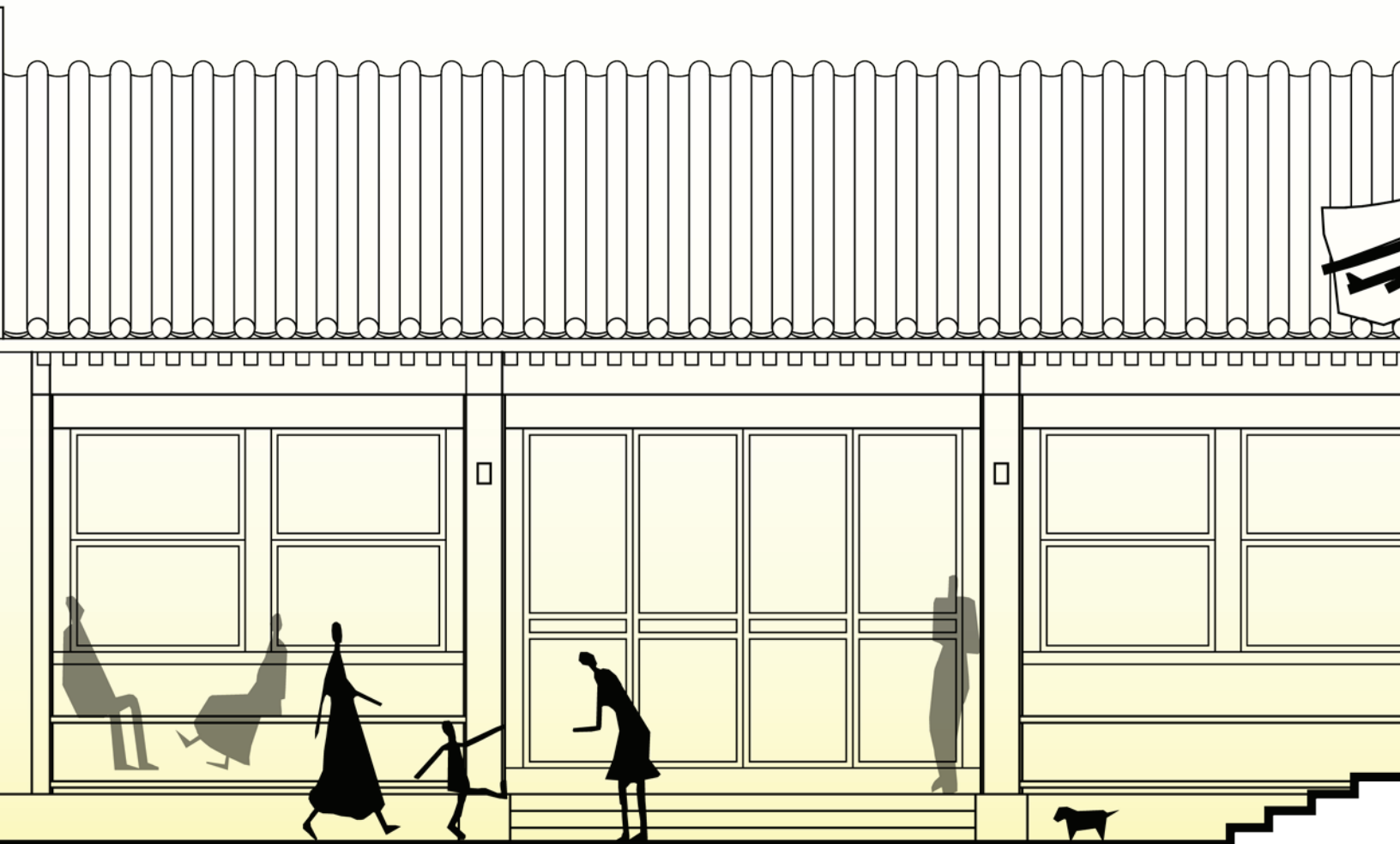


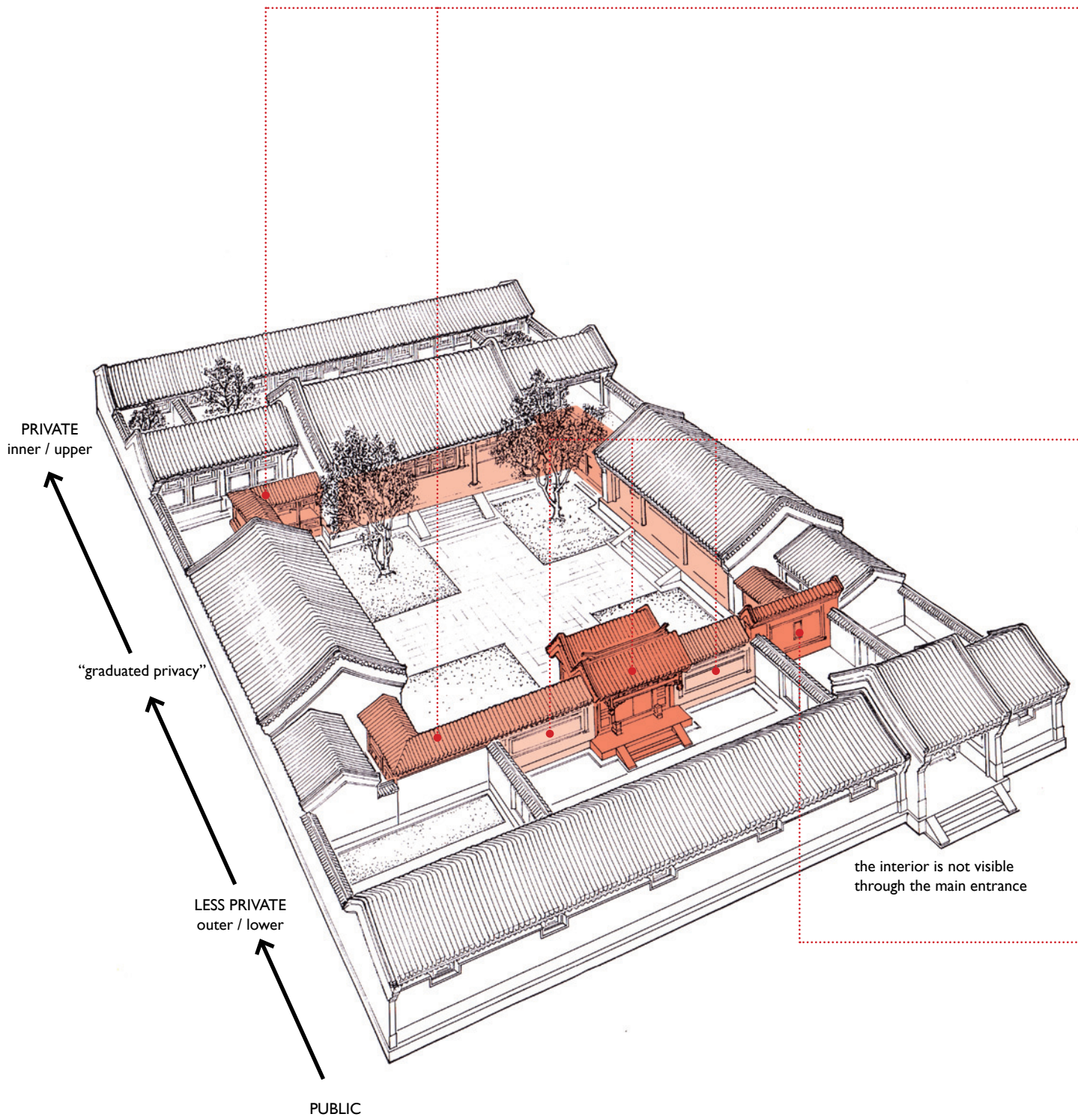
2.2.9 Hierarchical relationship between open and closed spaces



Spatial Privacy

There is a layering of indoor and outdoor spaces such that, in section, the courtyard is an extension of the interior living space. Even though activities are carried beyond the building interior, there is still a clear sense of common and private spaces. The court is the most common and accessible for family members and guests, whereas the buildings are for private use. If verandas are present, they are the transitional spaces between the interior and exterior, as well as an intermediate zone separating the public from the private. This generous space also offers great shading benefits. The principle further extends to the relationship between the compound and the hutongs. When viewed as a whole with relation to the outside streets, the courtyard serves as a buffer zone before one steps into a more private realm. This effect is multiplied by the addition of extra gates, courts, galleries and verandas in more elaborate houses – the further one ventures into the complex, the more private the quarter becomes. This hierarchy provides a rich variation of experiences in the urban space and creates a quiet and livable environment.





2.2.10
Spatial privacy is achieved through series of walls and thresholds

The Transitional Link: Covered Pathway

In a typical configuration, *chaoshou youlang* 抄手游廊 (a covered pathway) connects the festoon gate and the veranda space in front of the main house and wing houses together. It is usually 1.3 m to 1.6 m wide, and roughly 2.2 m to 2.4 m high. Seating is installed in between the columns. The lintel piece is decorative and can also hang birdcages for viewing. The covered pathway is ideal for circulation and outdoor activities during unpleasant weathers such as rain and extreme sun. It sets a permeable boundary and frames views to further enrich the sensual experience in the courtyard house.

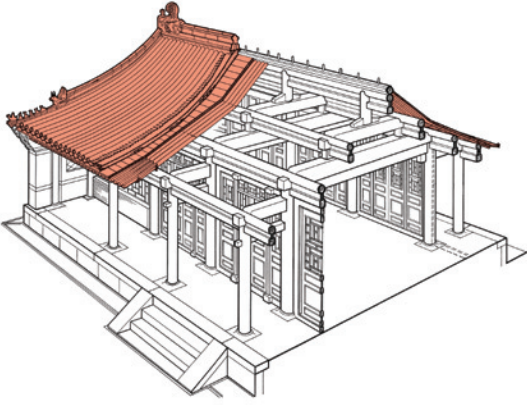
The Second Threshold: Viewing Wall and Festoon Gate

If the courtyard complex includes a forecourt separated from the main court by *kanmianqiang* 看面墙 (viewing wall), the two are linked by a strikingly large and richly decorated inner gate, called *chuihuamen* 垂花门 (festoon gate). The festoon gate is the second threshold that leads to the private family quarters, while the guests are usually kept in the forecourt. The gate is a single bay overhanging gable structure roughly 2.5 m to 3.3 m wide and with a depth slightly larger than the width. In wealthier complex, joint roof is used to achieve a greater depth. Together with the extravagant ornamentations and elevated height, the status of the occupant is greatly emphasized. Aside from the uses for separation and protection, some festoon gates are large enough to form a performing stage for entertaining guests and family members. In smaller residences, screen doors are used instead. They are smaller in size and lighter in construction, and their primary purpose is to block views and to divide spaces. These doors separate areas of different functions, so that spaces such as the entrance, living and study room, washroom and storage have their own little contained court in front.

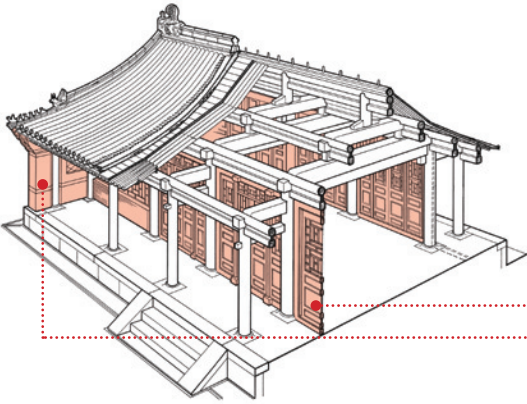
The First Threshold: Spirit Wall

In the courtyard house, the view through gateways is blocked by *yingshi* 影壁 (the spirit wall)². It is a screen sets just inside the entrance to protect the inner courtyard from public view and as a decorative element, on which auspicious stone or brick carvings as well as poems or couplets are engraved. The public and private realm is clearly defined without any physical closure. The atmosphere changes as one turns the corner beyond the wall. In the past, it also carried the function of warding off evil spirits, which can only move in straight lines; thus getting its name, “spirit wall”.

² The spirit wall is also known as the “shadow wall”, which is a direct translation from *yingshi* 影 (shadow) 壁 (wall).

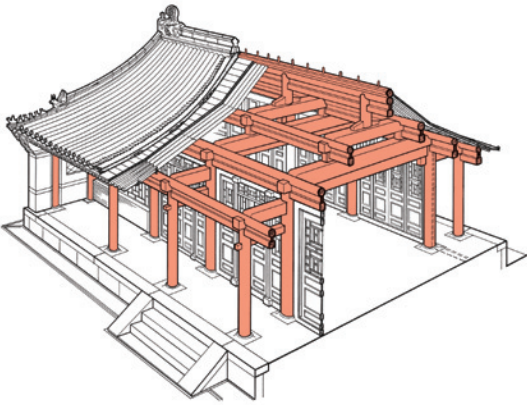


Tiled Roof

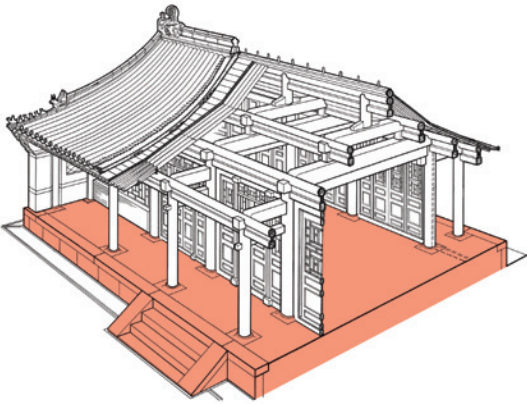


Non-Structural Enclosure

..... Infills: Wood Windows / Doors
 Shell: Brick Wall



Wooden Structural System



Elevated Stone Podium

2.2.11
 Hierarchical relationship between structural and non-structural elements

Structural Hierarchy

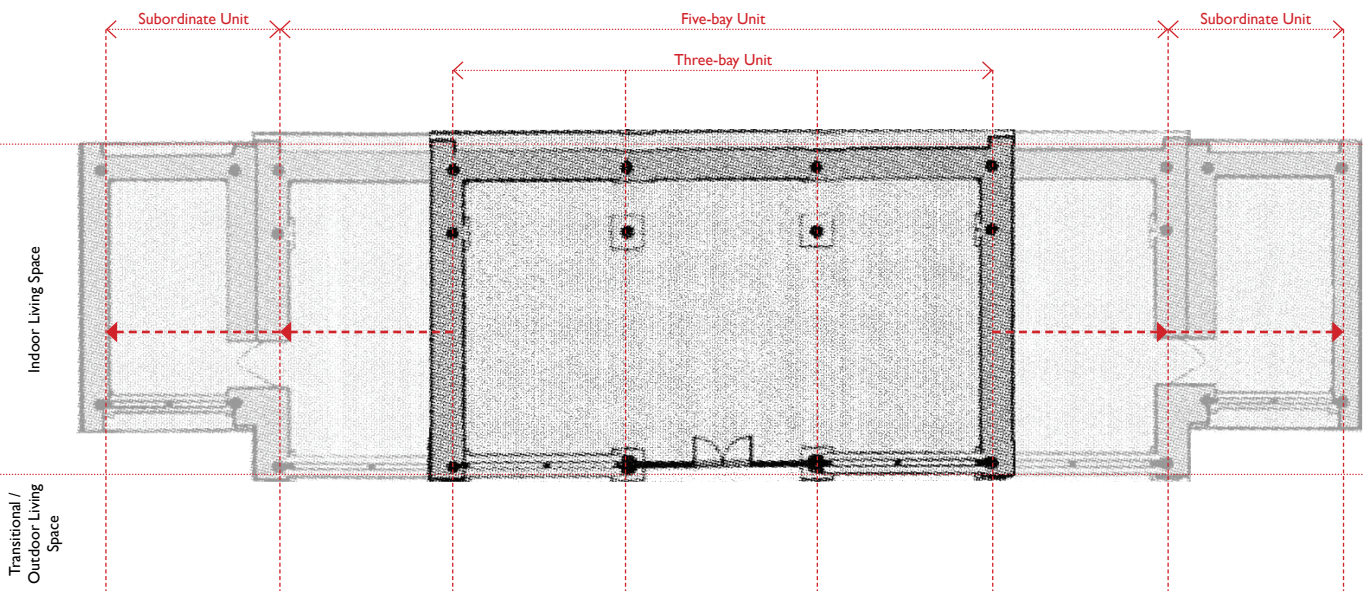
“墙倒屋不塌” *Qiang dao wu buta*

The wall collapsed but the house stands.

The Chinese proverb described the relationship between the structural frame and the wall enclosure, which are independent from each other.

In courtyard houses, the lime-washed masonry walls and walls of the dark grey bricks create an impression of weight and solidity while the rows of wooden pillars lend transparency and lightness to the scene. Usually mistaken, however, the structural system is actually based upon the wooden framework that rises from the ground to support the weight of the roof. Contrasts to its heavy appearance, the wall is a mere curtain and carries no load at all. Much as in contemporary skyscraper construction, this unique curtain wall structure is already in use. The freestanding wooden skeleton makes possible an extraordinary flexibility in the sizing and placement of windows and doors in encircling walls. This is because the walls are now free from structural limitations.

Together with the bay building module, the wooden framework standardizes traditional Chinese architecture to a remarkable degree. As related systems, the bay and the wooden frame permit a high degree of flexibility and freedom of design. Equal heights of the pairs of pillars, equidistant spacing of the purlins and other building components simplify and standardize the construction process, making possible a surprising level of prefabrication and modularization and encouraging the economical fabrication of building members.



2.2.12

Traditional three-bay configuration is easily transformed into a five-bay room with subordinate wings by adding another set of equally spaced columns.

Interlacing: aesthetics, functions and nature The courtyard complex is filled with decorations. From the most extravagant gate, window and roof to the simple paving pattern, beauty is appreciated in every aspect for the Chinese. Many of the decorative elements are not only aesthetically pleasing to the eye, but also fully functional.

One of the most noticeable decorative elements is the window. The Chinese architecture is known for its beautiful woodwork on the window frame. The pattern varies and carries different folk meanings; but most importantly, the wooden frame serves as an effective shading device. The idea of “double glazing” was not unfamiliar to the ancestors. In fact, the window consists of two layers to prevent heat loss in the winter. Unlike the casement windows we use today that open sideways, the windows in traditional courtyard houses are awning windows that divide into upper and lower portions. The upper part swings outward and can be used as overhangs for shading. The lower portion is usually fixed, but the outer layer can be removed during the summer for ventilation.

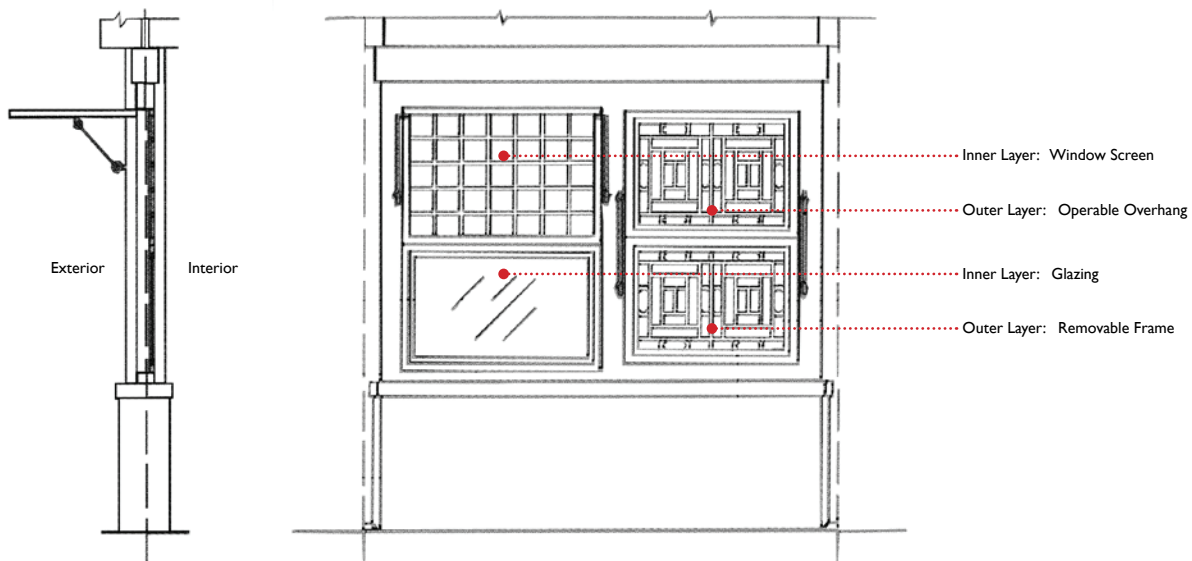


2.2.13

2.2.14

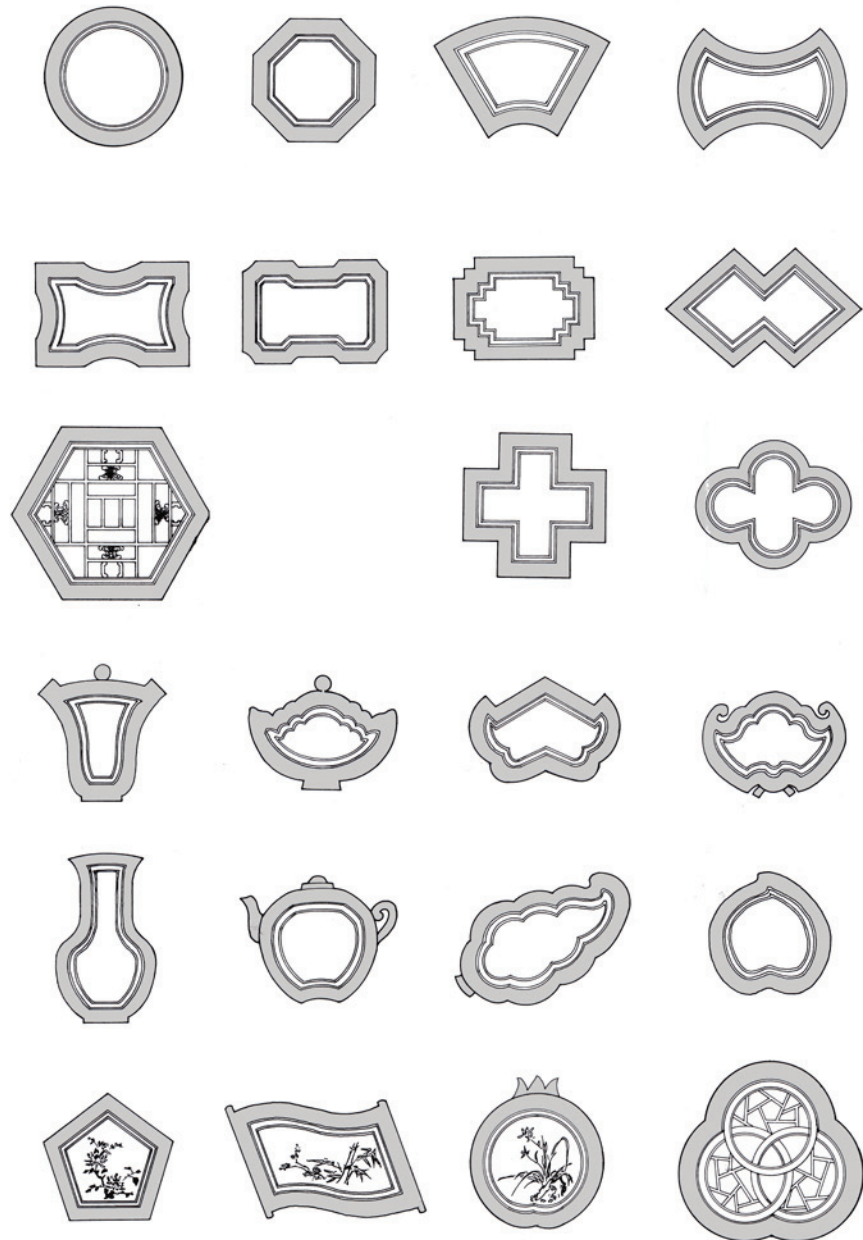
2.2.15

Examples of awning window (zhizhaichuang 支摘窗) in courtyard houses

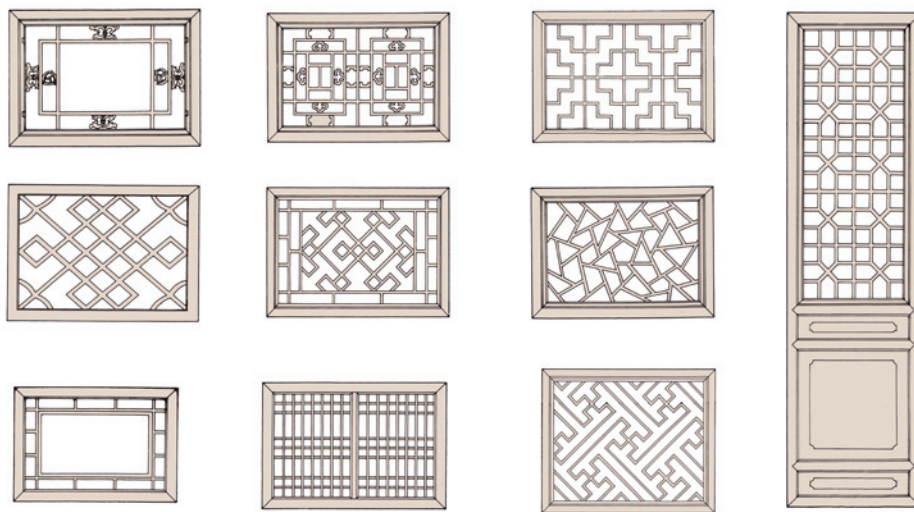


2.2.16
“Double glazing” detail

Multiform window is a type of highly ornamental perforated opening that can embellish wall surfaces, communicate between spaces, borrow and frame views, and facilitate ventilation. It is widely adapted in the design of courtyard houses, especially integrated with the viewing wall. The multiform window can be a single-layered frame with perforation, or a double-layered unit with paintings on the glazing and lights integrated in between. It is either made of wood or carved from stone. Myriad forms exist and are usually inspired by the shapes of domestic wares, flowers, vegetables, fruits and geometrical shapes. Examples are wine cup, scroll, fan, vase, silver ingot, bat, moon, pomegranate, peach, pentagon, hexagon, octagon, plum blossom, and so on.



2.2.17
Examples of multiform window



2.2.18
Examples of wooden window pattern



2.2.19
Summer ambient lights into the interior



2.2.20
Winter direct lights into the interior



2.2.21
Wooden window pattern casts shadow on the interior wall. The interesting light patterns change with time and season.



2.2.22 *Frame by viewing window*



2.2.23 *Frame by wall screen*



2.2.24 *Frame by window pattern*



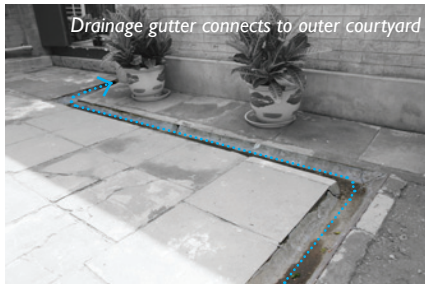
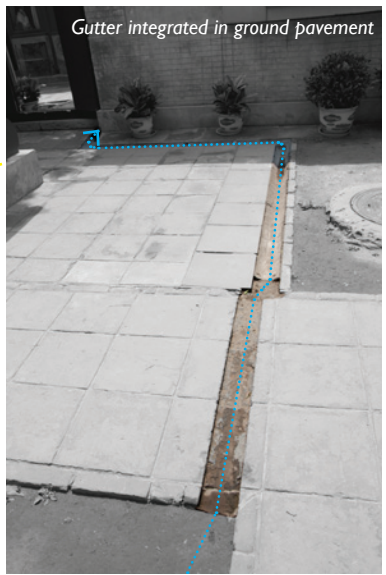
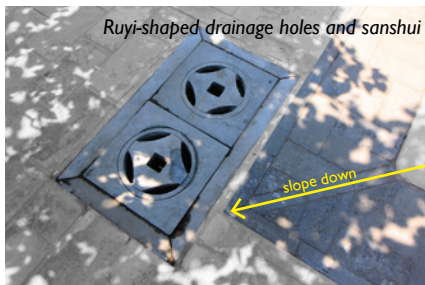
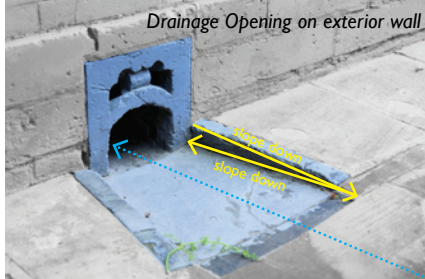
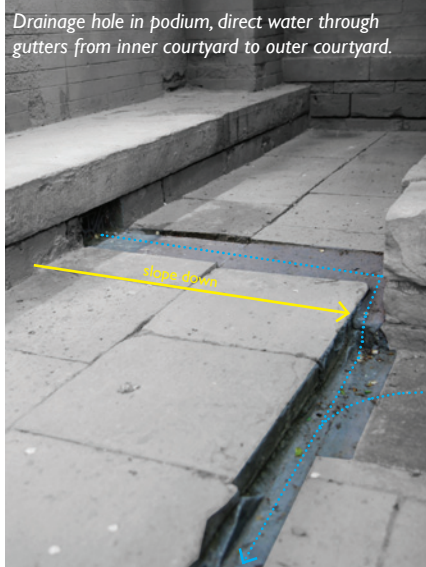
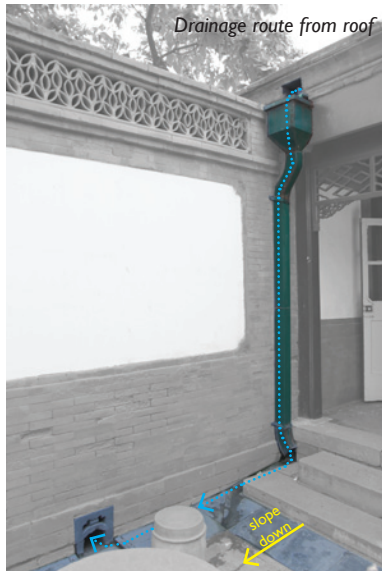
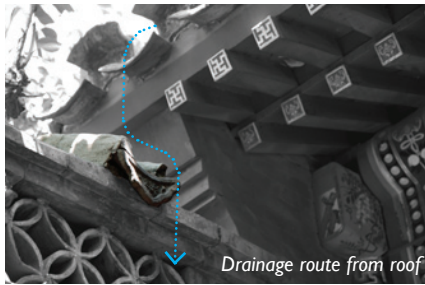
2.2.25 Frame by entrance



2.2.26 Frame by covered veranda



2.2.27 Frame by screen door



2.2.28 Drainage details in courtyard houses

Beauty is appreciated in every aspect of design. The ground is also treated with care. Drainage holes located along the lower walls and on the ground are disguised behind the highly decorative carvings. By cleverly positioning the openings, symbolic shapes are created. The most often seen ones are the old Chinese coin and *myi* 如意 (an S-shaped scepter), symbolizing power and good fortune.

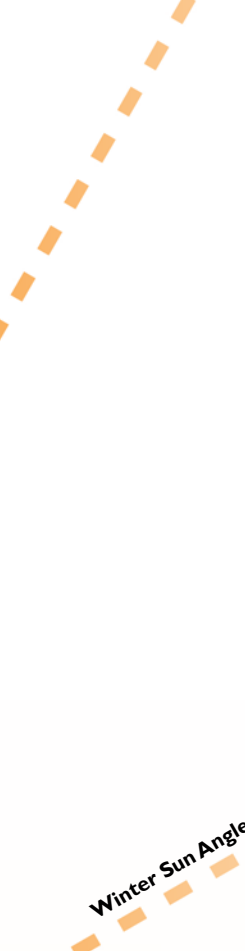
Sanshui 散水 or apron, is paved along the podium perimeter to further protect the foundation and structure from water damage. Its function, much like flashing, is to direct water down and away from the building enclosure. The width of the apron depends on the size of the overhangs and the scale of the building. It can be between 600 mm to 1000 mm in width or about 200 mm to 300 mm greater than the length of the overhang. The inner edge of the apron lines up with *tuchenshi* 土衬石 (the base lining) and the outer edge levels with the courtyard ground, forming a gradual slope of roughly three to five percent. Such configuration ensures the rainwater permeates into the ground as far away as possible from the structure, keeping the foundation dry and protected. The brick paths in the courtyard linking the buildings are also paved in such a way to facilitate drainage. The surface is higher along the centre line and lower on the sides, allowing water flows into the nearby flowerbeds. There are several ways of paving the ground to enhance the appearance of the courtyard as well.

Furthermore, the ground is covered with either earth or brick pavement, which absorbs and retains moisture well. Because the process of evaporation can cool down the surrounding air, the residents often spray water on the ground to passively cool the space during hot summer days.

As an expressive feature of the traditional Chinese dwelling and its association with powerful symbolisms, the roof also fulfils its primary purpose of sheltering the structure and interior living space from the elements. Its particular form, material and construction methods contribute greatly in protecting the wooden structures from weathering. Recognizing that water only moves downward and in one direction, the pitched gable roofs can quickly move the falling water to the eaves where it falls to the ground. The curvature formed by several adjoining segments of different slant facilitates drainage in a much more effective manner. To further reduce the splashing of water as it drops, the roofline is generally extended by using broad eaves. The eaves often extend beyond the edge of the podium to keep it dry and allow occupation of the covered path during rainy days. The size of the overhang is carefully manipulated as well, such that it is big enough for shading during the summer, but allows solar exposure for winter heat gain due to the low sun angle.



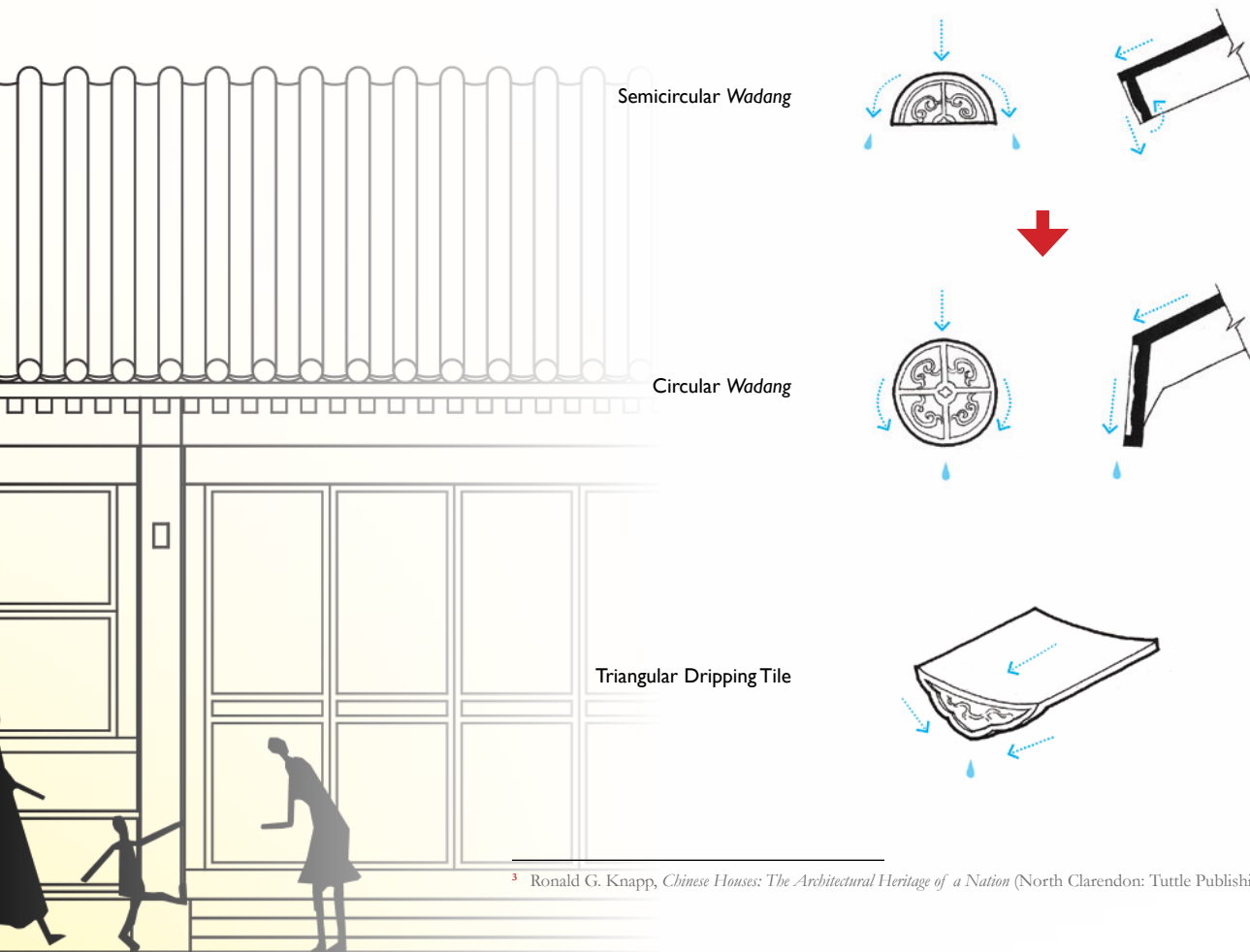
2.2.29 Roof shading and drainage



The shape of the roof is no doubt a key player in dealing with water, however, the materials used to cover the roof structure also play an essential role in enhancing the performances against weathering. The manner of laying roof tiles (*wazuo* 瓦作) involves the manipulation of concave and convex shapes. Rows of concave tiles are laid first across the roof surface, then followed by rows of convex tiles overlapping the joints to prevent water seepage and heat loss. The vertical arrangement of alternating and overlapping tiles produce gutters, which carry rainwater quickly to the eaves. There are other variations of tiles and patterns as well. An especially interesting and functional element of tile shape emerged after many experimentations: the end tile or eaves tile, called *wadang* 瓦当. *Wadangs* are the decorative additions along the projecting eaves placed at the end of the rows of roof tiles. They are predominantly molded or carved on their exposed surfaces with symbolic meanings, and are found in many shapes – semicircular, circular and somewhat triangular. Interesting to note that circular shapes drain water much faster along their circumference than is the case with truncated semicircular shapes.³ As a result, the ancestors eventually replaced semicircular tile with circular *wadang*. Triangular dripping tiles similarly draw water rapidly from a sloping roof and accelerate water dripping to the ground below. The circular tiles are usually placed at the end of the convex rows with the triangular ones at the end of the concave rows. The combination of the alternating end tiles, again, is both aesthetic and pragmatic.

2.2.30

Schematic drawing showing water prevention capacity of the eaves tile (*wadang*) and dripping tile



³ Ronald G. Knapp, *Chinese Houses: The Architectural Heritage of a Nation* (North Clarendon: Tuttle Publishing, 2005), 50.

2.2.31 Opera actor Mei Lanfang watching his grandchildren playing in the courtyard at No. 9 Huguo Temple, Xicheng District (西城区护国寺9号宅院)



Trees



Awnings



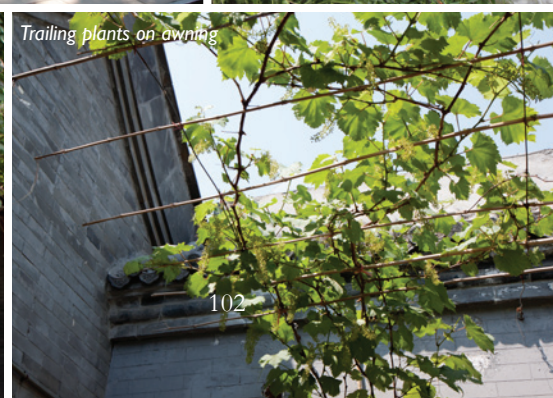
Trained climbing plants on wall



Shrubs planted in the flowerbeds



Trees planted in front of main house



Trailing plants on awning



Fish tank

Built Form, Nature and Culture

Location of trees

Location of potted flowers on window sill

Location of potted plants on podium

Location of plants in flowerbeds

Location of fish tank and potted plants

Nature is always present in the Chinese built environment. Whether in the sophisticated gardens of large residences or the humblest courtyards in smaller complexes, plants, fish tanks and other small reminders of nature are often found. One effect is to create a peaceful oasis where residents can find relief from the stress and bustle of the city. Another important effect is to offer certain environmental benefits such as creating a comfortable microclimate within the courtyard and forming heat sinks that benefit the city on the larger scale. In addition, the courtyard itself highlights the local culture and creates a sense of place. From the most delicate carvings to the simpler elements, almost every detail carries a fortunate symbolism and tells a story. Local plants and flowers with special folk meanings also emphasize the tradition and reflect the personality of the inhabitants. Even though this folk tradition has lost much of its original literal relevance nowadays, the environment it has bequeathed us remains as aesthetically and environmentally valuable as ever.

The traditional courtyard house, as its name suggests, places great emphasis in the courtyard. The central court is not only the place where most activities of the family take place; it is also the full embodiment of the harmonious relationship between heaven, earth and people. The multipurpose room opens up to the sky. The two natural elements – earth beneath and sky above – ensure the direct contact with nature. Under the sky canopy, the inhabitants can exercise, plant flowers, play chess, dry laundry, drink tea, chat with family or friends, nap, read or study, picturing a pleasant and relaxing lifestyle. Thus, greening and landscaping in the courtyard are of utmost importance to ensure such comfortable environment.

Trees and flowers are planted in the courtyard to add to its beauty. Fruit trees provide fragrance in the courtyard gardens, flowers give scent and bouquet, as well as colour and form, and water invites contemplation. The ephemeral effect of nature and time plays its magic as seasons pass. Effortless as it seems, the plant species are carefully selected and placed for their different meanings and connotations.

In a typical layout, the paths linking the facing buildings divide the courtyard into four quadrants. Trees, shrubs and flowers are planted in each patch of land. The inhabitants can place one tree in each quadrant; or more commonly, plant two in front of the main building (the north block), one on each side, leaving the south end of the courtyard open for smaller shrubs and flowers. This is because the north block, with windows facing south, receives the most sunlight. Overheating can be a problem during summer. By placing two trees right in front, the natural shading device can screen out solar radiation access, reducing the thermal discomfort. Vice versa, the south building, with windows facing north, receives limited solar exposure. Further shading is undesirable. Thus, the land in front is open for plants that are lower and smaller.



Potted flowers on podium

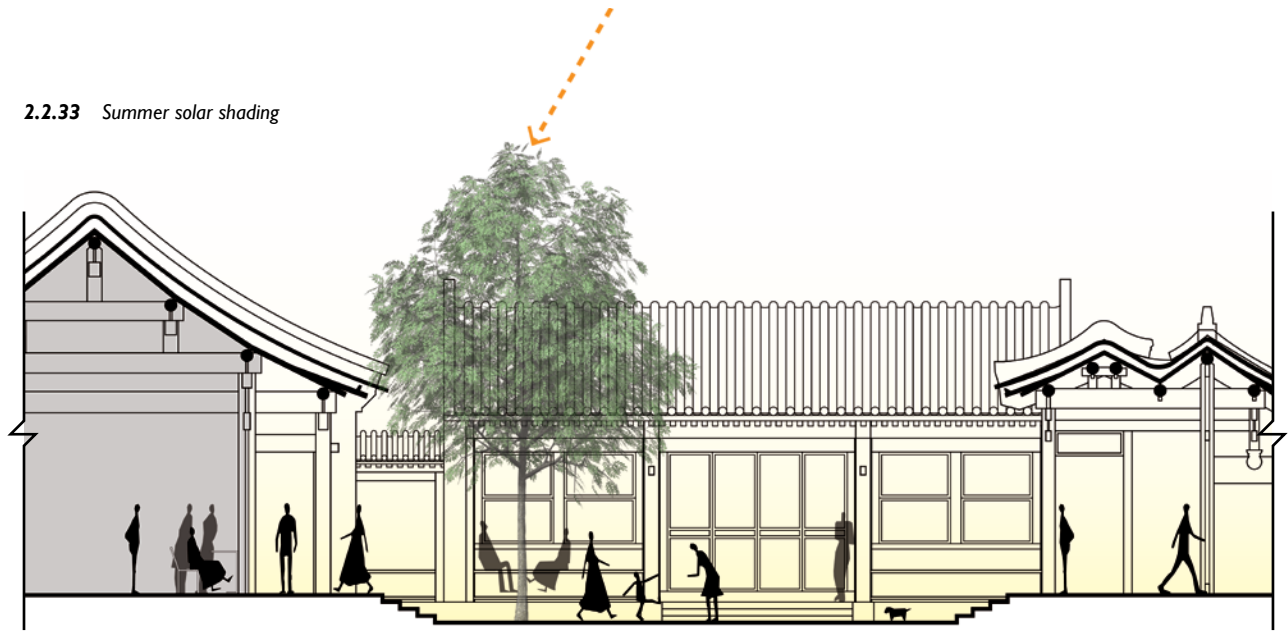


Potted flowers on window sill

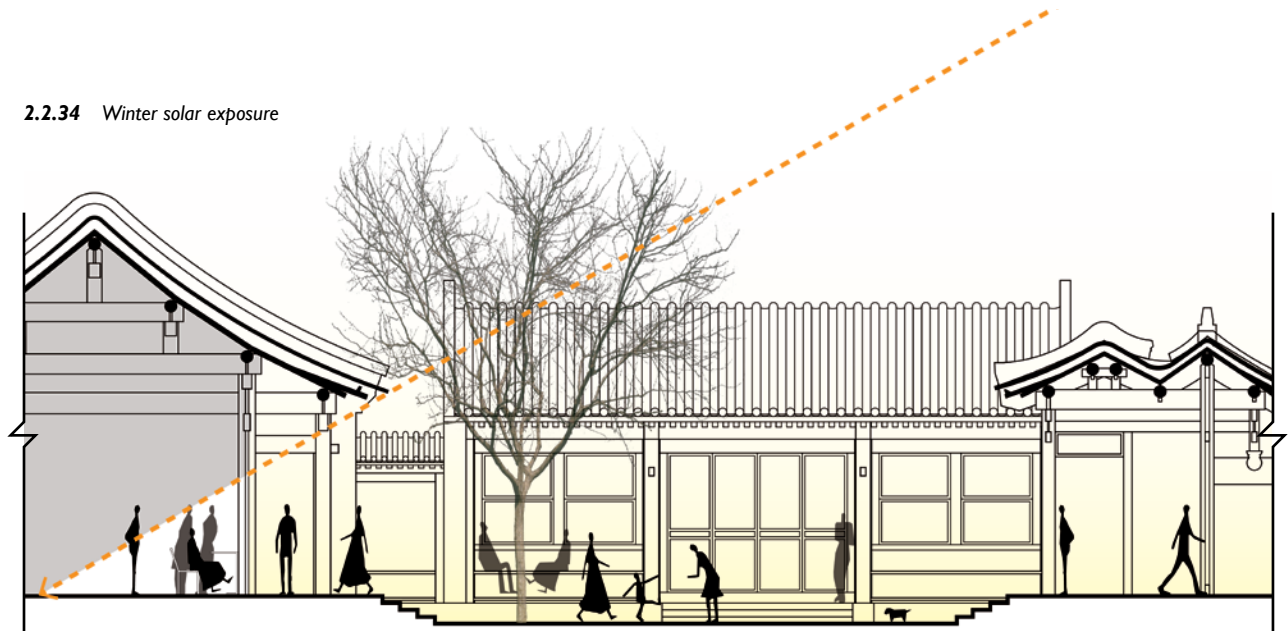
2.2.32

Type of vegetations found in traditional courtyard houses

2.2.33 Summer solar shading



2.2.34 Winter solar exposure



2.2.35 Favourable vegetations found in traditional courtyard houses



Trees typically found in the traditional courtyards in Beijing are Chinese crabapples (海棠), yulan magnolias (玉兰), lilacs (丁香), pomegranate trees (石榴), Chinese jujube trees (枣树), and pagoda trees (槐树). These trees are all elegant in form and moderate in height and size. They are species that blossom beautifully in the spring and bring forth rich fruit in the fall. During the hot summer days, their dense leaves provide natural cooling and shading in the courtyard, as well as prevent direct solar radiation entering the surrounding rooms, keeping the interior cool. In the cold winter when heating is the primary concern, leaves shed away. The warm sunrays pass through the bare branches and enter the interior, allowing the maximum solar exposure.

Furthermore, the fortunate connotations of these trees made them the all-time favourites. In traditional Chinese culture, red is an auspicious colour. Therefore, pomegranate trees (石榴) are often seen in the courtyards of Beijing for their bright red flowers and fruits. In addition, the elders believe that pomegranates are symbolic of fertility and numerous progeny. Because the Chinese word of seed “*zi* 子” is a homonym, the same character also means son or offspring. Thus, a fruit containing many seeds is a sign of fecundity. The ripe pomegranate fruits with countless seeds bursting forth are believed to bestow fertility and bless the dwelling with numerous offspring. To further play with the words, pomegranate tree is often planted together with Chinese jujube tree (枣树), implying “*zao*” *sheng* *guiz**zi*, *duoz**zi* *duosun* “早”生贵子，多子多孙. The letter for jujube “*zao* 枣” is a homonym of early “*zao* 早”. The phrase “早”生贵子，多子多孙 simply means that the household is blessed to have a baby soon and will have numerous sons and grandsons thereafter.

Yulan magnolia (玉兰) is favourable for its beautiful flowers and pleasant scent, as well as its excellent connotation. When planting together with the Chinese crabapple (海棠), they are often called *yutang-fugui* 玉堂富贵, signifying career advancement, wealth and prosperity.

Pagoda tree (槐树) has a bigger crown, and it is usually planted in complexes with a larger court. Its flowers give pleasant scent. The big branches and dense green leaves are excellent for shading during the hot summer days and are home for many birds and insects. The sound of cicadas calls forth the summer season, adding another layer to the sensual experience in the courtyard. It is also a pastime for children to collect both cicadas and the shells left behind. The pagoda tree symbolizes the conferment of a rank of nobility and establishment of a high-level official, and thus, gets its alternative name the “Chinese scholar tree”.



Lilacs



Yulan Magnolia



Chinese Crabapple



Pagoda Tree Flowers



2.2.36 Spring



2.2.37 Summer

Other than planting trees, flowers and shrubs are of great variety and diversity as well. Some are planted in the ground, and some are grown in pots or in water. “*Anning, fish jars, and pomegranate trees; master, fat dog, and plump maidservant*”⁴ is a popular saying from the Qing Dynasty, describing life in a traditional courtyard. In this phrase, the “*fish jar*” indicates the plants in water jars and “*pomegranate tree*” implies the potted vegetation. Due to the harsh northern winter, small pomegranate tree is usually planted in large wooden barrel. The barrel is placed in the courtyard during the warm months of spring, summer and fall; and it is then moved to the interior to pass the cold winter months. Other potted plants are such as China rose (月季), chrysanthemum (菊花), sweet tea olive (桂花), Chinese plum (梅花), wintersweet (腊梅), oleander (夹竹桃), azaleas (杜鹃), and cape jasmine (梔子). These moveable greeneries are highly decorative and can be replaced with the seasons, changing the visual appearance of the courtyard constantly. The inhabitants can place the pots anywhere based on their liking – under the window sill, along the edge of the veranda, in the courtyard or inside the rooms.

Lotus (荷花), water lilies (睡莲), water chestnuts (菱角), water hyacinths (水葫芦), and arrowheads (茨菇) are common plants in water. They are usually growing in the large fish jars together with the goldfishes. These water plants nourish the courtyards of Beijing that normally lack waterscapes, adding huge values in modifying temperature, changing air flow pattern, adding humidity and enhancing air quality. Some households pay great attention on the creation and craftsmanship of the fish jars. Together with the carefully selected and trimmed water plants, the finished piece further enhances the aesthetic scenery in the traditional courtyard dwelling.

⁴ The original Chinese saying reads “*tianpeng, yugang, shiliushu; laoye, feigou, pangyatou* 天棚、鱼缸、石榴树，老爷、肥狗、胖丫头。”



2.2.38 Autumn



2.2.39 Winter

Some inhabitants set up a pergola or “awning” in the courtyard, forming a shaded seating area with trained climbing or trailing plants. Chinese wisteria (藤萝) is popular for its gorgeous flowers, and grape is another favourable choice for its delicious fruit.

Plants found in the flowerbeds before the steps of houses are usually China roses (月季), four o'clock flowers⁵ (草茉莉), touch-me-not (凤仙花), passion flowers (西蕃莲), morning glories (喇叭花), luffa flowers (丝瓜花), hyacinth bean flowers (扁豆花), scarlet sages (串红), jasmines (茉莉), daylilies (黄花), oleanders (夹竹桃) and flowering almonds (榆叶梅). Sometimes hostas (玉簪花) are planted in the shaded areas. The more precious species such as tree peonies (牡丹), Chinese peonies (芍药), dahlias (大丽花) and chrysanthemums (菊花) are more commonly seen in the courtyards of the wealthier families.

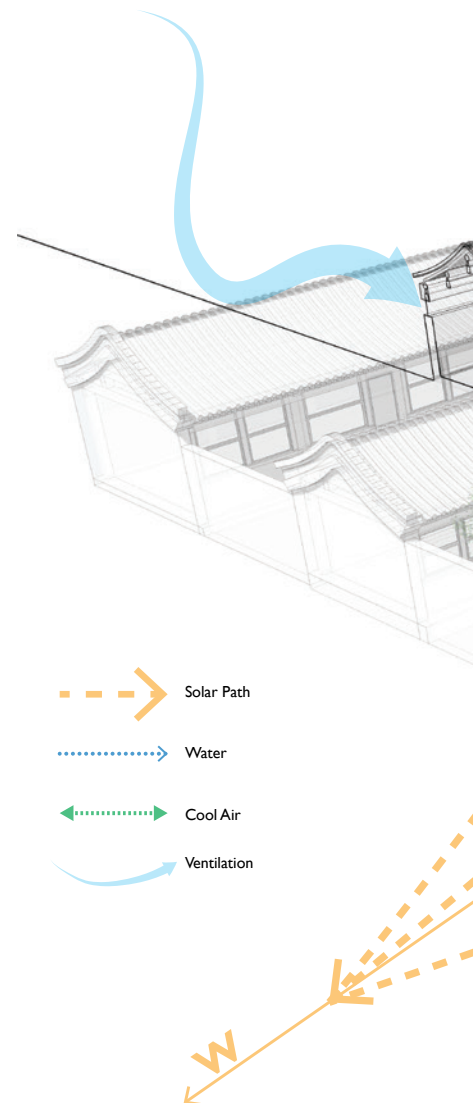
Although the courtyard housing contains a great variety of vegetation, there are certain taboos. Old Beijingers never plant pine trees, cypress, mulberries and pear trees in the courtyard. This is because pine and cypress are usually found in the cemeteries. It is ominous to have them in the house of the living. Mulberry in Chinese, *sang* 桑, has the same pronunciation as the word “*sang* 丧”, meaning mourning and loss, and is often associated with funerals. The character for pear, *li* 梨, implies separation, “*li* 离”, another Chinese homonym. Nowadays, people are less superstitious, and some start to introduce pine trees and cypress into their courtyard residences. However, despite the fact that they remain green all year long, such coniferous trees are not the best choices in terms of passive design. Because evergreens never shed their leaves, they block out the precious sunlight in the winter, preventing solar heating and daylighting in the surrounding rooms.

⁵ In China, it is called the “shower flower” (洗澡花) or “rice boiling flower” (煮饭花), because it is in bloom at the time of these activities.

Greening and beautifying the living environment is an important part of the traditional residential culture in China. The ancestors take great pleasure in creating their little paradise within the limited courtyard space. Of course, planting in the courtyard does not simply offer aesthetic pleasure, the embedded sustainable aspects are also things worthy of serious study and carry forward.

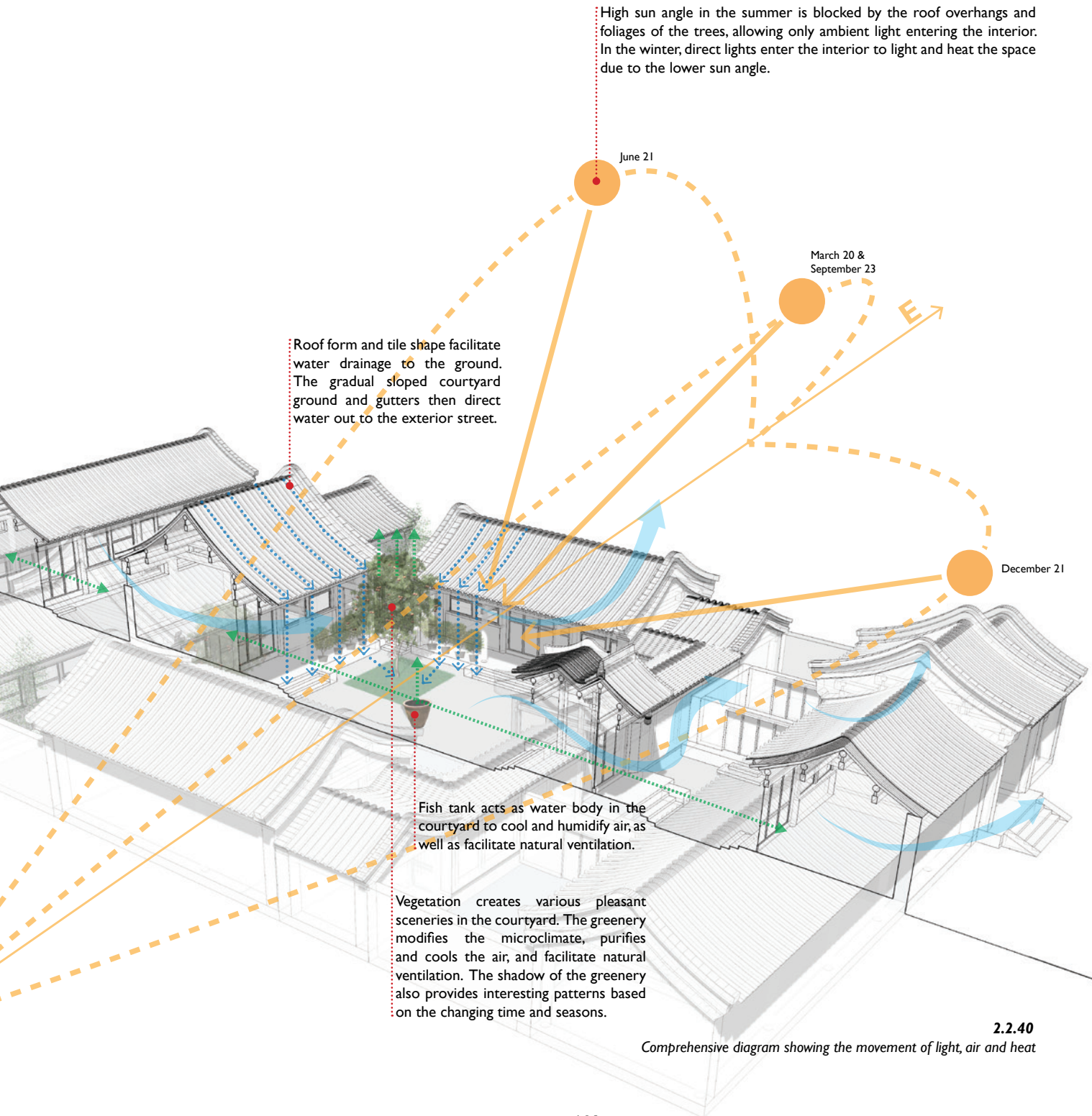
The vegetation can purify air, water and soil, filter out noises, absorb and cleanse pollutants. Furthermore, the creation of a mild environment within a harsh climate is one of the most prevalent functional interpretations of a courtyard. Trees and dense vegetation create a microclimate that can be calibrated by seasonal shading, water spraying and irrigation, surface treatment and lighting. The extensive use of vegetation contributes greatly in passive cooling through the natural process of *evapotranspiration*. Like how people sweat, plants secrete or “transpire” water through the pores in their leaves when evapotranspiration occurs. The water draws heat as it evaporates, cooling the air in the process. Research shows that a single mature, properly watered tree with a crown of nine metres can “evapotranspire” up to 150 litres of water in a day, which is like removing all the heat produced in four hours by a small electric space heater.⁶ In addition, screening out or allowing solar radiation access according to the season, especially temperature control, is another important function of the courtyard garden. The dense greens act as natural shading devices in the summer, filtering out the unwanted heat; while during the winter months, the barren branches allow heat penetrates into the building. The climate modifying action and airflow pattern are also noteworthy. Outside air over a house descends and is drawn down by the cool air within the courtyard. Tree shade and evaporative cooling from water bodies cool the new air. Cool air within the volume of the courtyard then moves horizontally into the verandas and rooms surrounding, and then exits through the openings in the back wall.

In addition, humidity is important in reducing the dryness of air. Excessively dry air can give a perception of excessive temperature; whilst in reality, the same temperature with slightly more humidity may feel more comfortable. Adding moisture to the air can reduce temperature by evaporation as well as adding a welcome increase in general air humidity. So the shape and location of courtyard buildings are critical for the balance of maximum solar radiation, natural ventilation and provision of the optimum humidity levels. Since the water will need the sun to aid evaporation and hence humidify the air, bodies of water are normally centrally placed in the courtyard because of the vertical midday sun in the summer. Due to the lack of flowing water, ponds or water wells are impractical in the traditional courtyards of Beijing. Instead, one or several fish jars are placed at the intersection of the two perpendicular paths linking the facing building blocks. The inhabitants can raise goldfishes and plant water lilies in the jar, further enhancing the beauty of the court. The size of the jar is more manageable in terms of periodic water change to avoid the smelly stagnant water. The jars can also collect rainwater, which is then used for irrigation. Thus, no water is wasted in a place where the resource is precious. From the sustainable design perspective, the jars of water add great values in modifying



⁶ Terri Meyer Boake, March 2, 2011.

temperature, changing air flow pattern, adding humidity and enhancing air quality. Even though the size is incomparable to large ponds or lakes, within the given courtyard area, the small bodies of water can cool the local environment effectively. Moreover, as the only water body present, the extra humidity added to the air can prevent potential fire due to the dryness in Beijing.





2.2.41 *The window to the sky*



2.2.42 *The ephemeral effect of nature and time*

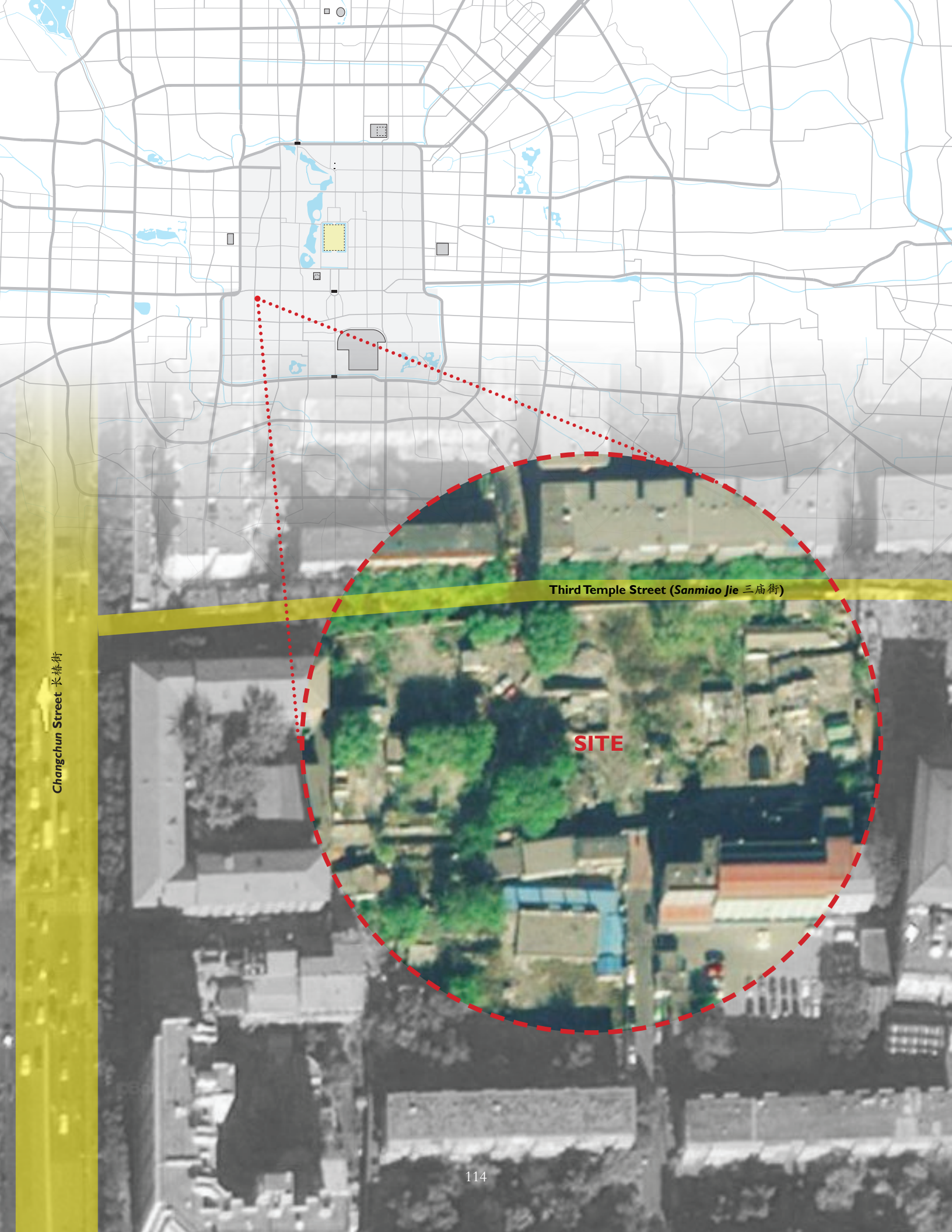


3.0.1 Demolished courtyard neighbourhood at Sanmiao Jie, 2012

3 Site:

Sanmiao Jie, the Third Temple Street





Changchun Street 长椿街

Third Temple Street (Sanmiao Jie 三庙街)

SITE

When the thesis first took shape, I imagined a site somewhat close to the historic city centre that is either waiting for development or under construction with imported typologies proposed for the project. So instead of building something out of the context, my proposal encourages the preservation of cultural heritage and promotes the applications of sustainable design. After much consideration and exploration, a site came into my attention: *Sanmiao Jie* 三庙街, or in English, the Third Temple Street, just north of where my grandfather's courtyard used to be. Its location within the Old City and my personal connection with the area urged me to seek out more details about this particular site.



Shunhe 3rd Alley 顺河三巷

Upper Oblique Street
(Shangxie Jie 上斜街)

Lower Oblique Street
(Xiaxie Jie 下斜街)



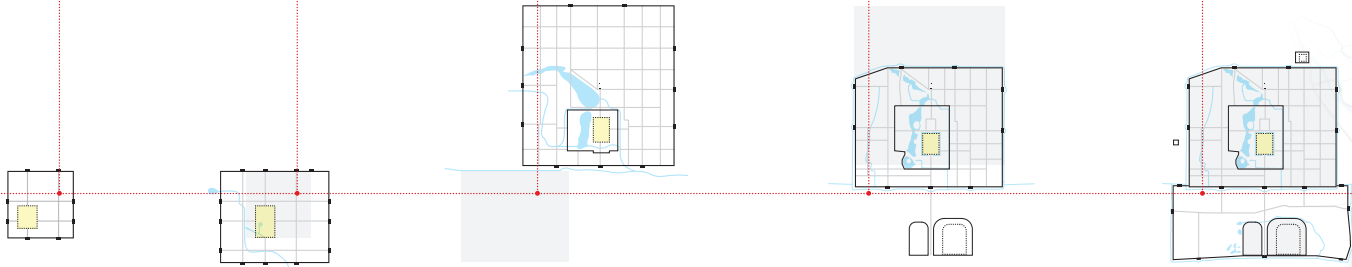
Liao
907 - 1125

Jin
1115 - 1234

Yuan
1271 - 1368

Ming
1368 - 1644

Qing
1644 - 1911

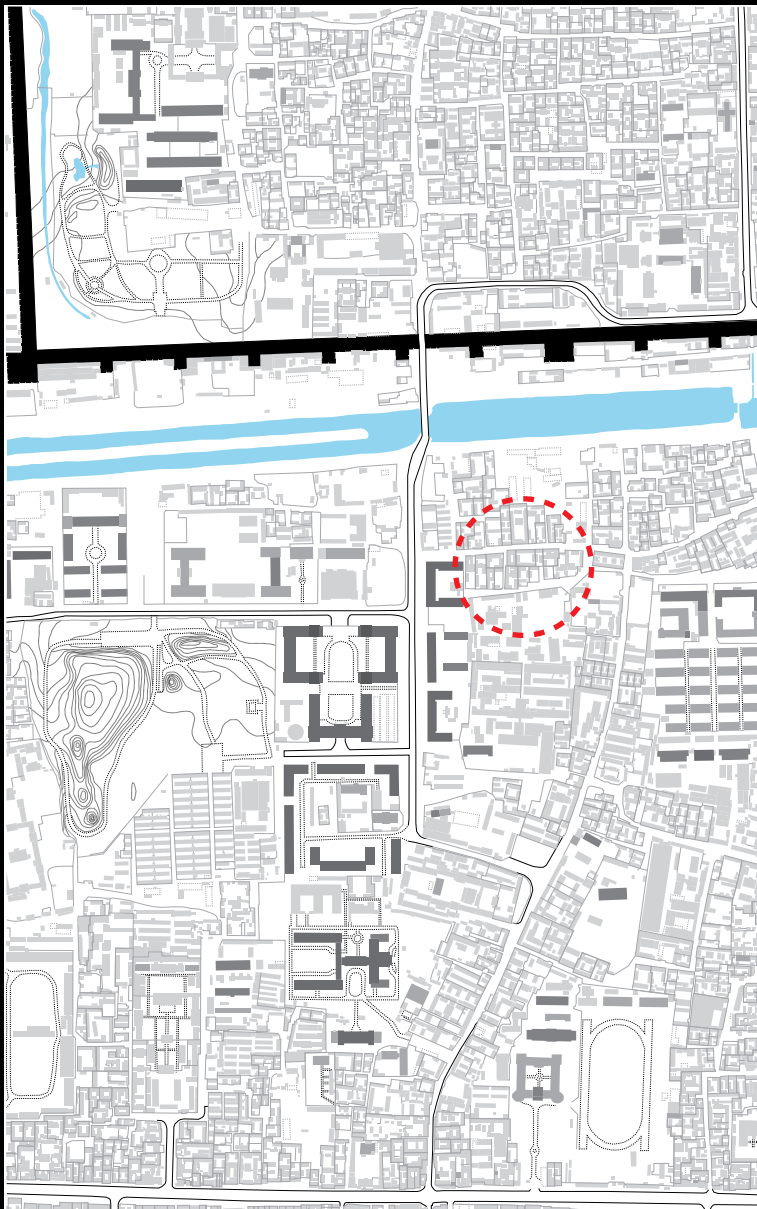


3.0.3 City morphology since the Liao Dynasty

3.0.4 Site morphology, 1:10000

1962

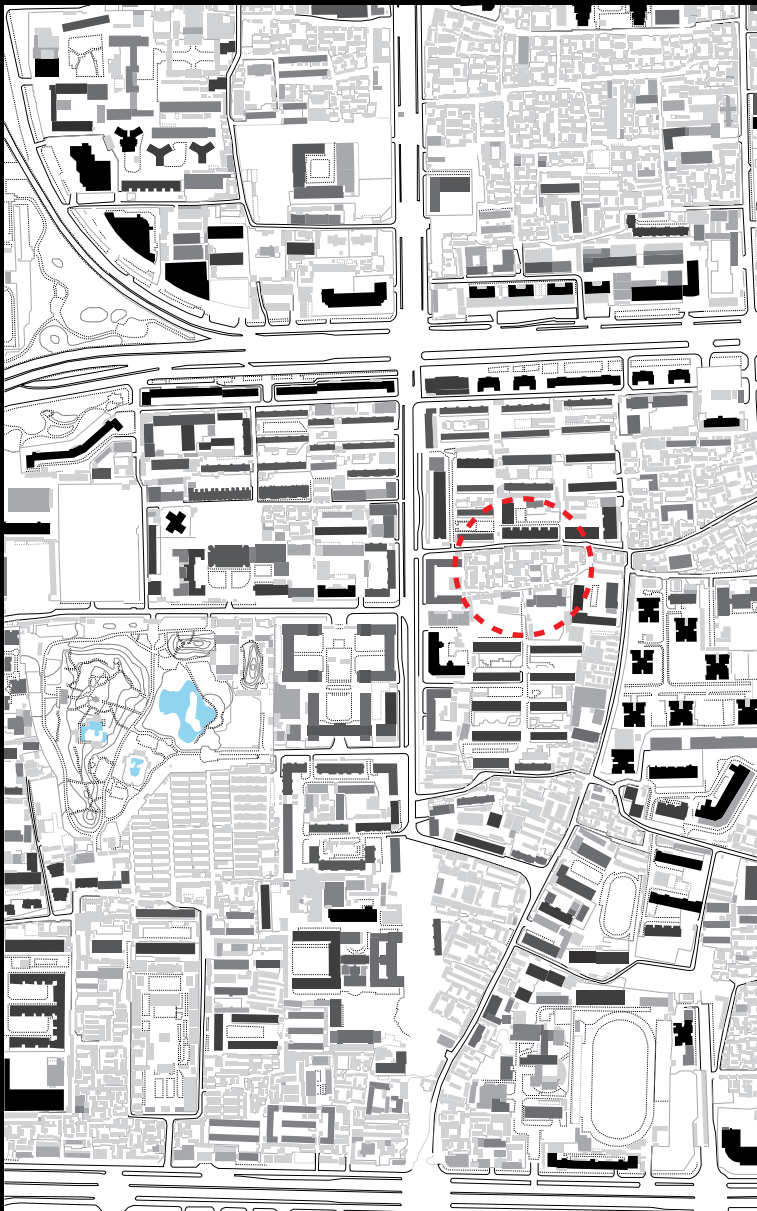
1991



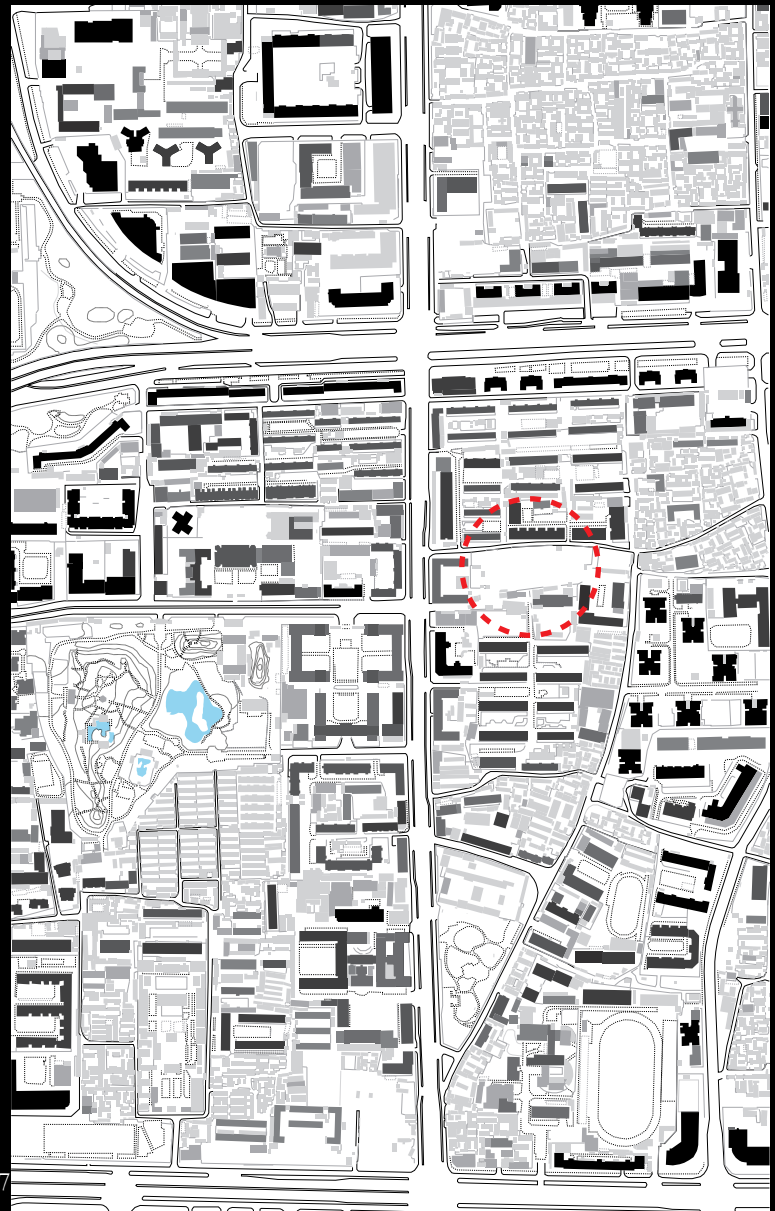
People's Republic of China
Present

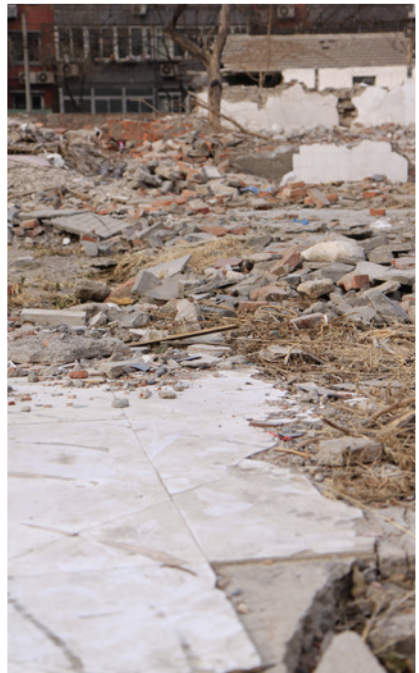
Sanmiao Jie 三庙街, the Third Temple Street, is located just south of *Xuanwumen* 宣武门 (Xuanwu Gate) in the Outer City of the historic centre. Being the oldest hutong found in Beijing, its history can be traced back to the Liao Dynasty (辽, 907 – 1125) more than nine hundred years ago. The street used to be prosperous and bustling during the Liao and Jin Dynasties (金, 1115 – 1234). However, as time flies by, it is slowly declining, and now it becomes an inconspicuous small laneway in the bustling city of Beijing. The roughly three-hundred-metre long and four- to six-metre wide hutong runs east-west connecting to *Shangxie Jie* 上斜街 (the Upper Oblique Street) at the east end. There were three temples built in the area. Two were located along the Upper Oblique Street with the last one along this hutong, thus getting its name *Third Temple Street*. Now, only the first temple remained its original function. The second temple was converted to residential uses, and the third temple was unfortunately destroyed in the forties of the last century.

2003



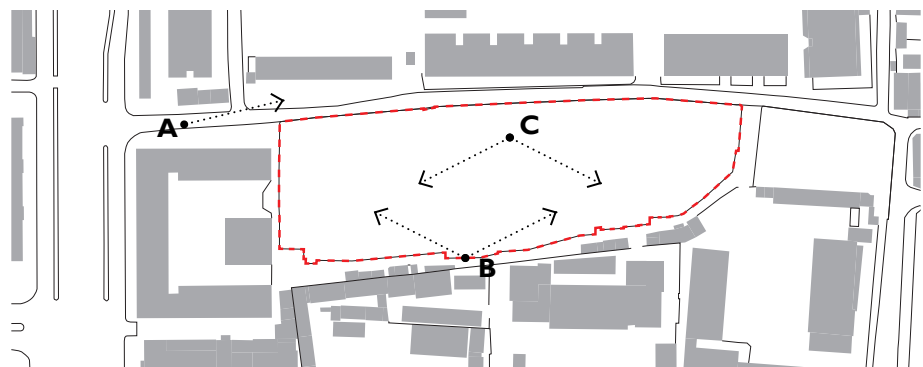
2011





3.0.5 Site visit

As I approached the site, a brick wall commonly found around construction sites was put up running the length of the Third Temple Street. For certain, some development is going to happen. Will it be the similar residential blocks or the high-rise towers found in the area, I have yet to find out. As I ventured into the site with curiosity, I was shocked to see the scenes that filled my eyesight. No longer any courtyards remained, what lied behind the brick wall was a barren land of rubbles with only a few trees left standing. Everything was knocked down, only the leftover floor tiles and foundation walls showed traces of where the rooms and walls used to be. Nothing seemed to be happening: bricks, tiles, twigs and garbage were laying everywhere. It seemed to me an abandon site for ages. I stopped a passerby to inquire more about this area. I learned that the site was demolished long before the 2008 Olympics. She could not recall exactly when. However, nothing was planned and it continued to be abandoned. No one knew what is going up here.



3.0.6 Site photo identification

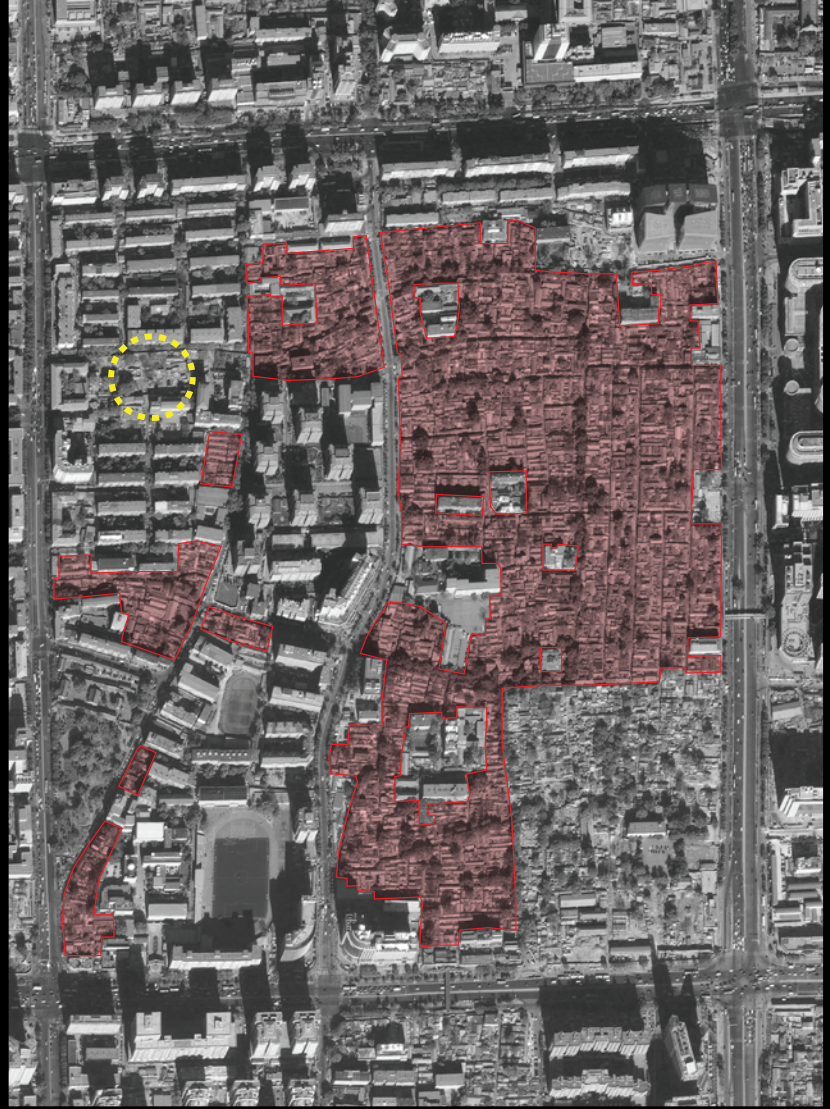


B



C





These courtyards are cleared for either private real estate development or public projects. Construction for the new subway line is currently underway at the southeast corner of the block, the *Caishikou* 菜市口 intersection.

Habitable Floors : 1 to 2
Residential Density : 220 units per hectare
FAR : 0.48
Living Space per Capita : 6 m²

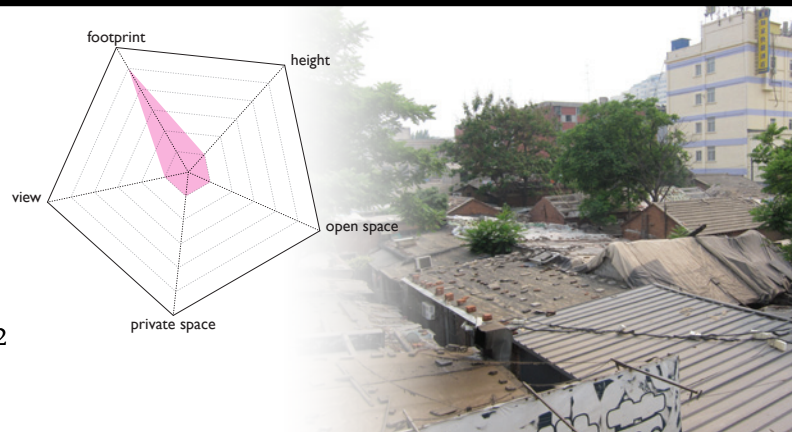
Property Type : Private Housing

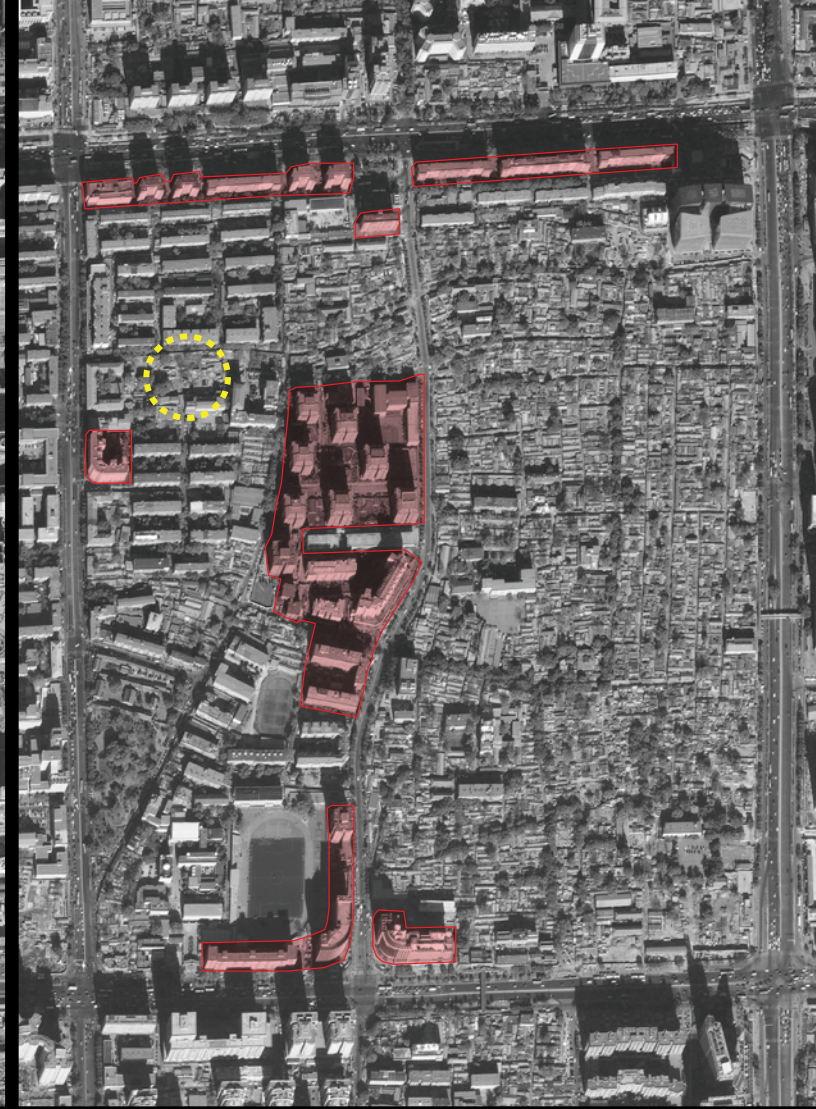
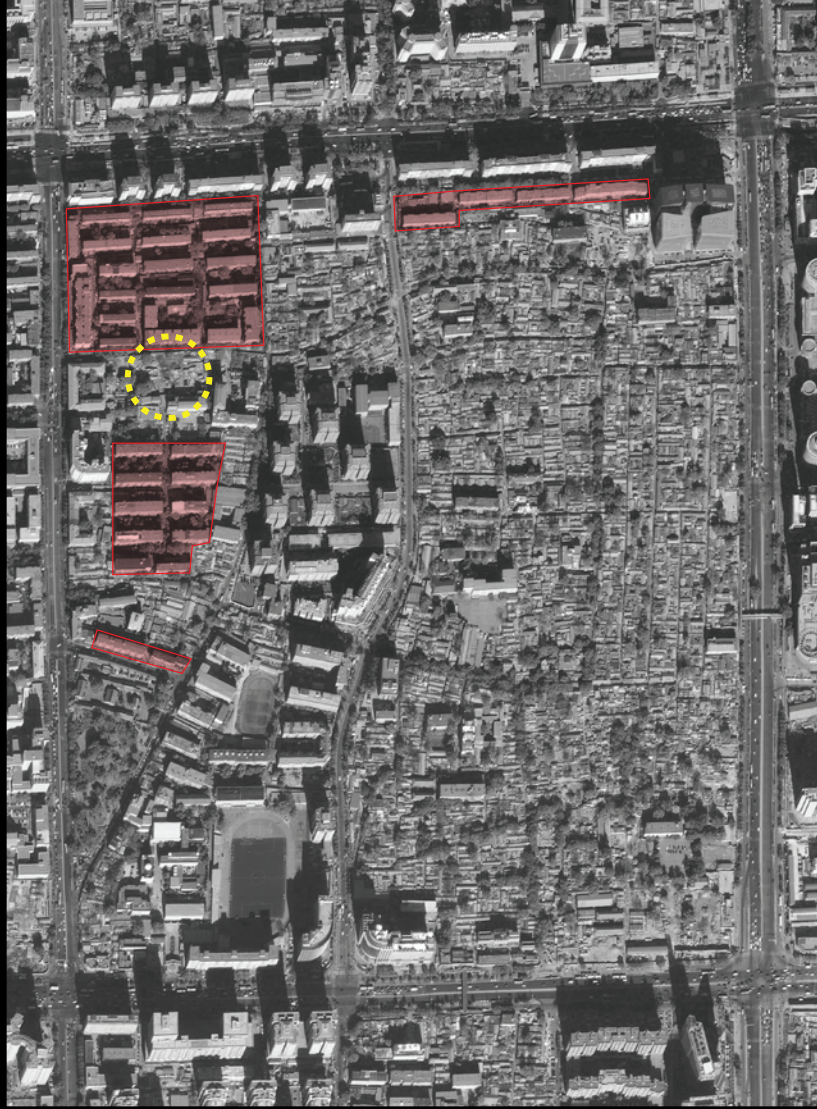
Demographics : Floating population
 Low income workers

HUTONG: DEMOLISHED COURTYARD



HUTONG: INFILLED COURTYARD





Habitable Floors : 5 to 6
Residential Density : 318 units per hectare
FAR : 1.48
Living Space per Capita : 16 m²

Property Type : Work Unit Housing
 Private Housing

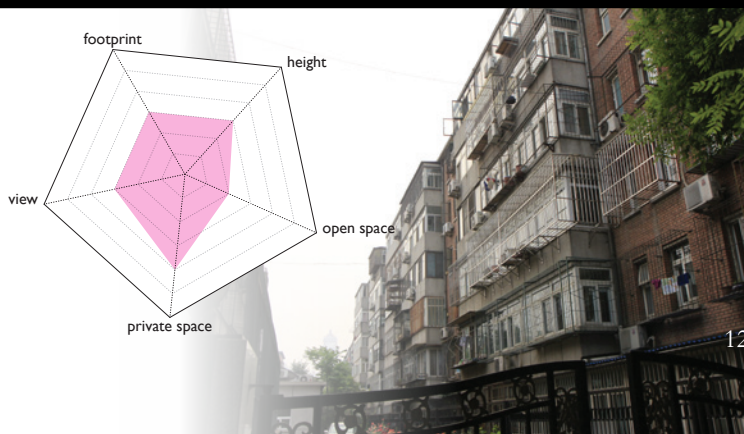
Demographics : Workers
 Retirees

Habitable Floors : 10+
Residential Density : 243 units per hectare
FAR : 4.25
Living Space per Capita : 31 m²

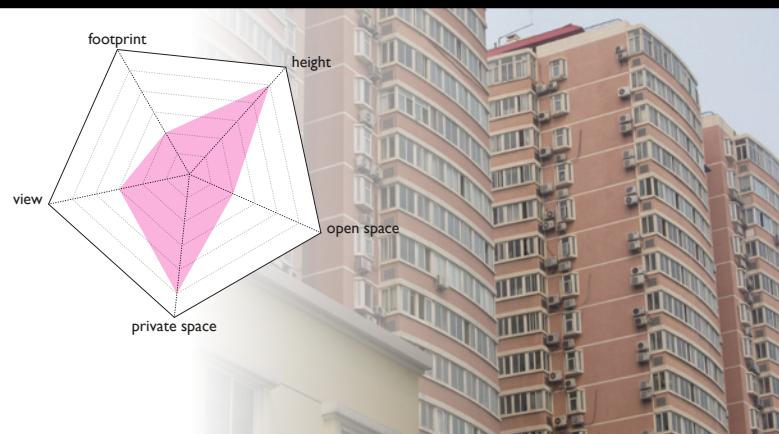
Property Type : Work Unit Housing
 Private Housing

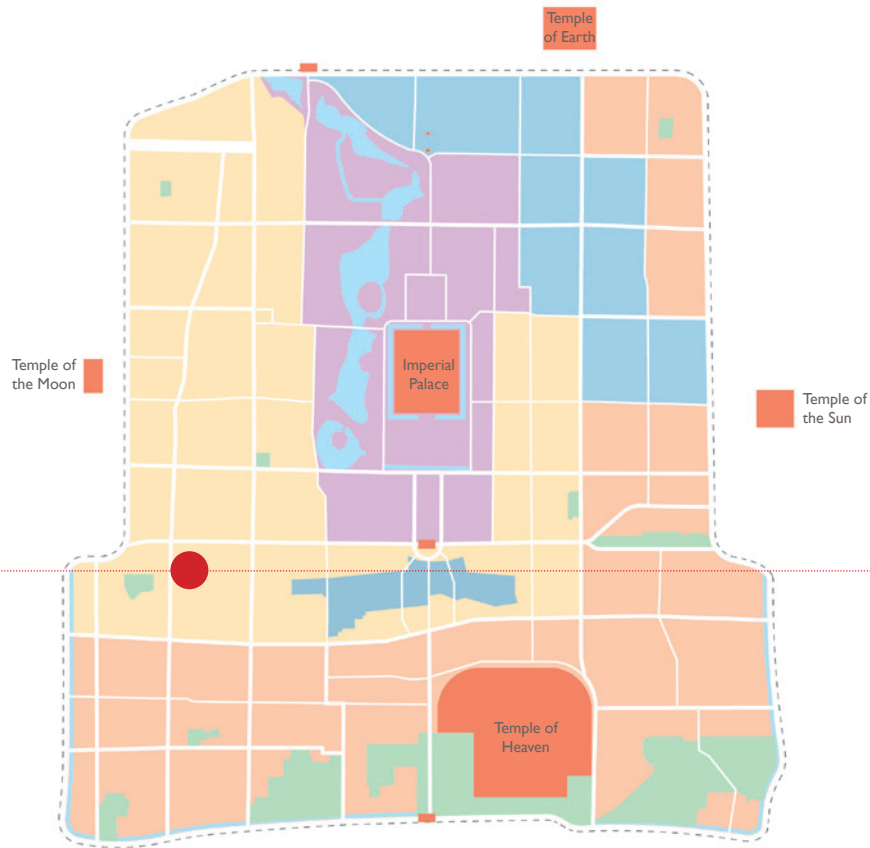
Demographics : White-collar workers

DORMITORY BLOCKS



HIGH-RISE DEVELOPMENTS





3.0.10 Cultural asset protection areas

Cultural Protection Area
 Within the area, all buildings are under strict protection. Maintenance and rebuilding have to follow the exact original style and form. No new buildings or additions are allowed.

Transitional Area
 Areas outside the previous three control zones. Control measures are more relaxed. Despite this, an awareness of the need to protect the style and image of the old city will always be necessary.

Style Protection Area / Cultural Control Area
 Within the area, the identity of the locale is under protection. Buildings may be demolished or newly constructed if they do not impair the style of the area. These are areas under height control of 3.3 m, 9 m and 18 m for maintaining a complementary setting of individually scattered cultural assets. New buildings are controlled in height, volume, style and colour variously according to their distance from the cultural asset. They are screened to ensure that they agree with or promote the identity of the area.

New Development Area
 They are large tracts of land within the planned urban areas outside the old city, excluding the northwestern suburb. Building density and height are subject to general planning control only.



3.0.11 Suggested height control within the historic centre of Beijing



The site on the Third Temple Street is located within the *Transitional Area* outlined in the *Cultural Asset Protection Law* (Figure 3.0.10). It is also under the building height restriction of below 18 metres (Figure 3.0.11). This opens up the possibilities of creating multi-storey houses to accommodate the increasing density. The word “transitional” is utterly fitted for my proposal. It is a transitional piece bridging the old and the new, a continuation of evolution in history. In this particular zone, the project can develop out of the mere physical replication of the traditional typology mentality, and can open up for potential alterations and integrations that are more sensible to the modern life. It is the hope of this proposal to test out a workable form that addresses the conflicting needs of preservation and development, so the precious heritage can survive.



4.0.1 Conceptual model 1:500

An architectural model of a courtyard in contemporary Beijing. The model shows a grid of white rectangular buildings with flat roofs. A central courtyard area is highlighted in a vibrant blue color, indicating the focus of the design. The surrounding buildings are arranged in a way that creates a sense of enclosure and depth. The overall aesthetic is clean and modern, reflecting contemporary architectural trends in Beijing.

4 Design: courtyard in contemporary Beijing

During the development of the new Beijing since 1949, few architects and urban designers took into consideration of the social, aesthetic and environmental legacy of the traditional courtyards, placing the emphasis instead on urban streets and free standing blocks. The consequences of pursuing the import typologies resulted in a city of no coherent style, form and identity, as well as a polluted city filled with energy intensive buildings. The five-thousand-year-old heritage is easily being trampled on in less than a century. Today, the protection of the traditional courtyard houses in Beijing, which some see as an essential domestic architectural type, remains the focus of heated conflict concerning how to preserve the historical character of China's capital in the fast changing metropolis. With the rising emphasis on sustainable development and energy efficient design, teardown courtyard sites within the old city wall that are still waiting for development, such as the one on *Sanmiao Jie*, reside the potential to address the remediation and reinterpretation of the traditional typology in a contemporary city. Thus, preservation can go beyond the level of mere physical replication.

*"Most vernaculars are in fact hybrids of indigenous and imported types and these types also change and adapt."*¹

- *William Curtis*

Not to completely reject everything foreign, but as architects, we should pay more attention to the vernacular: extracting the good from the traditional design and integrating new techniques to optimize the final product. Just as the courtyard house evolved in history, the design of courtyard now should first examine the changing conditions of the current era before an appropriate solution for adaptation and renewal can be made.

¹ William Curtis, *Regionalism in Architecture* (Geneva, The Aga Khan Award for Architecture, 2001), 74.

**The Current
Conditions + Demands**

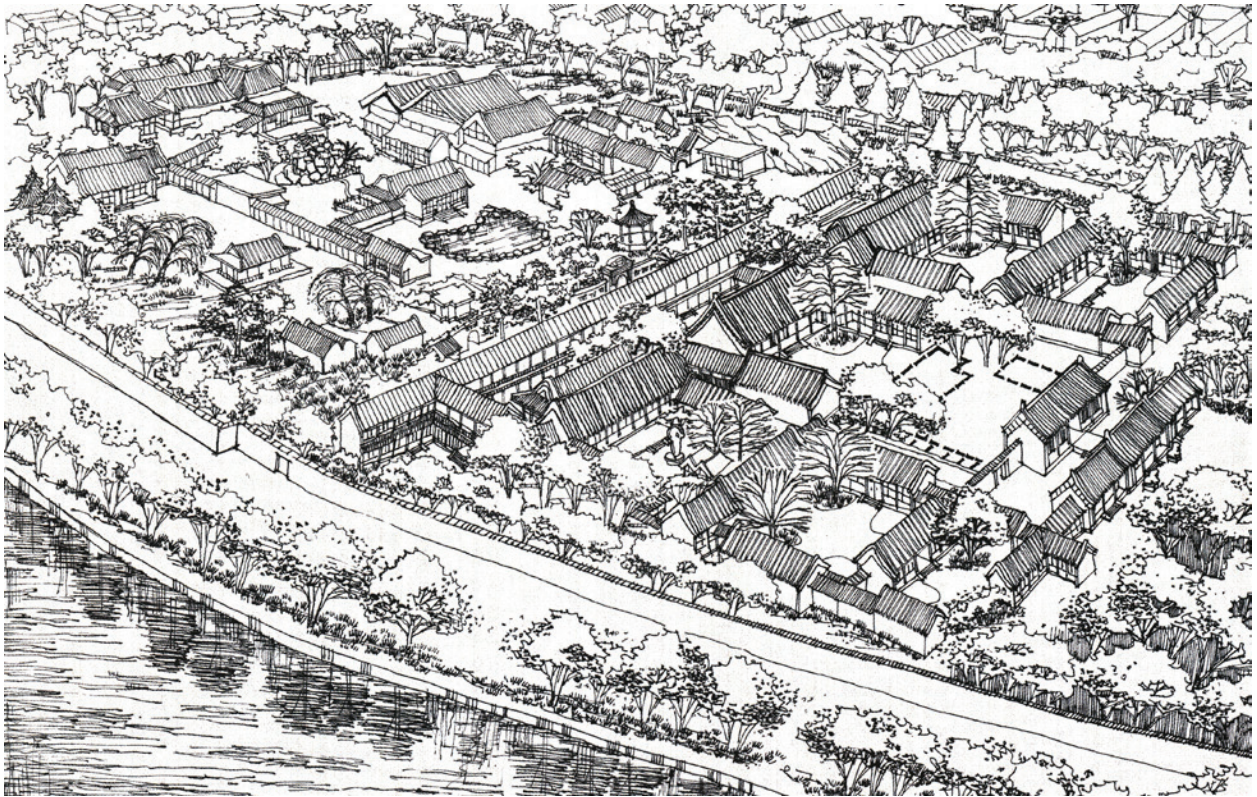
Increasing population and density The traditional Chinese architecture emphasizes the horizontal. Due to the high land value in the market and the fast growing population, one-storey dwelling is no longer feasible under the current pressure. Thus, this forces the typology to develop in the vertical, to “borrow the sky instead of the land”².

Single family clusters over extended families In China today, there is a clear tendency for each newly married couples to establish their own independent household rather than share living space with the extended families. Furthermore, reflecting the government’s population policy encouraging the one-child family, there has been an overall trend towards smaller household size. This movement towards nuclear families has brought a parallel change in the nature of housing. For many average households, it is impractical to occupy one spacious courtyard with only two to three people. As a result, single-family dwellings that are much smaller and space efficient have captured the attention of many home builders and owners.

Shift from family unit to community unit Because household size is becoming smaller and smaller, activities that traditionally occurred inside a courtyard slowly extend to a community level. Common spaces are provided for communal interactions, such as parks and plazas for morning exercises, community offices for cultural activities and so on. The solid wall that separates the public and the private, in certain instances, only exists metaphorically. The sense of closure becomes more permeable.

Demands for energy efficient “green” buildings As described earlier, the consequence of the rapid development in Beijing is detrimental to the environment and is threatening the future generations. The Chinese government has placed measures to conserve energy, reduce pollution and promote sustainable lifestyle. The market for green architecture is thus in great demand and the integration of green technology is strongly encouraged.

² Ronald G. Knapp, *The Chinese House* (New York: Oxford University Press, Inc., 1990), 79.



4.1.1 Courtyard complex of Prince Gong, an example of juxtaposed garden courtyard

4.1 Design Strategies

The design work focuses on developing a new courtyard cluster with a reasonable density and floor-area ratio that also meets the requirements for sunlight, ventilation, and privacy. The idea behind is referenced from the layout of juxtaposed garden courtyards. A series of courts develops in both directions and is connected by inner passages. Houses of different heights and orientation are put together. The relationship between building height and courtyard size is determined in order to meet the standard sunlight requirements; courtyards of different sizes and purposes are then fit into the proposed site. The proposal promotes “house in the garden; garden in the house” as a desirable mode of design.



Habitable Floors

3 to 4

Residential Density

89 units per hectare

FAR

1.28

Living Space per Capita

24 m²

Property Type

Residential

4.1.2 Ju'er Hutong revitalization project by Wu Liangyong, Beijing

The pilot project initiated by Wu Liangyong at *Ju'er Hutong* 菊儿胡同 (Figure 4.1.2) provided many insights into courtyard housing. The cluster approach allowed each phase to be a little different, yet the overall cohesiveness of the project did not get lost in the development. The various sizes and heights reflected the different housing needs, as well as environmental requirements such as solar access. It also confirmed the saying of Lin Hok Leung, “a medium-rise courtyard house of four to five storeys can provide as much floor space as an eight- to ten-storey high-rise apartment” and can have several advantages over the latter.¹ The Ju'er Hutong project showed that it is possible to reach higher densities with a two- to three-storey courtyard building form than can ordinary row apartment buildings with the same depth. Additional advantages, not directly related to density, are that low-rise courtyard housing forms can help to create a more energy efficient microclimate and that the courtyard locations and sizes are quite variable, allowing for the preservation of existing trees and other irregular features on site.

¹ Lin Hok Leung, “A Modern Chinese Cityscape,” *China City Planning Review* 3 (December 1987): 52.

Habitable Floors
3 + basement

Residential Density
100 units per hectare

FAR
1.05

Living Space per Capita
35 m²

Property Type
Residential



4.1.3 *Seijo Townhouses by Sejima Kazuyo, Tokyo, Japan*

Seijo Townhouses in Tokyo, Japan by Sejima Kazuyo (*Figure 4.1.3*) is another example of cluster housing. The project composed of twenty small buildings, shifted to relieve their potential impact on the nearby houses. The built form can be interpreted as either apartment or townhouse. The scattered arrangement and shifted blocks provide gardens or roof terraces for all the units, forming a sequence of communal spaces. Such form and space granted the possibility of socializing between inhabitants without breaking the unity of the complex as a whole.

Successful in terms of designing collectively rather than individually, the juxtaposition of the buildings and the play on scale grant interesting qualities to the space, either the open courtyards or the closed private units. However, there is a certain inwardness presented in both examples as they serve only the community within the property line. Even though there is no clear boundary, a sense that they are not accessible by everyone is given, probably because of their pure function as residences.



Habitable Floors

21

Residential Density

104 units per hectare

FAR

2.64

Living Space per Capita

37 m²

Property Type

Mixed Use

4.1.4 *Linked Hybrid by Steven Holl, Beijing*

To be viable in the contemporary world, the project should not create isolated pockets like the gated communities. The development should benefit the community by not only serving its own inhabitants, but also welcoming everyone from the surrounding areas. So that it can be socially sustainable by encouraging interaction between the increasingly privatized lives of Beijingers and somehow humanizing the edges in the city filled with monolithic towers.

Linked Hybrid by Steven Holl (*Figure 4.1.4*) is a mixed-use development adjacent to the site of the old city wall of Beijing, northeast of the 2nd Ring Road. This example is on the right path to a holistic design addressing both environmental, social and economic sustainability. Aside from its environmental endeavor to reach LEED for Neighbourhood Development Gold certification and the economic payoff in the long run, the social aspects of the *Linked Hybrid* must be emphasized. The development creates a porous urban space that is open to all from multiple sides. Green spaces like the courtyard and rooftops encourage spontaneous community interactions in the city whose residents have less and less interaction with each other. The openness and the freedom of movement make the courtyard of the *Linked Hybrid* full of life: residents, workers, shoppers coming and going, shops and event space filling and emptying. Somehow it resembles the life in the old courtyard but on a vastly different scale.

Property Type
Institutional



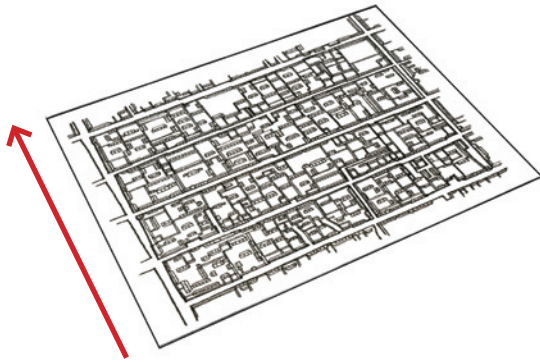
4.1.5 Xiangshan Campus, China Academy of Art by Wang Shu, Hangzhou

Xiangshan Campus, China Academy of Art in Hangzhou by Wang Shu (*Figure 4.1.5*) is a project that mixes traditional Chinese architecture with a contemporary way of rethinking these ancient ideas: garden making, construction, differentiation, material recycling and reuse. The adaptation of courtyards offers obvious advantages: the building depth is reduced to allow for maximum daylight penetration and cross ventilation, and the overall footprint is minimized as the travel distance between opposing wings is reduced. While the material palette incorporates traditional elements such as the grey bricks, tiles, wooden patterns and so on, they are deployed in non-traditional ways. The wooden shutters, typically small operable panels, are expanded to the height of the corridor. More than two million tile pieces of different ages and sizes, salvaged from demolished traditional houses, are used to cover the roof of the campus buildings, and are also applied to the large louvres supported by steel frames over the modern ribbon window and curtain wall. The project is said to be a synthesis, an attempt to reconcile the past and the present in a new vernacular architecture that celebrates the experience and materiality instead of the physical appearance.

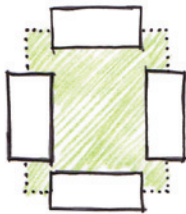
All these projects encompass some qualities that are important and should be highlighted in the thesis proposal. A pure residential cluster housing will not be the final resolution. On top of the green benefits, the project needs to offer something to the larger community; and in addressing the cultural aspect, the design should break through the physical limits of the form and focus more on recreating the *genius loci* through materials, techniques and most importantly, the experiences.

4.2.1 Design inspiration and parti diagrams

Traditional Courtyard Housing in Beijing



The traditional city is laid primarily on the horizontal plan.

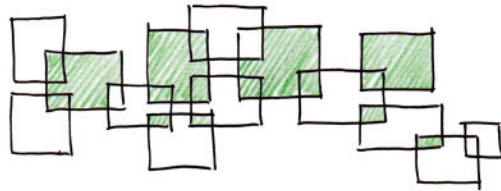


Typical courtyard layout - buildings framing the central court

Courtyard Reinvented: the proposal



The design is inspired by the folding of the horizontal plane to explore in the vertical domain.



Parti - the interlocking pavilions

4.2 Design Proposal

The project is inspired by folding the horizontal plane of a traditional hutong neighbourhood. The interesting grids formed by the courtyards in between hutongs are then translated seamlessly into the vertical plane. Instead of placing individual buildings to frame the courtyard, the proposal features a series of interlocking pavilion “rooms”. The “room” can either be a program function or a courtyard garden. The overlap is formed either by walls that define a clear boundary, roof overhangs that protrude out to create a nice covered outdoor area, or by ground treatments that continue into the indoor space, blurring the boundary between the interior and exterior. The space in between becomes the link connecting the two volumes.

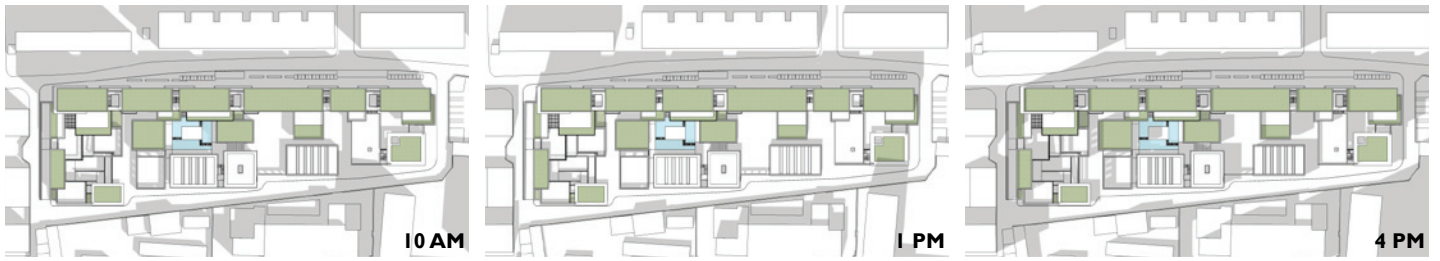
In cities that have a rich historic heritage, the development requires the recognition of local cultural values. It needs to retain the cultural identity while allowing changes that are consistent with such values. The straightforward approach is to conserve the appearances of the built structures, the tangible heritage. Because of the changing social and economic conditions, the historical typology is no longer the ideal form in many instances. But for conservation sake, new developments with traditional add-ons are often found. These incorporations are, in most cases, forced, leaving the built structure an empty shell. Hence, preservation cannot stop at such superficial level. The preservation of the intangible, namely the sense of place, the quality and experiences the old form bestows, and the values are of utmost importance as well for the cultural legacy to sustain.

It is for these reasons, the thesis proposal may not resemble anything like the traditional courtyard house in Beijing at first glance. However, as you venture deeper, maybe you can find resonances through the layers of thresholds, the sceneries in the various courtyards, the viewing frames, the wandering paths between buildings, the air, the vegetation and the quality of light falling in any given spaces.

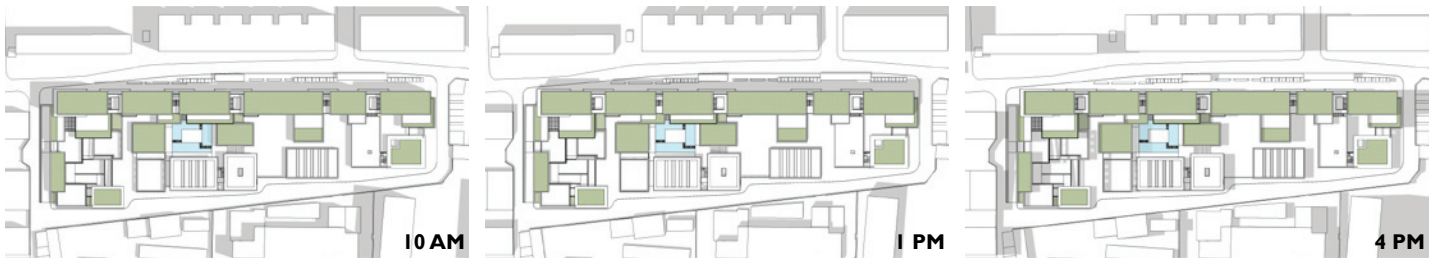
To clearly demonstrate the features inherited from the traditional typology discussed in the previous chapter, the project unfolds in similar sequence:

- Siting: design decisions based on local conditions;
- Layering: the hierarchical relationship; and
- Interlacing: aesthetics, functions and nature.

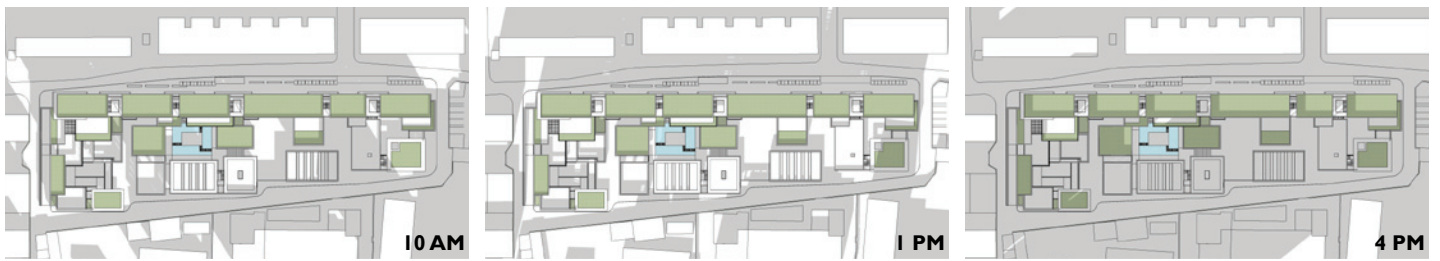
4.2.2 Site Shadow Study: March 20 / September 23



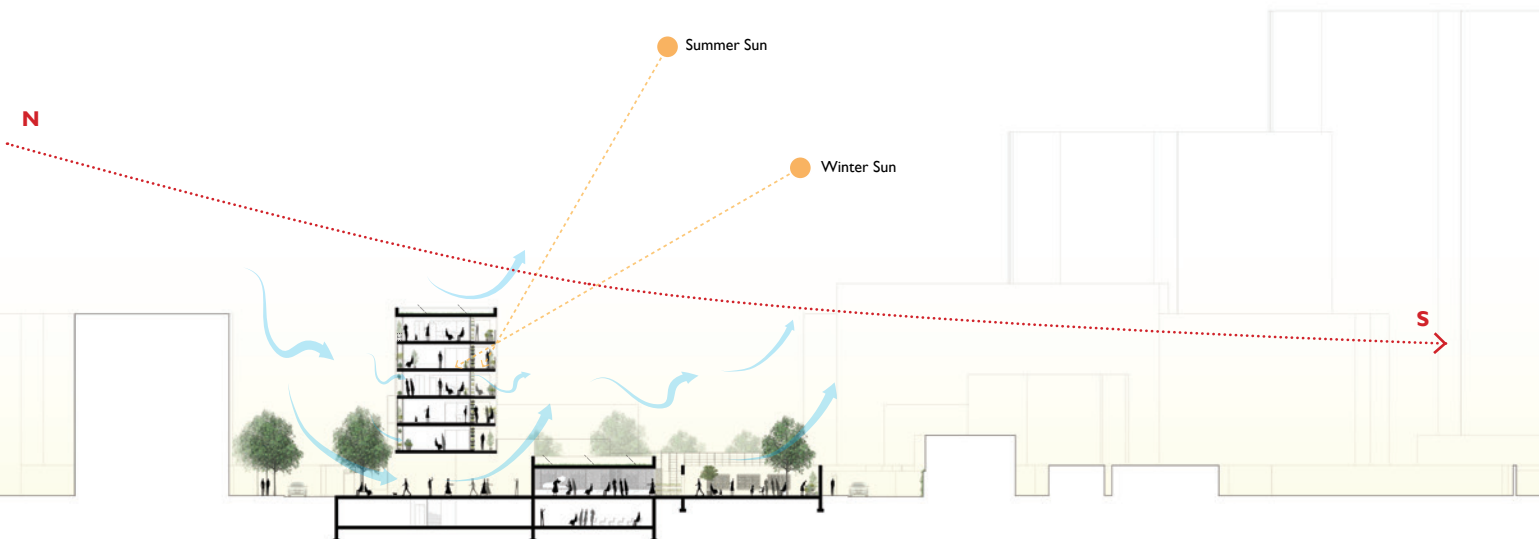
4.2.3 Site Shadow Study: June 21



4.2.4 Site Shadow Study: December 21

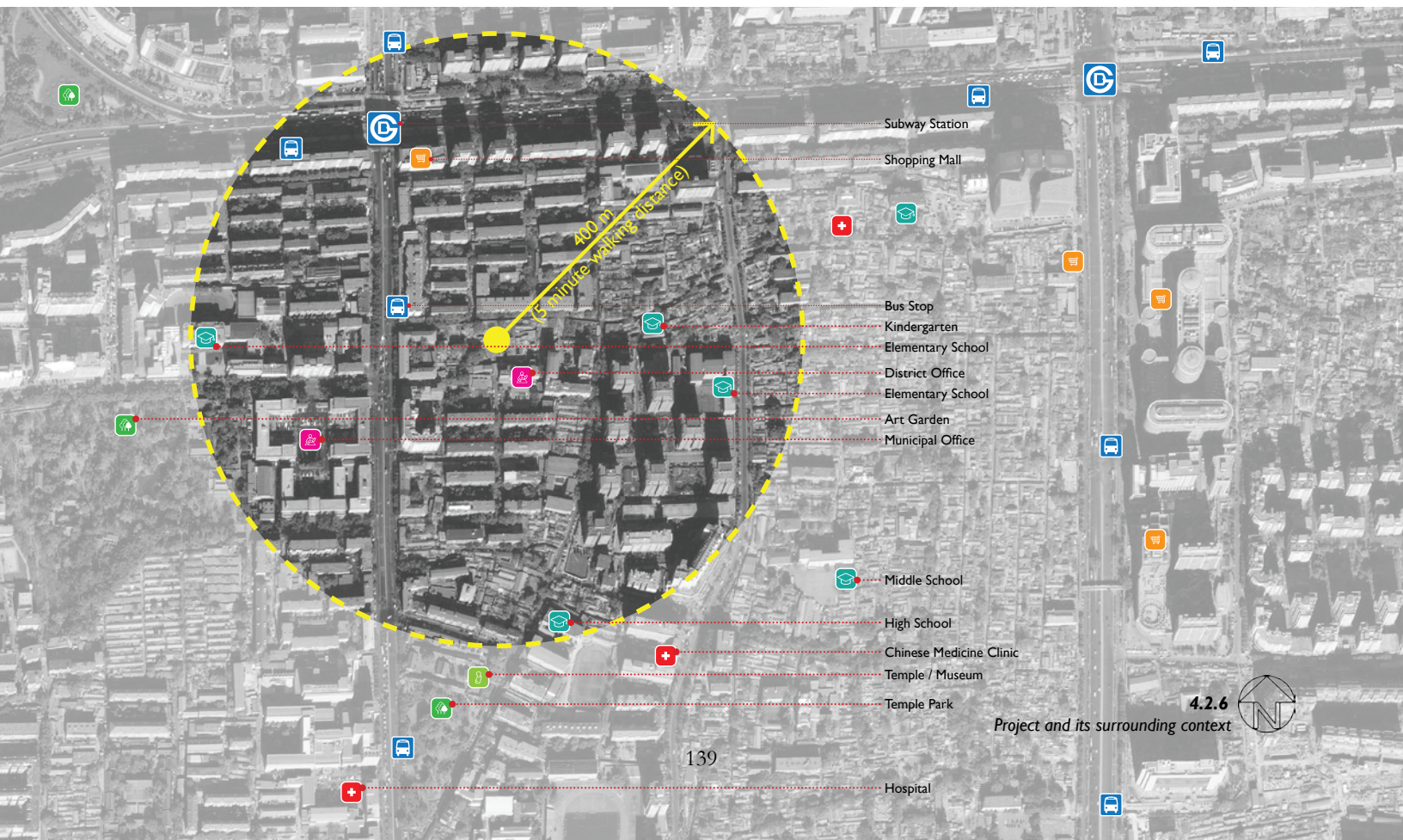


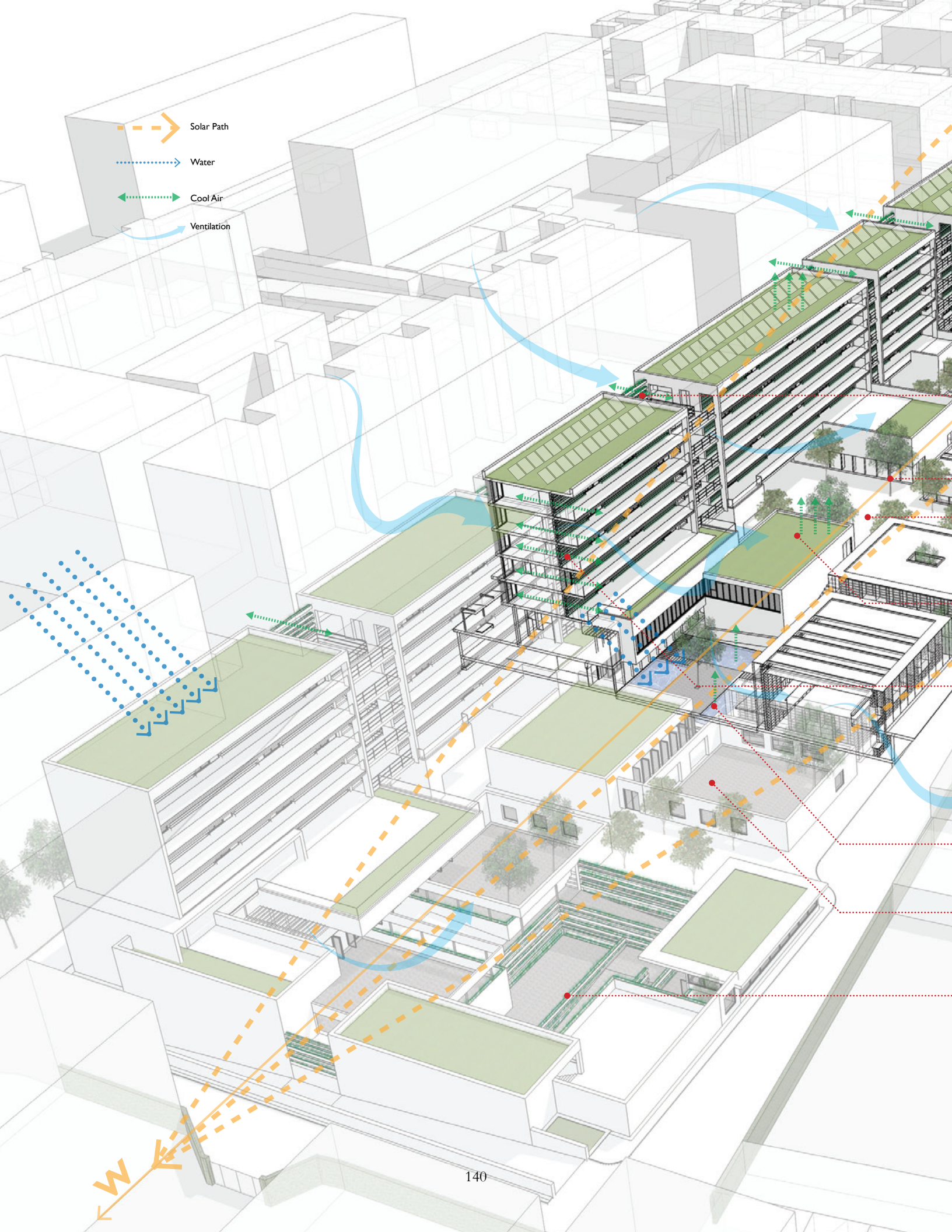
4.2.5 Site Section | 1:750



Siting: design decisions based on local conditions Learning from the previous chapter, climate governed the majority of the design decisions in a traditional courtyard. Passive systems were in great demand to fully utilize the natural forces to create a livable environment. However, there were not many choices to further enhance the green performances of the traditional typology at the time. Nowadays as technology advances, many sustainable and high performance products are developed. It is time to rethink the design to bring building performance to its maximum potential, so the buildings can place less burden on our precious environment. Because the ancestral methods began with passive strategies for climate control to reduce energy requirements (the first step in achieving sustainable design), the reliance on other systems is minimized. Thus the design proposal first adapts the courtyard scheme to create a vernacular typology that is climate responsive. Then by integrating new building products and technology, further enhancement is made possible, which was once unable to realize. Following the principle of *zuobei-chaonan* 坐北朝南, “*sitting north and facing south*”, the tallest volumes housing residential functions are placed at the north end; whereas the lower public functions and courtyard spaces are placed toward the south. Along with the shifting of position and height, overshadowing is avoided. The taller volumes act as the barrier against the intrusion of harsh wind and noises. With such configuration, the qualities of light, heat and air are optimized for a pleasant and comfortable living environment.

The close proximity to major streets, transit systems, monuments, other residential communities, and amenities such as schools and hospitals determines the programs in the proposal. Based on the local conditions, the project strives to offer some purpose to the community at large.







June 21

March 20 & September 23

December 21

Respect Solar Orientation The principle of *zuobei-chaonan*, “sitting north and facing south” is used by placing the tallest volumes on the north end and the lower volumes towards the south. Along with the shifting of position and height, overshadowing is avoid.

Green roofs are used on the residential blocks to protect interior from the extreme solar heat, and to facilitate drainage and water collection. The greenery modifies the microclimate and contributes to the reduction of urban heat island effect.

Solar panels are installed on the roofs to harvest solar energy for the building use.

Trained climbing or trailing plants grow on the site walls forming a **green wall** that enhances view, as well as purifies and cools air of the surrounding community.

Vertical green planter wall is placed on the north side of the residential circulation courtyard to filter out the exhausts and noises from the city. In addition, the green-filled wall enhances views, as well as purifies and cools air of the surrounding community.

Most existing trees are preserved on site.

Permeable paving is used on site to facilitate drainage and direct water to stormwater collection mechanism underground. The occasional greens pop out along the edges of the paver give lightness to the ground.

Green roofs are used for the public functions to protect interior from the extreme solar heat and to facilitate drainage. The greenery modifies the microclimate and contributes to the reduction of heat island effect. The lower green roofs also provide pleasant sceneries for the residences.

Vertical green planter wall is placed in front of residential units as a reinterpretation of the courtyard in the vertical direction. It enhances view and encourages planting, which is an important traditional pastime. The greenery is able to modify the microclimate, purify and cool air, and facilitate natural ventilation. Furthermore, it is a screen that protects the interior from direct sunlight. The strong direct light is filtered and changed to ambient light as it enters the living space. The shadow of the greenery also provides interesting patterns based on the changing time and seasons.

Sunken water courtyard acts as a water collection mechanism on site. The water body purifies, cools and humidifies the surrounding air. It also facilitates natural ventilation.

Traditional roof tiles are **reused** as pavement in the program courtyards. The gaps occur naturally in between the tiles create a permeable paving that facilitate drainage. Drainage gutters are hidden under the apron that surrounds building for better appearance.

Encourage planting local vegetation The project rigorously plants new trees, shrubs and flowers of different types to create varied sceneries in miniature. Many different spaces are provided for the residents to engage in this traditional pastime as well.

4.2.7

Comprehensive Design Diagram



4.2.8 View from the east end of Sanmiao Jie



Economic Offerings

From a building construction perspective, a sustainable design in general may cost more to construct. This is the reason why many profit driven developers turned away from being “green” for cheaper constructions. However, they often overlooked the expensive operational and maintenance cost of such development. Green design may be expensive, but not so expensive if we are looking ahead ten or fifty years from now. Through the better use of materials, insulation, and more efficient lighting and HVAC systems, the savings can be tremendous in the long run. These savings not only lift off the monetary burdens of the residents from high utility costs, but also free the environment from energy intensive buildings and pollutions.

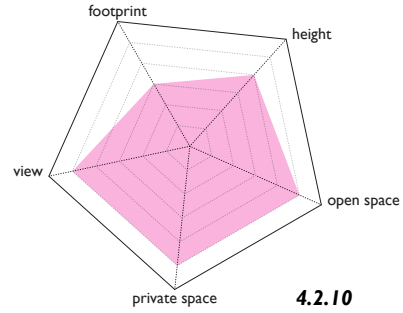
Commercial functions such as restaurant, shops, market square and youth hostel are integrated in the proposal. These programs not only add value to place-making and social interactions, they help to generate a healthy community economy as well.



4.2.9 Permanent and temporary market vendors along Sanmiao Jie



Habitable Floors : 5 residential levels
Residential Density : 172 units per hectare*
FAR : 1.80 site
 2.08 residential only*
Living Space per Capita : 31 m² unit
 36 m² unit + deck



4.2.10
Star diagram of design proposal

Property Type : Private Housing

Demographics : White-collar workers
 Retirees

* Because the project is of a mixed use nature, large portion of the site is dedicated to the public functions. Thus, for the density to be more comparable with the surrounding typology, the figure is obtained by assuming a region for residential use only within the larger site, which is about 5 m offset from the residential floor plate.



4.2.11 *View from the west end of Sanmiao Jie*

Addressing Density

The intrinsic value of land dictates a high land-use intensity in the city centre. It is crucial to increase housing density so as to match the land value in the central areas. However, to be sustainable, the solution is not to increase density at all cost to rival the densities of the surrounding communities, which are often overpopulated and unpleasant to live. Thus the goal in the new development is to obtain decent amount of density while to create an agreeable living environment. Because the proposal is of a mixed-used nature, the insensitive pursue of density will defeat the purpose of improving the quality of life of its inhabitants and creating a park-like space that encourages social interactions. Furthermore, it is important to not ignore the city's planning for its future in order for the project to be feasible in the long run.

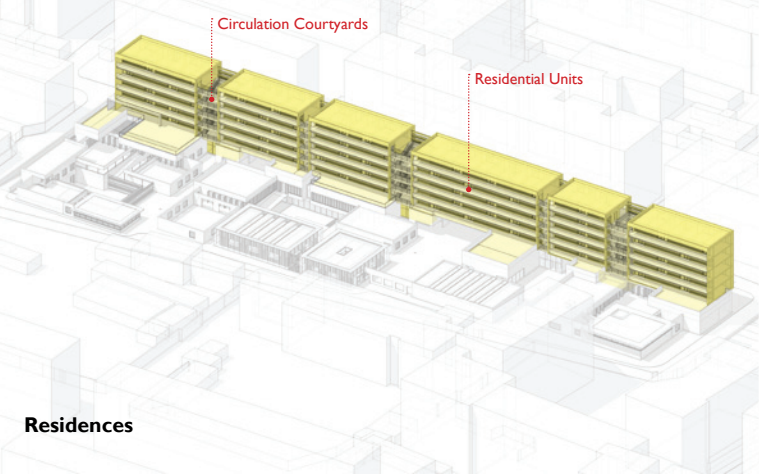
With a population exceeded 20 million at the end of 2011, the Old City of Beijing is overpopulated and decentralization is deemed necessary. According to *Beijing City Master Plan 2004 – 2020*, the city is to adopt the “two axes, two corridors and poly-centres”¹ model. The goals of the new strategic plan are to decentralize the urban functions on the basis of environmental protection, to reduce population growth and concentration inside the old city centre, to raise the social and ecological qualities, and at the same time, to create a humanistic and habitable city.² In addressing density, the aim is to control population size at approximately 18 million people by 2020. In the historic centre within the 2nd Ring Road, the population is to be relocated to the surrounding metro centres, reducing the current population of 1.4 million to 0.8 million.³ Such that some breathing room can be created and the living condition can be improved.

The current policies and planning projections reinforced the thesis proposal approach in dealing with housing density on site. It provided an opportunity to develop without taking density as the top priority, but focusing more on the provision of a pleasant environment for both the individual and the community. It is so sustainability is attained.

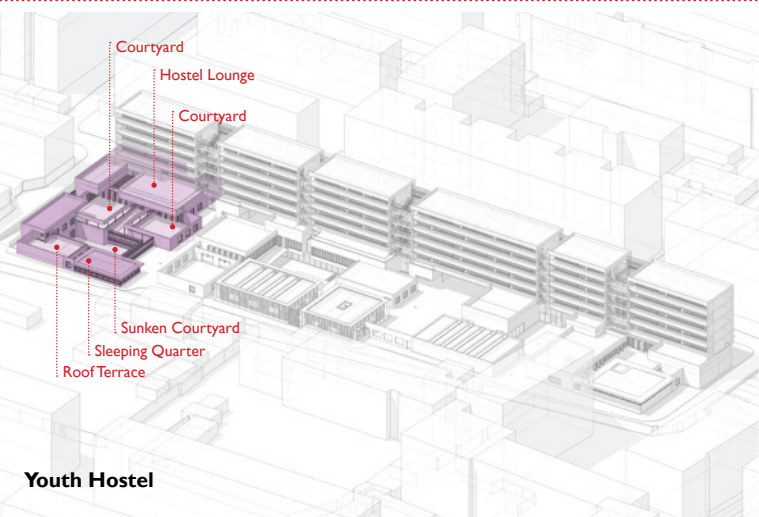
¹ The “two axes” are the east-west Chang’an Avenue and the north-south ancient axis crossing at central Beijing. The “two corridors” refer to the eastern development zone and the western ecological zone. The “poly-centres” consist of medium-sized and small-sized town nodes spread across the region.

² “Beijing chengshi zongti guihua (2004 – 2010) 北京城市总体规划 (2004年 – 2020年) (Beijing City Master Plan 2004 – 2020),” accessed December 3, 2012. http://www.bjpc.gov.cn/Ezgh_1/cszzgh/200740/4195452.htm.

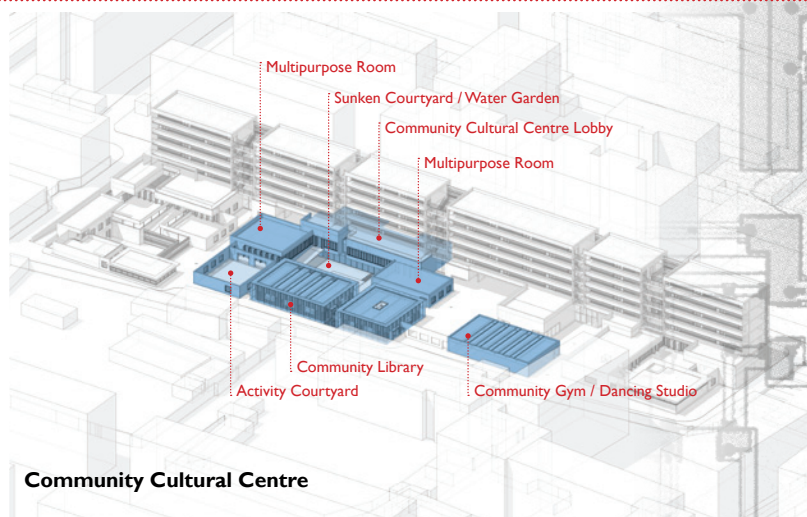
³ “Beijing zhongxincheng guihua jianyi 北京中心城规划建议 (Planning Advice on Beijing City Centre),” last modified August 16, 2007. http://news.xinhuanet.com/local/2007-08/16/content_6540206.htm.



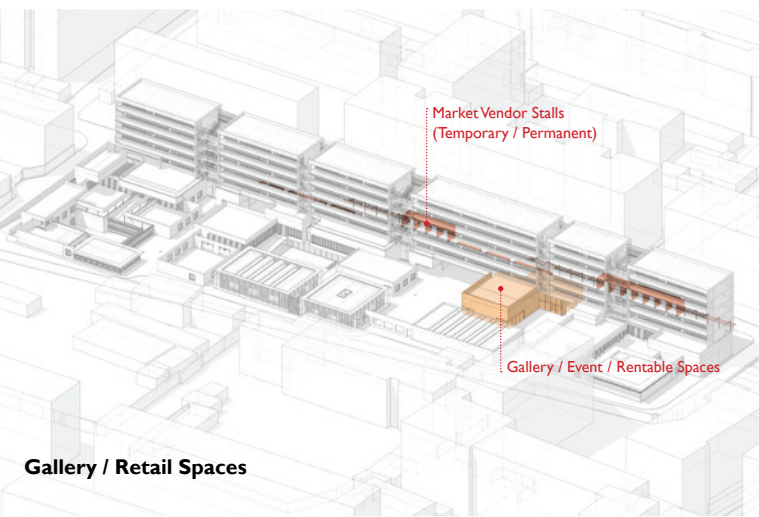
Residences



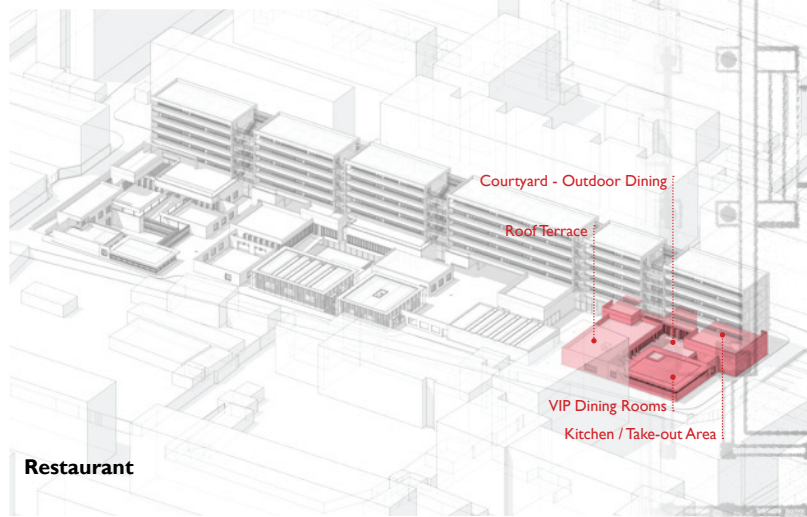
Youth Hostel



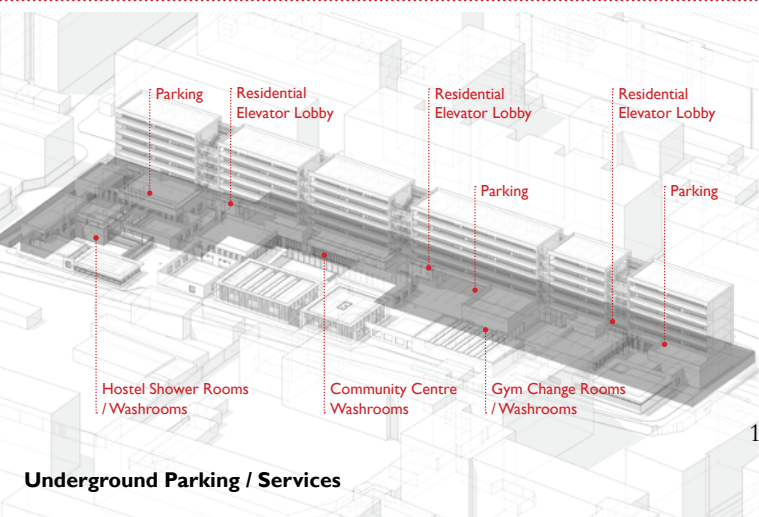
Community Cultural Centre



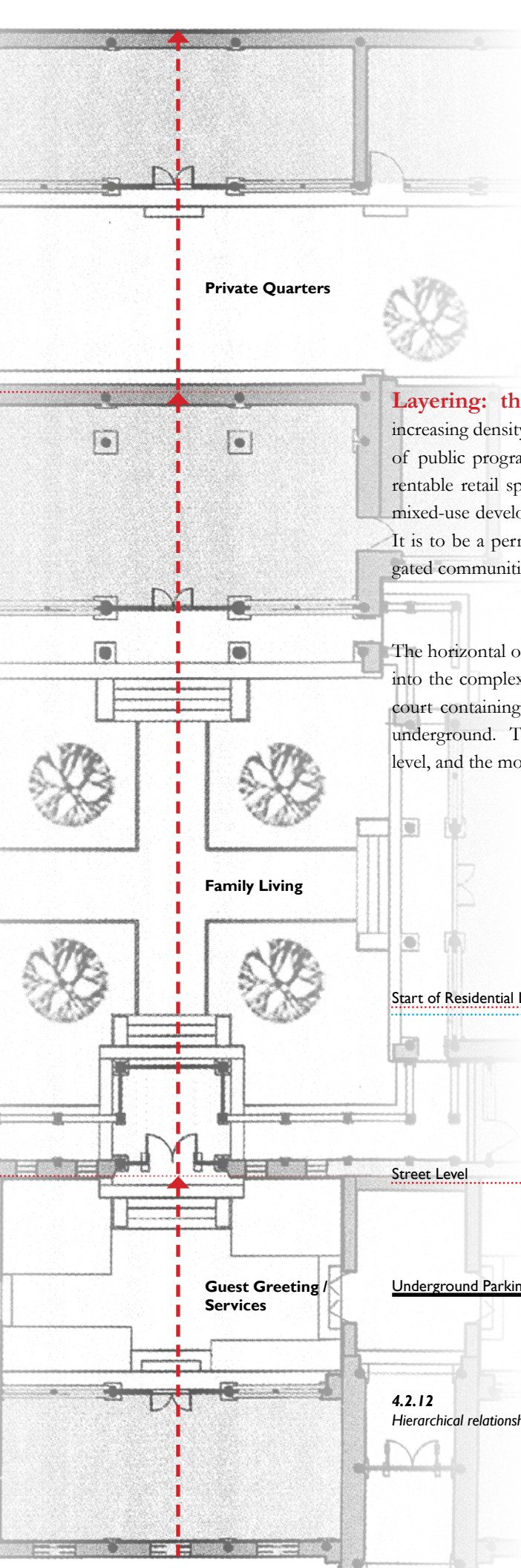
Gallery / Retail Spaces



Restaurant



Underground Parking / Services



Private Quarters

Family Living

Guest Greeting / Services

Layering: the hierarchical relationship

To address the pressing needs for increasing density while maintaining a sense of community, the proposal features a series of public programs consisting of youth hostel, community cultural centre, restaurant, rentable retail spaces and market square, along with residential functions above. The mixed-use development aims to promote local culture and encourage social interaction. It is to be a permeable park space that welcomes everyone in contrast to the enclosed gated communities.

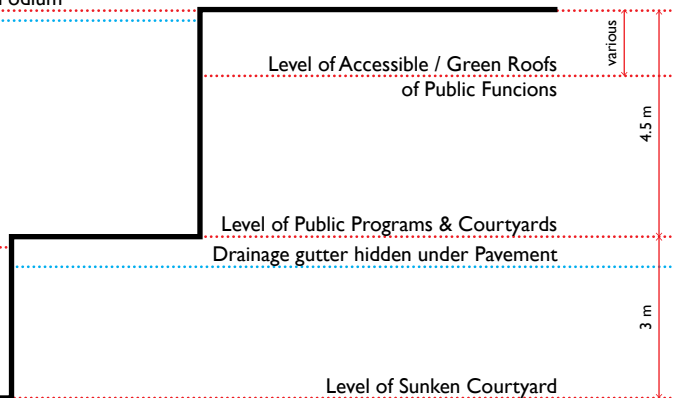
The horizontal organization of the traditional courtyard, where privacy increases further into the complex, is translated on the vertical axis in the design proposal. The service court containing public washrooms, back of house functions and parking are located underground. The “family court” containing community functions are on the ground level, and the most private residential units are located above.

Start of Residential Level on Podium

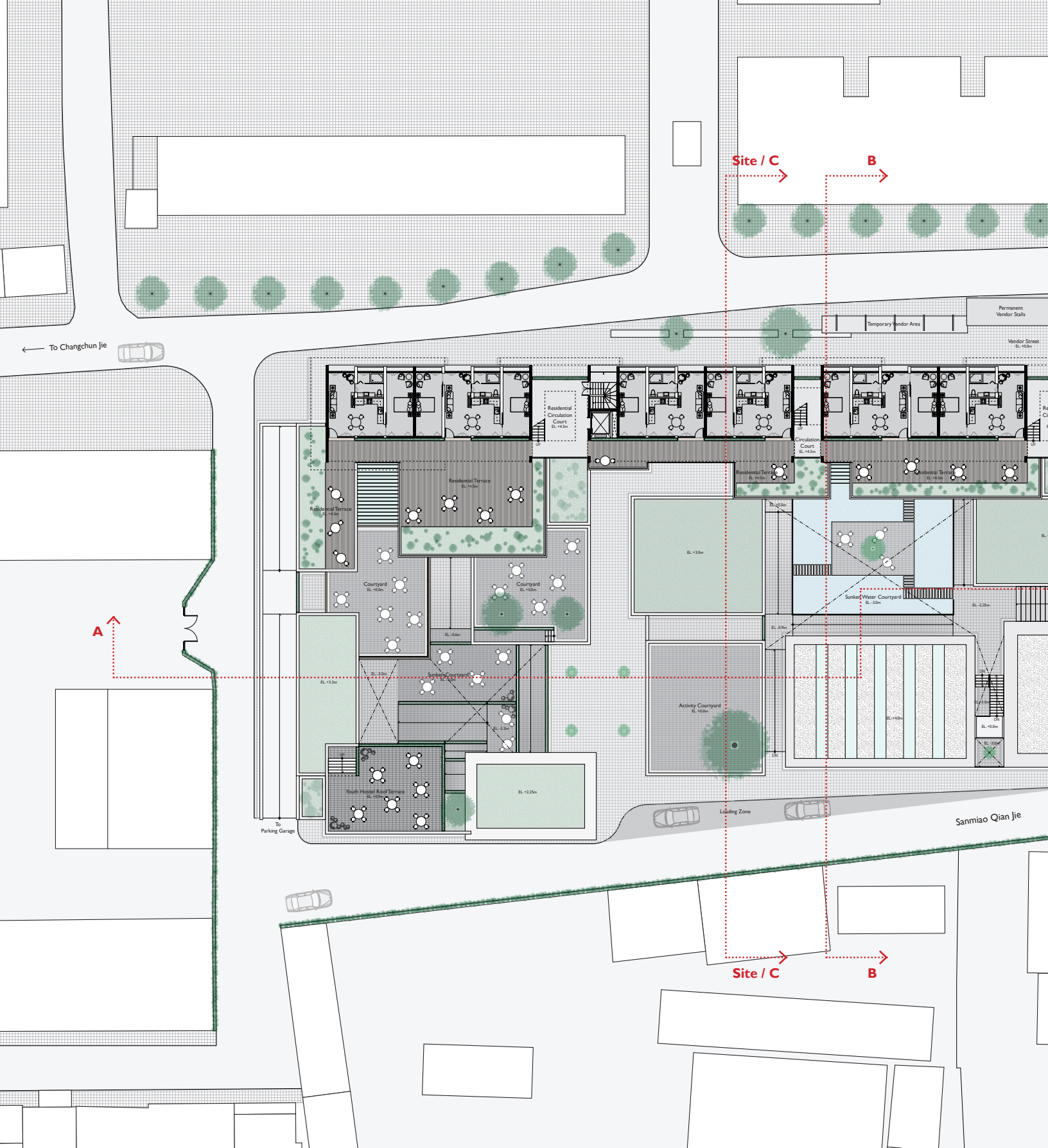
Street Level

Underground Parking Level

4.2.13
Level change illustration



4.2.12
Hierarchical relationship between program functions in comparison to the traditional courtyard typology



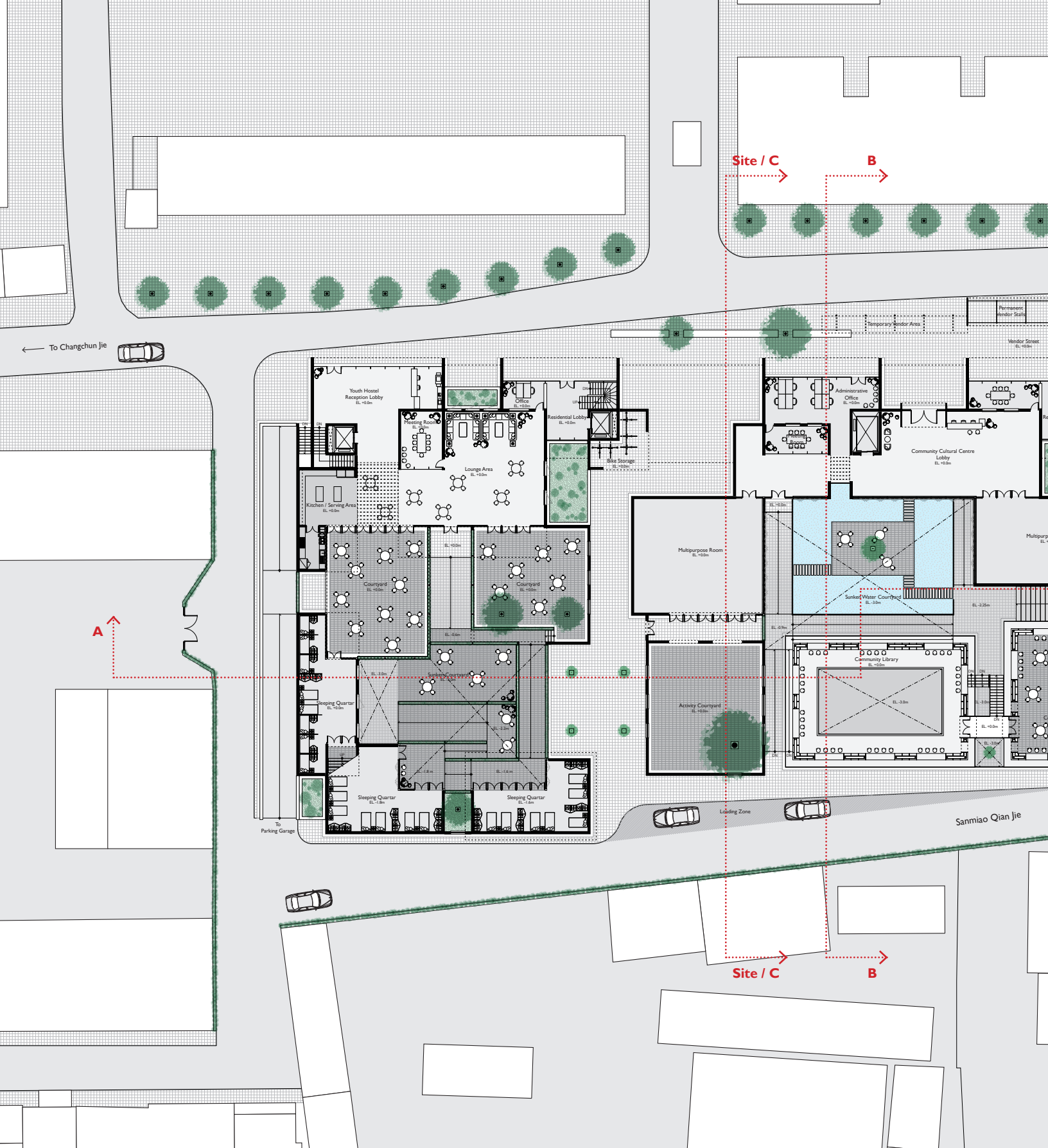


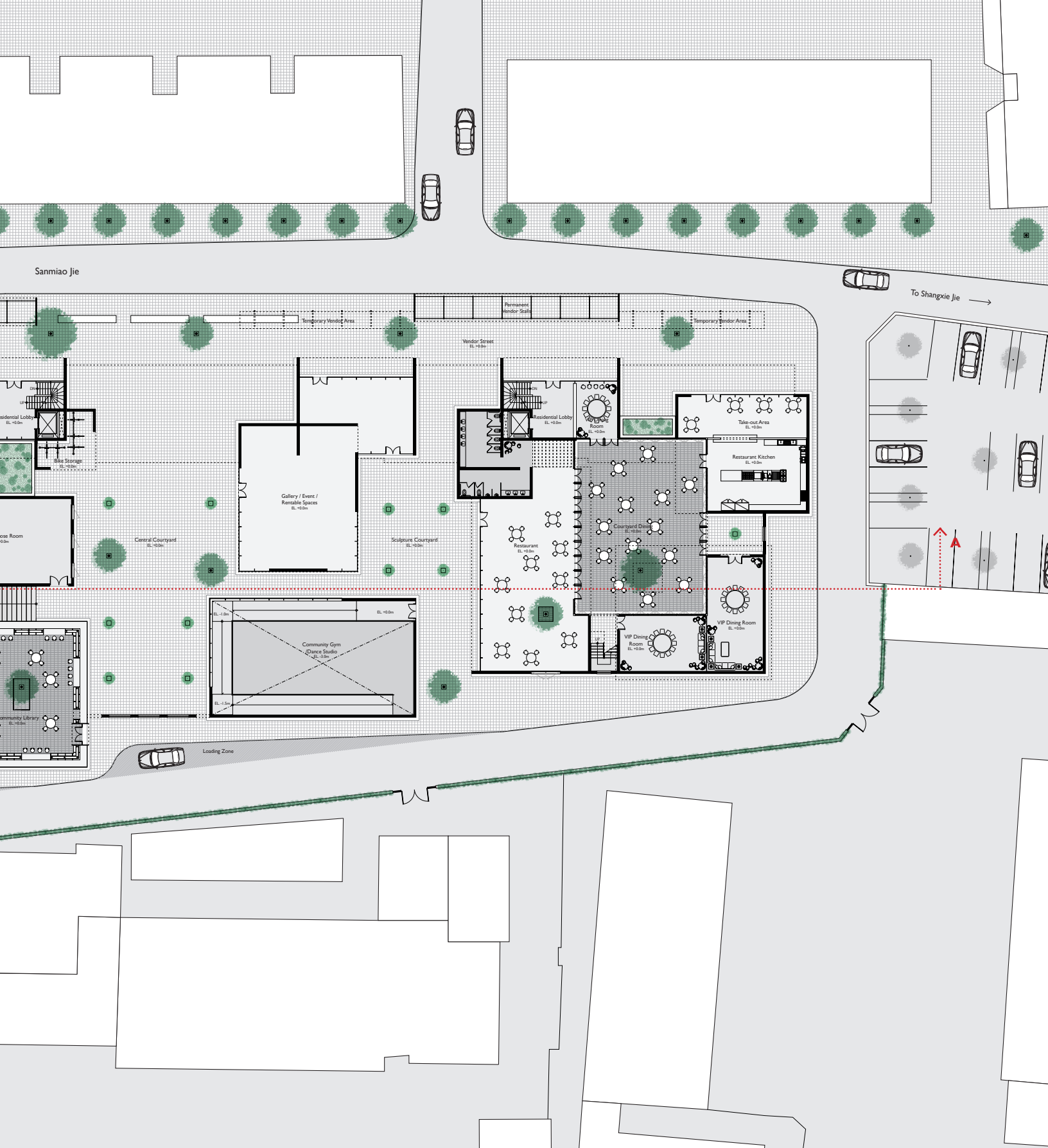
Sanmiao Jie

To Shangxie Jie →

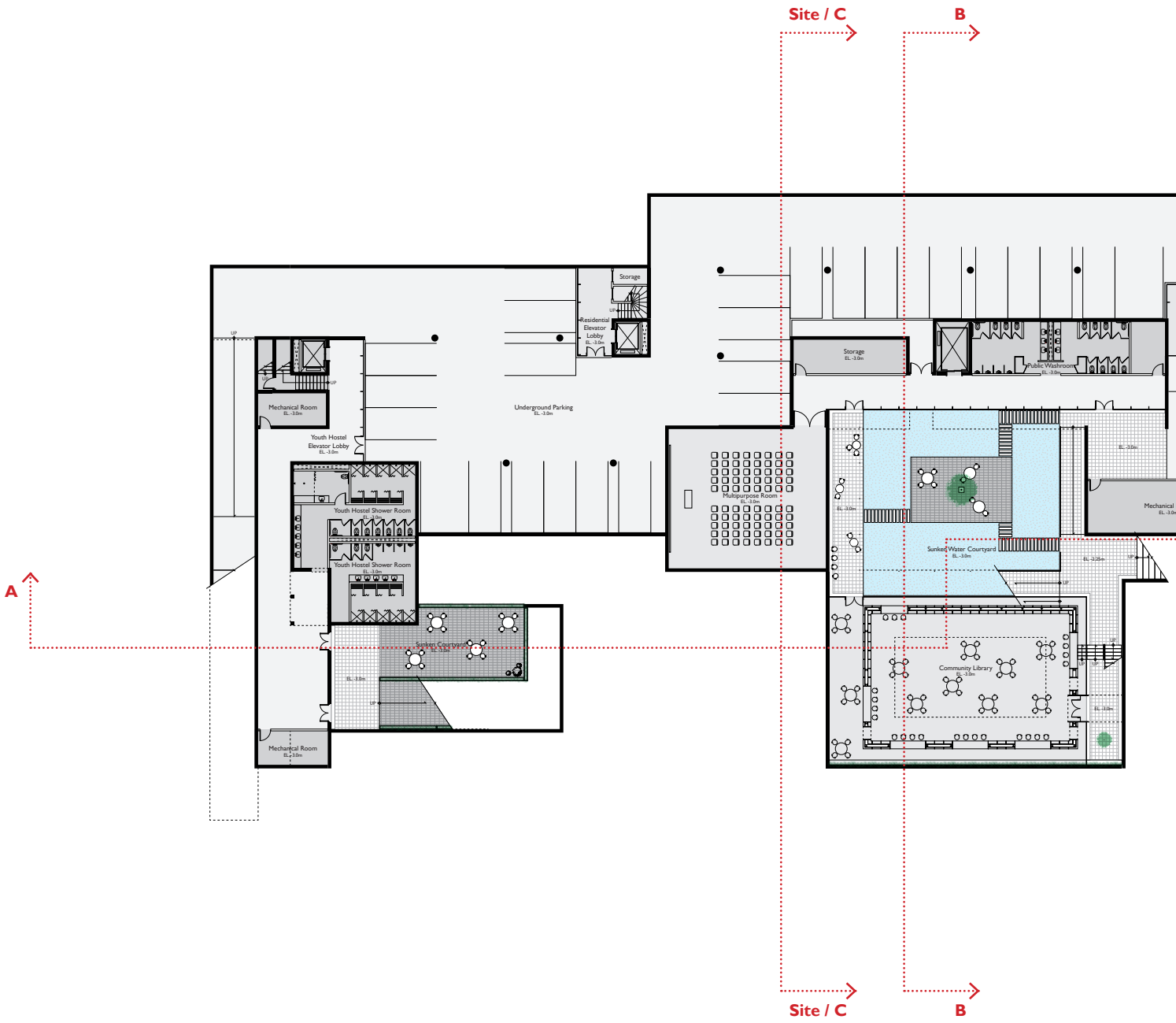
4.2.14
Level Two Plan: Residential Units
 1:500

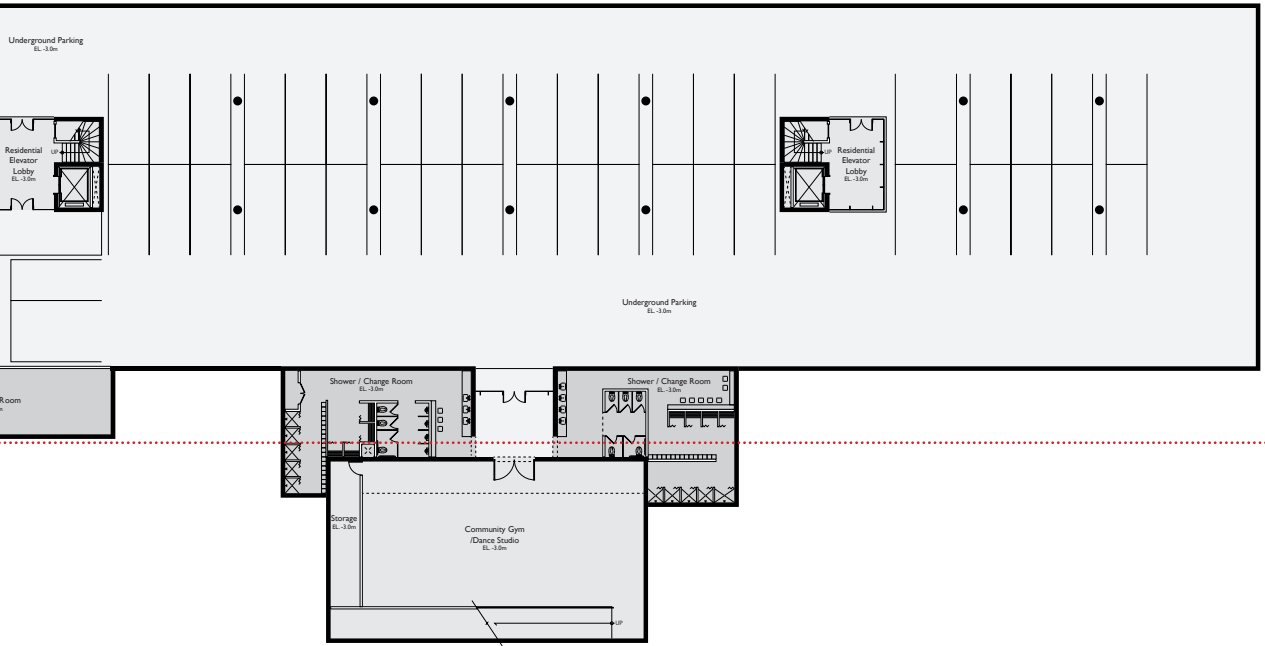






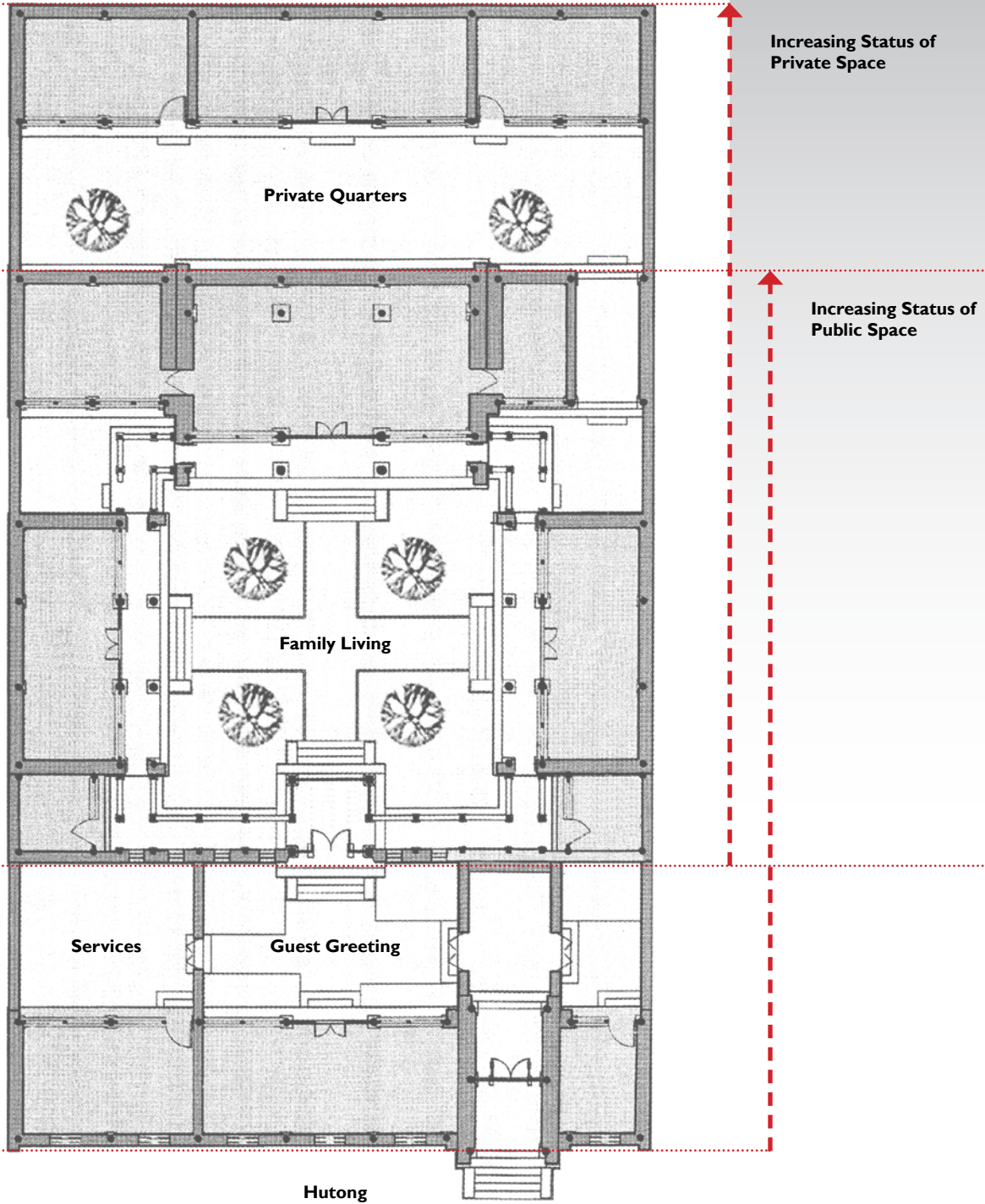
4.2.15
Ground Level Plan: Public Functions
 1:500 





4.2.16
Underground Level Plan: Service / BOH Functions
 1:500





4.2.17 Hierarchical relationship between public and private spaces in comparison to the traditional courtyard typology

Circulation Decks

Restricted Access
Residents Only

Circulation Courts

Restricted Access
Residents Only

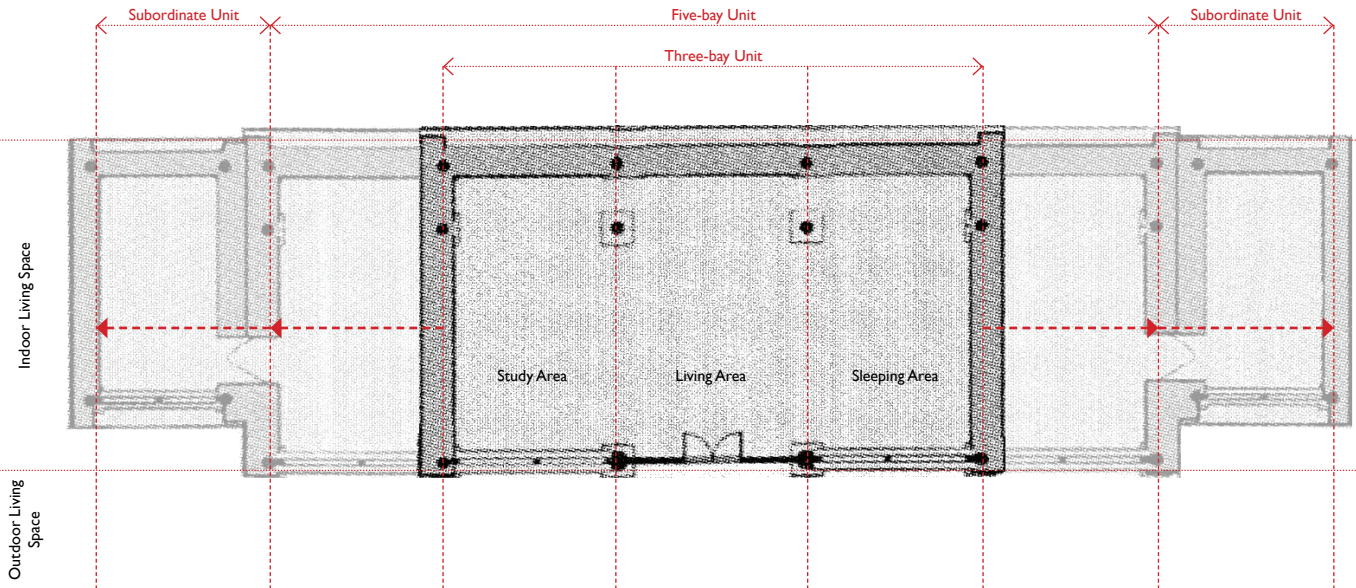
Program Courtyards

Controlled Access for All

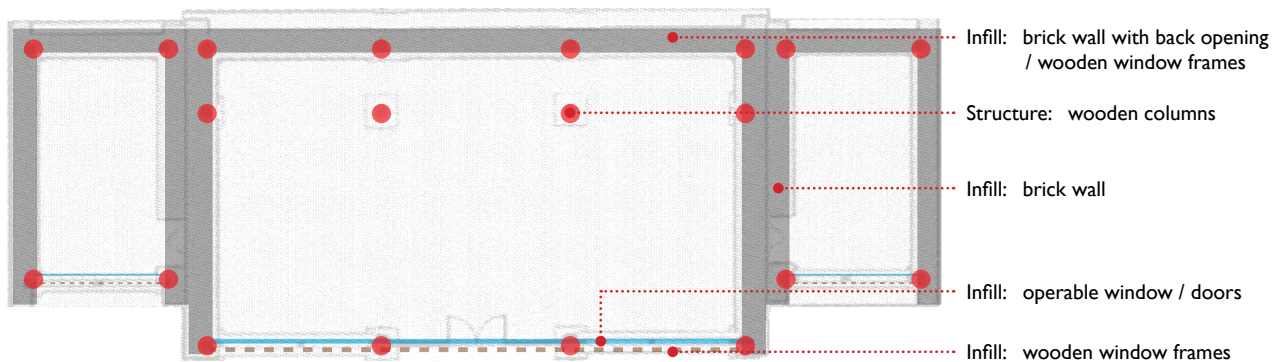
Open Courtyards

Free Access for All

The proposal adopts the bay configuration by featuring a modular organization of living area, dining kitchen and bedrooms, each occupies a bay of 3 m wide by 7 m deep and 2.7 m high. The spatial hierarchy is similar in terms of the centralized living area with the private sleeping area off to the sides. The circulation corridor becomes the covered outdoor deck that serves as a buffer between the exterior and interior, as well as a transitional piece before one steps into the more private realm, very much like the veranda space in the traditional courtyard.

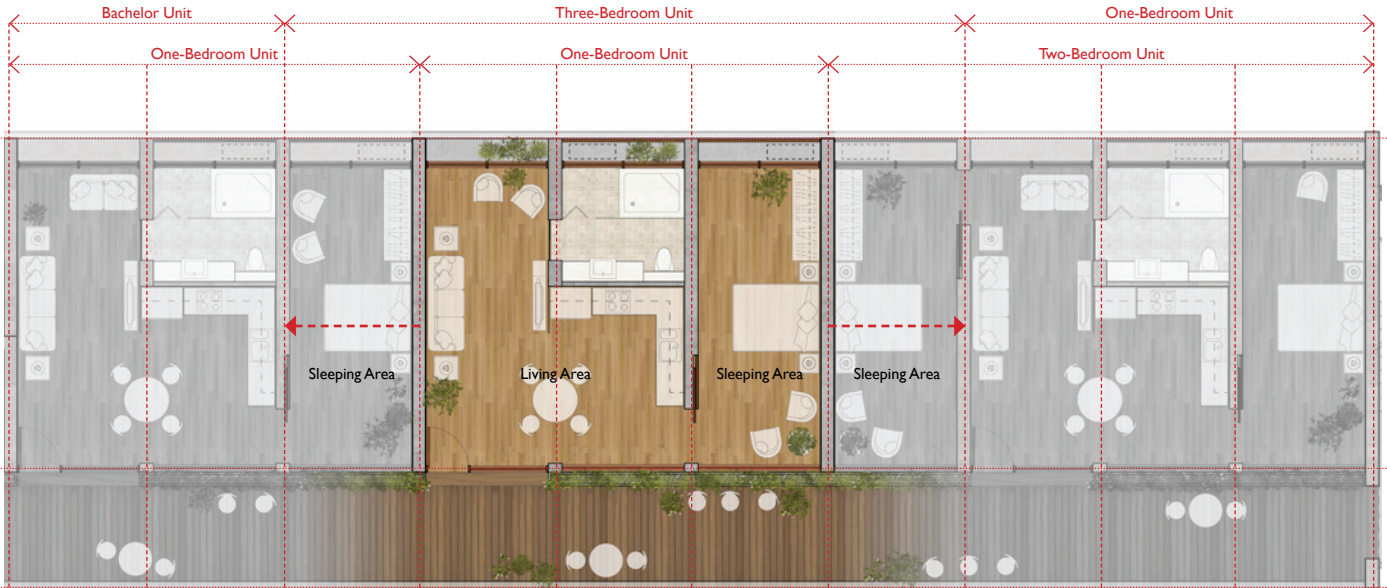


4.2.18
Illustrative diagram showing transformation of a three-bay building into a five-bay structure with subordinate wings by adding another set of equally spaced columns in the traditional courtyard house.

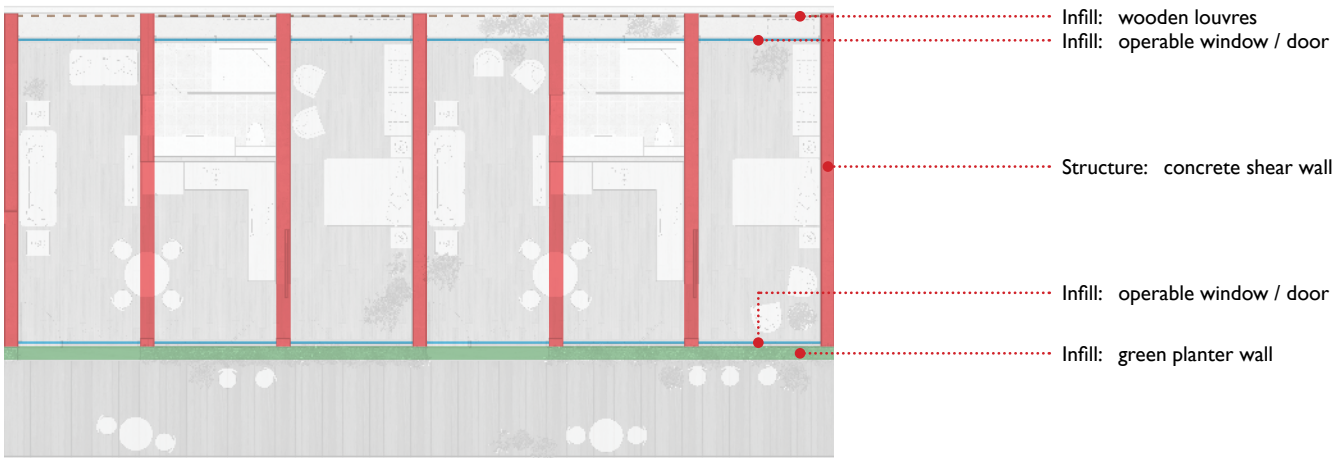


4.2.19
Hierarchical relationship between structural and non-structural elements in the traditional courtyard typology

The structural divisions allow large openings to be placed on the north and south façade. The double layering of planter wall as an external shading device and the operable glazing system as the interior barrier further enhances lighting, heating and natural ventilation of the entire complex. Alteration is also made easy without disruption due to the modular configuration. The three-bay one-bedroom unit can be expanded easily into a four- or five-bay unit. The surrounding units will adjust accordingly: shrinking into a two-bay bachelor unit or a three-bay unit.

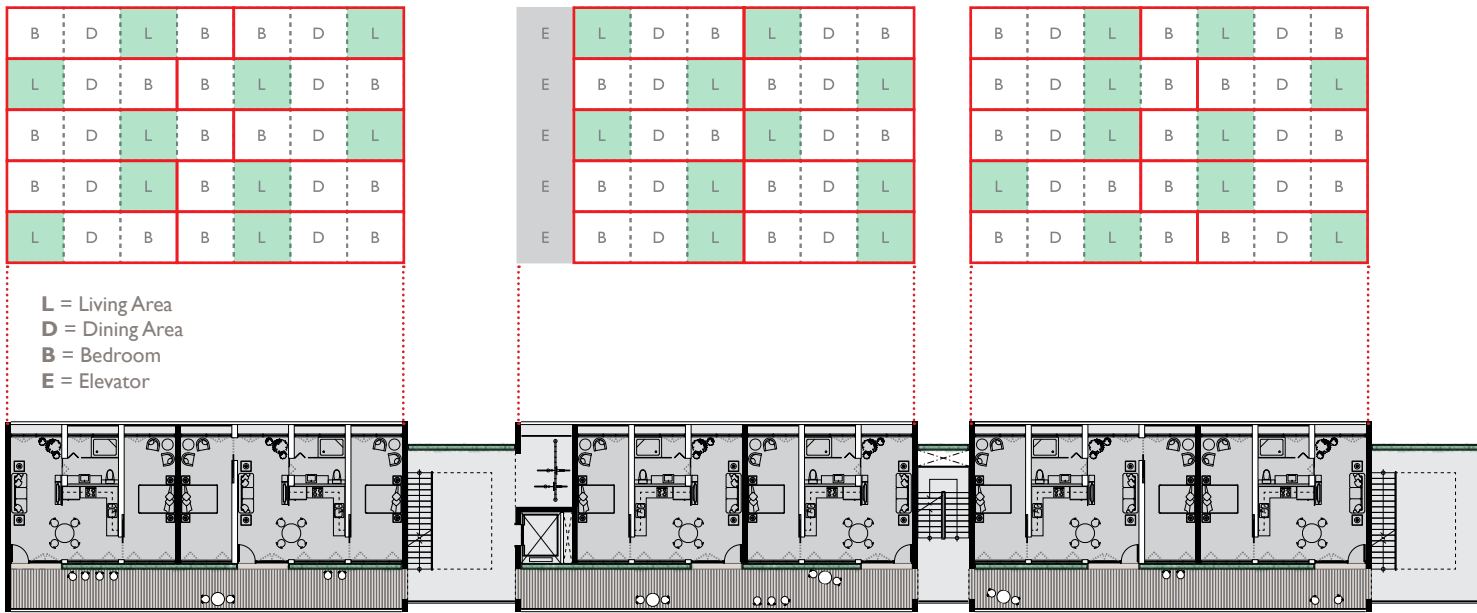


4.2.20
Illustrative diagram showing possible unit configurations for expansion



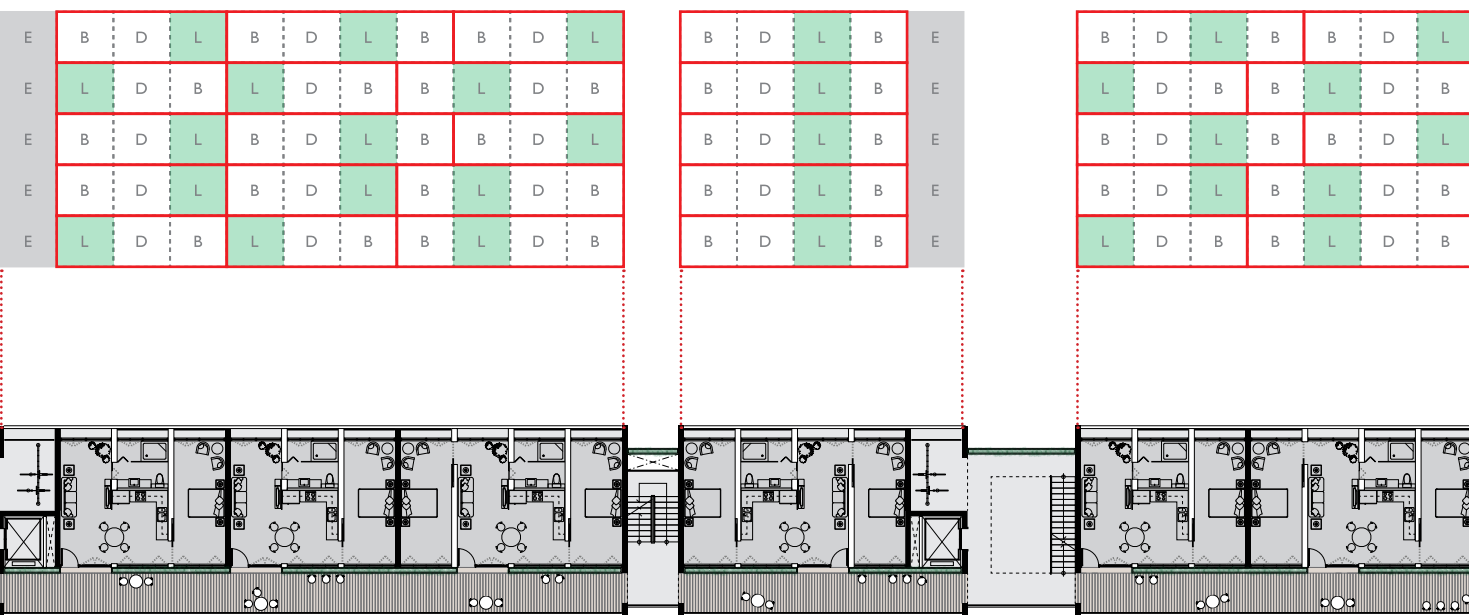
4.2.21
Hierarchical relationship between structural and non-structural elements in the design proposal

4.2.22
Residential Unit Configurations in Elevation



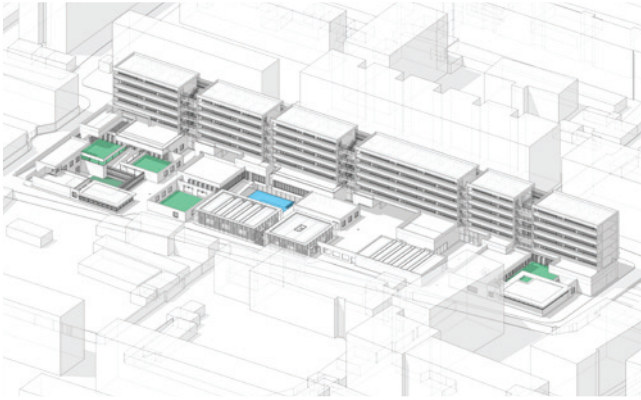
4.2.23
Typical Residential Plan | 1:500



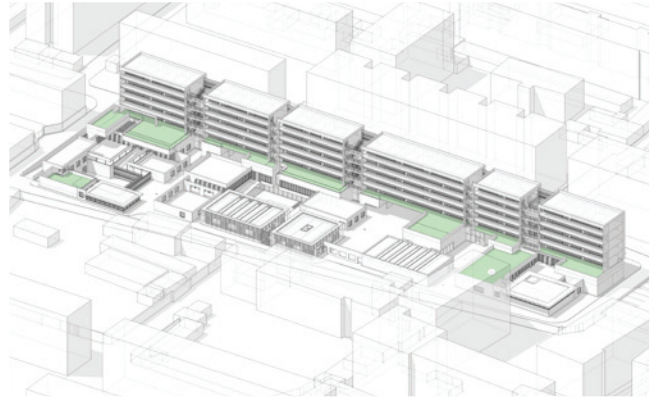


4.2.24
Residential Unit Plan
 1:100 

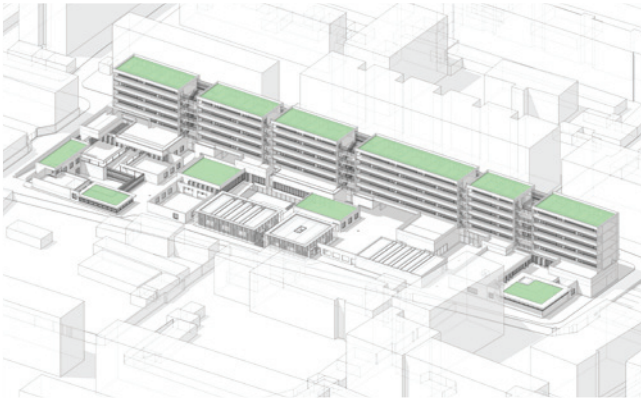
4.2.25 Type of "courtyards" and location



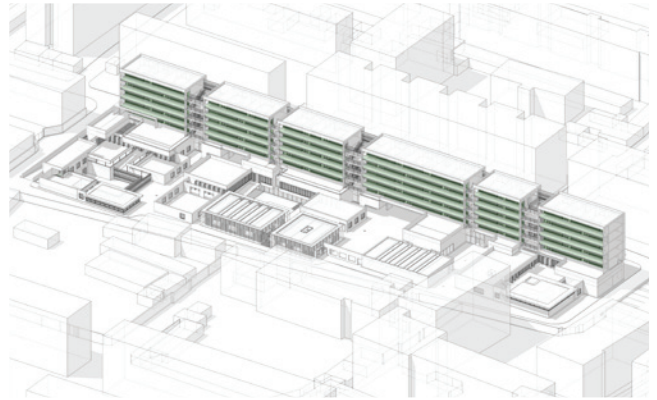
Courtyards on the Ground



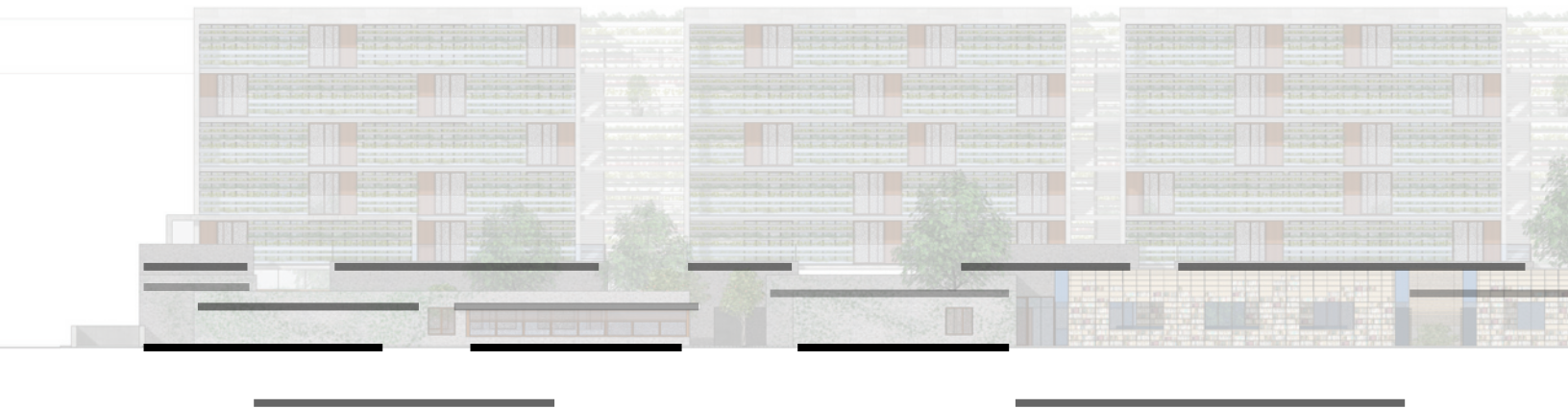
Accessible Roof Gardens



Green Roofs integrated with Service Elements



Residential Green Planter Wall: Vertical Courtyards



4.2.26 Diagrammatic representation of the green platforms

Interlacing: aesthetics, functions and nature Famous Chinese novelist Lao She wrote in his essay “Fond Memories of Beiping⁴” that “*in Beiping [Beijing], one always finds nature in this man-made city. The city as a whole is neither too crowded nor too secluded. Even houses tucked away in very small lanes have their own courtyards and trees; and the most secluded places are not too far from the business and residential districts. [...] The good thing about Beiping is not its having perfect design everywhere, but its having space everywhere for one to breathe freely. The beauty of Beiping does not rest solely on its architecture; rather, it is the space around each building that adds to its architectural beauty.*”⁵ In the modern city, big plazas with hard concrete paving and closely spaced high-rises filled the city core. This uniquely intimate spaciousness and its accompanying sense of peace and quiet existed in the traditional city have long been lost.

Built Form, Nature and Culture

The new courtyard design reintroduces the nature and the intimate breathing space, especially for the sake of the children and the elderly. The integration of accessible design, such as the ramped paths, allows people of every age and ability to reside and participate in the community throughout their life. The provision of generous tree-lined sidewalks, spaces for bicycle storage, and the close proximity to the major street make it easier for people to travel by foot, bicycle and transit. The mixed-use nature also welcomes and brings together everyone, which strengthens the social networks.

To make the new courtyards comfortable, the design carefully controlled the height of the surrounding buildings to avoid creating the feeling of being in a well-like hollow. Careful furnishing with trellises, benches, lamps, paving, and patio spaces improved the function of the courtyards as outdoor living and social spaces. Most existing trees are preserved and incorporated into the courtyard space. The project also rigorously planted new trees, shrubs and flowers of different types to create varied sceneries in miniature. Gaps are opened and positioned in such a way to recreate similar pictorial view frames as the traditional courtyard.



⁴ *Beiping* 北平, is the name for Beijing used from 1928 to 1949 during the Republican era. The naming was then reverted to Beijing when Communists conquered the capital during the Chinese Civil War and founded the People's Republic of China in 1949.

⁵ Selected phrase from “Fond Memories of Beiping” written by Lao She in 1936. Essay later included in *Country Wind and City Sound*. The original phrase in Chinese is “北平在人为之中显出自然，几乎是什么地方既不挤得慌，又不太僻静：最小的胡同里的房子也有院子与树；是空旷的地方也离买卖街与住宅区不远。[...] 北平的好处不在处处设备得完全，而在它处处有空儿，可以使人自由的喘气；不在有好些美丽的建筑，而在建筑的四周都有空闲的地方，使它们成为美景。”



d

4.2.27
Market fair in the central courtyard



e

4.2.28
Morning exercise in the central courtyard



f

4.2.29
Dining in the outdoor courtyard



a
Sunken Hostel Courtyard

Circulation Courtyard

b
Activity Courtyard

c
Sunken Water Courtyard



d / e
Central Courtyard

f
Dining Courtyard

4.2.30
Section A
1:200

a



4.2.31
View to youth hostel sunken courtyard from the roof terrace

b

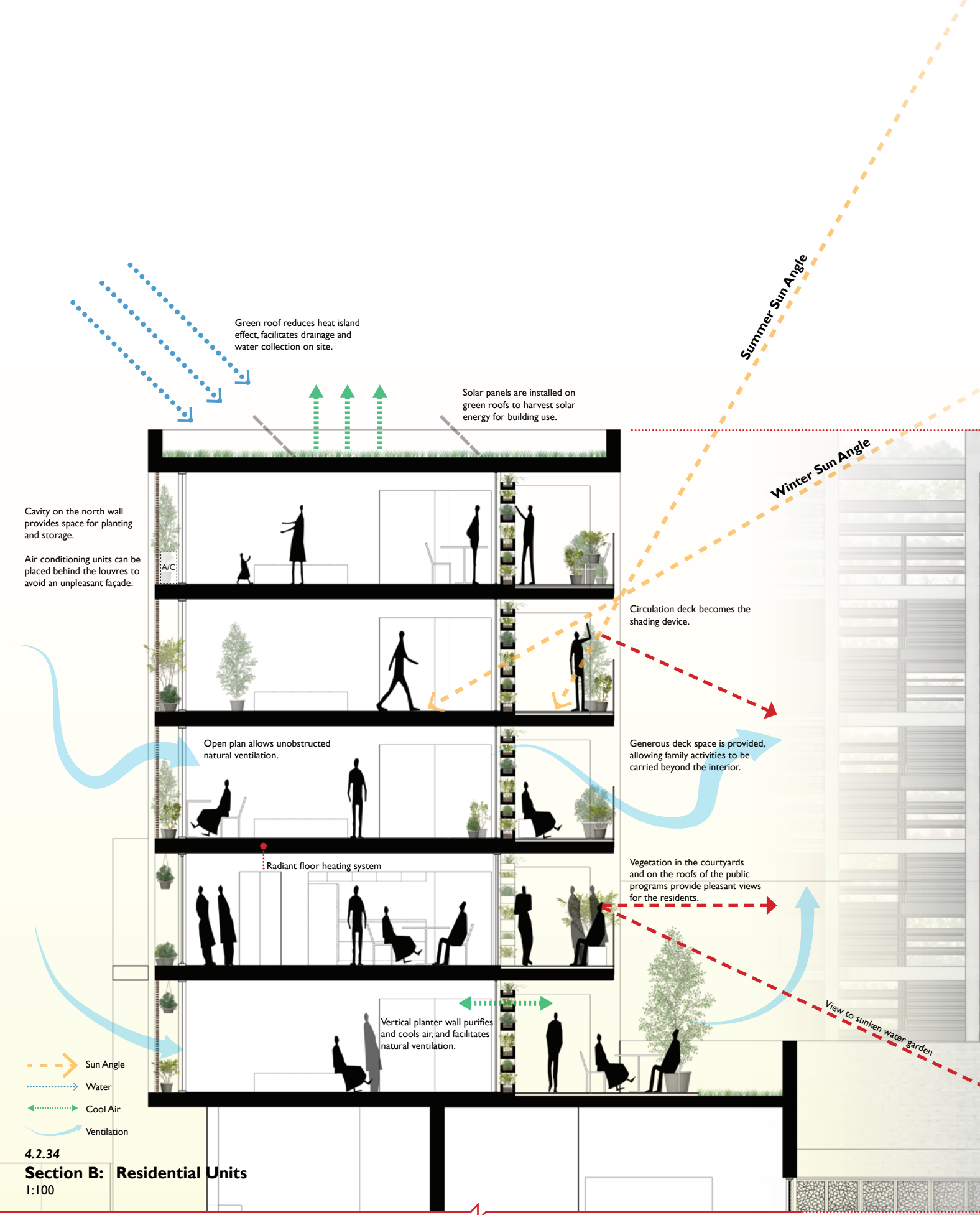


4.2.32
View to activity courtyard in community cultural centre

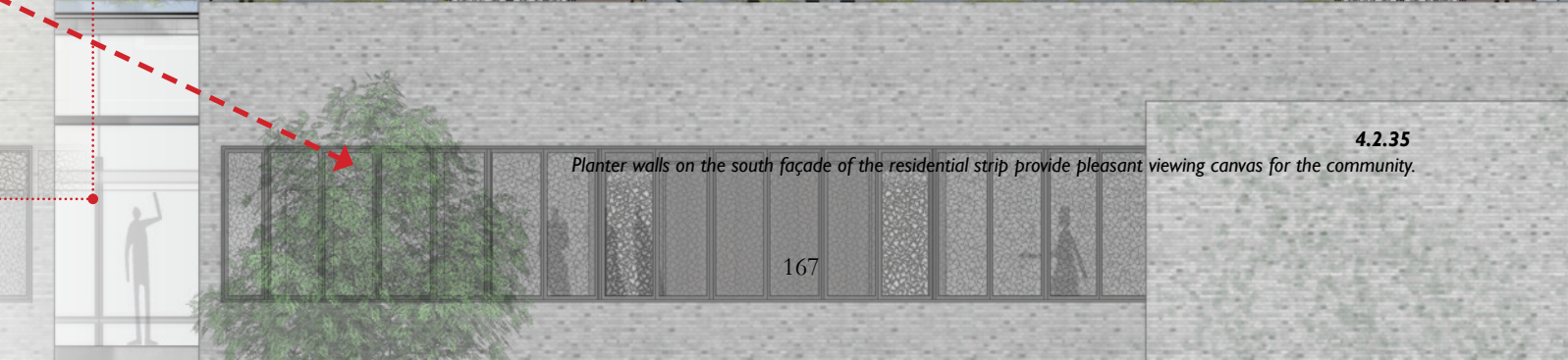
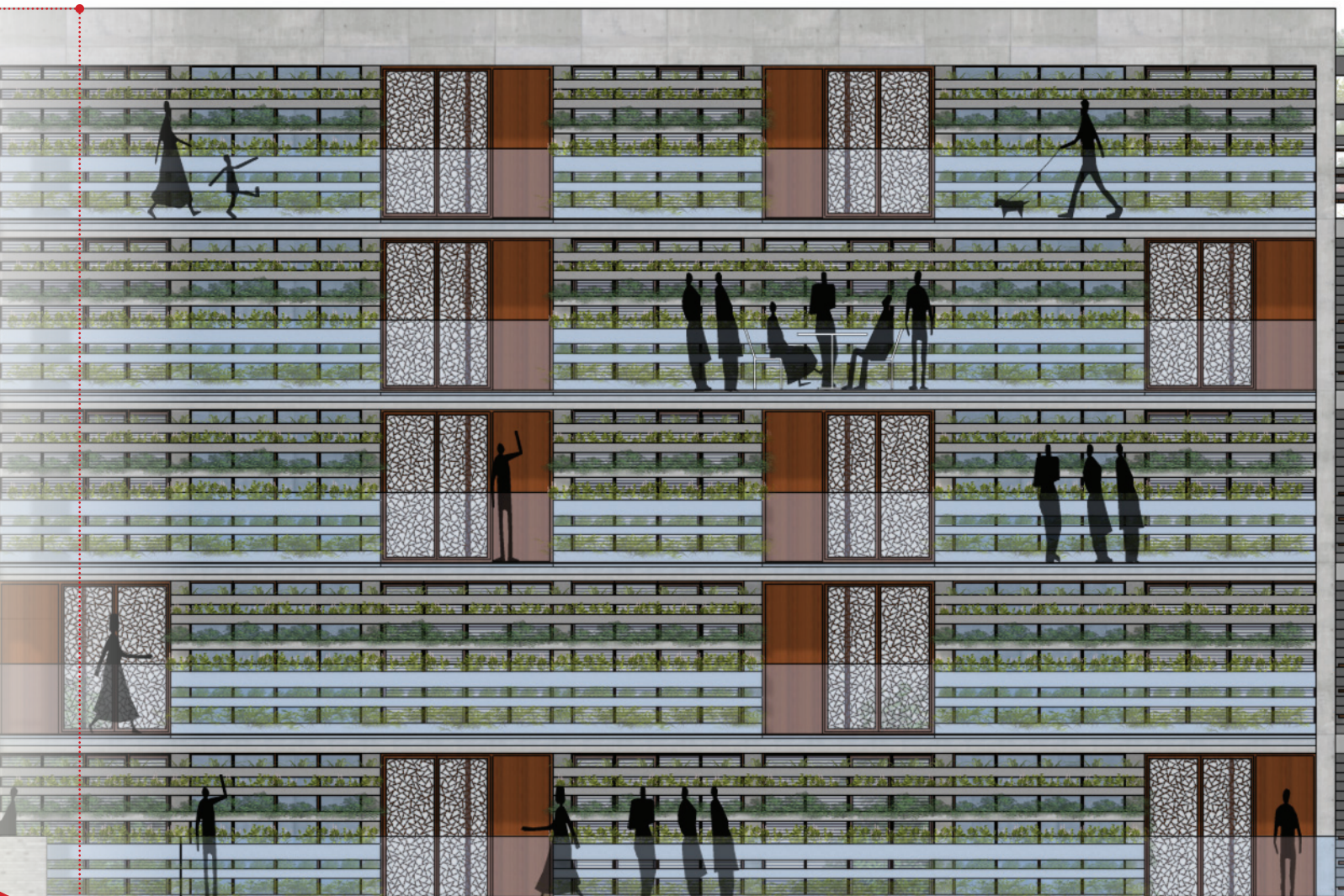
c



4.2.33
View to sunken water courtyard at community cultural centre

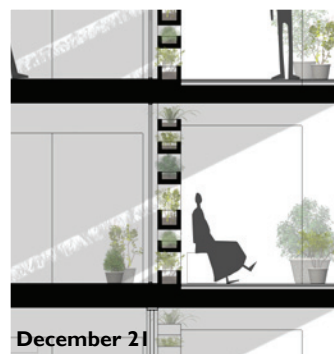


In the residential strip, green wall is used to reinterpret the courtyard in the vertical direction. The special treatment of the wall provides space for residents to engage in planting – an important traditional pastime. So people on every floor can have the same pleasant living condition as if they are on the ground. The circulation corridor is also reinterpreted, as it is no longer tucked away at the back for access only. Instead it is placed on the south side as circulation balcony in front of the units, which resembles the veranda in the traditional typology. With a generous width, activities are carried beyond the walls of the interior. The residents can sit and interact in this communal space with the green wall as the courtyard backdrop.



Planter walls on the south façade of the residential strip provide pleasant viewing canvas for the community.

4.2.35



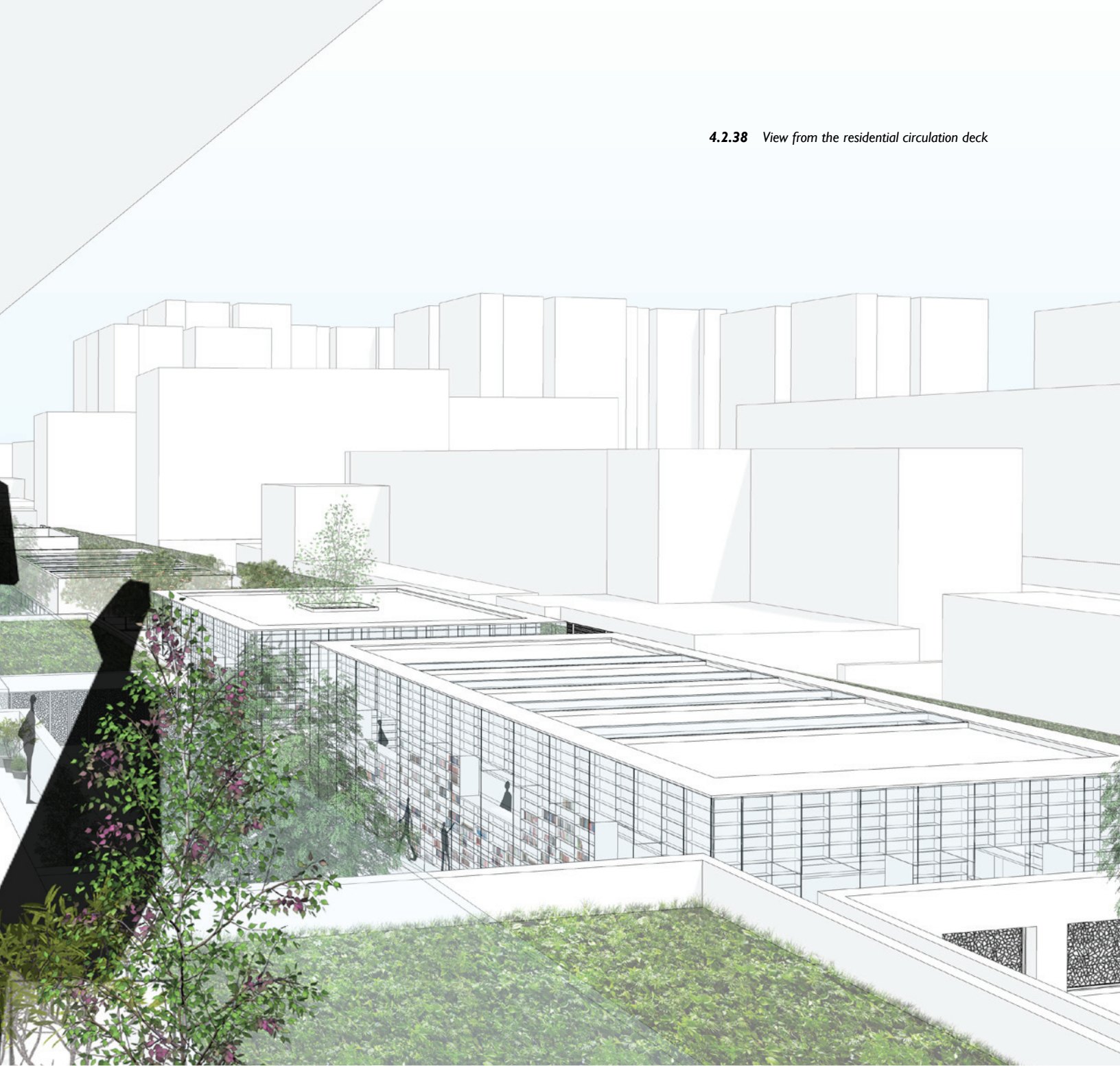
March 20

June 21

December 21

4.2.36 Shadow Study: Residential Units

4.2.38 View from the residential circulation deck



Window Pattern on Ground



Foliage on Ground

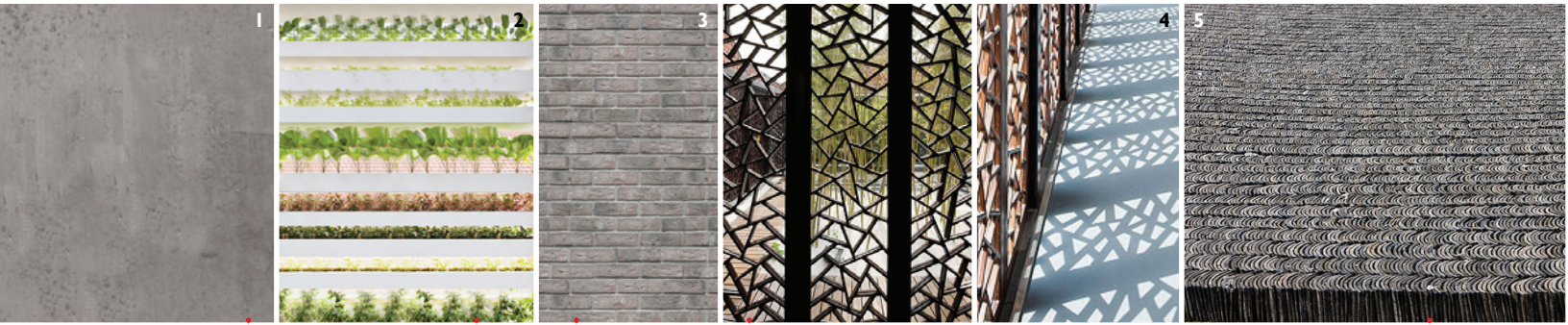


Foliage on Wall

4.2.37 Shadow Patterns

Light

4.2.39 Viewing frame



The design of the new courtyard housing is inspired by traditional architecture. Thus the choice of materials and colour schemes allows the new buildings to recreate the sense of place and to create an individuality utterly lacking in conventional modern apartment complexes. The use of traditional Chinese architectural elements like the spirit wall and the delicate wooden screens helps to create a sense of belonging and a home-like atmosphere for both residents and visitors. The remnants of the old courtyard houses such as the roof tiles and the carved bearing stones at entrances are collected and reused as paving and decorations in the courts of the new complex. Aesthetical but functional elements such as the drainage openings and frame patterns are integrated strategically to enhance the overall appearance of the new cluster and to offer many sustainable benefits. New technology is sometimes disguised under the decorative traditional façades as well. For instance, solar panels are placed on the roof following the tile patterns; stormwater-harvesting system is integrated with the ground pavement and courtyard gardens; and so on.

4.2.41

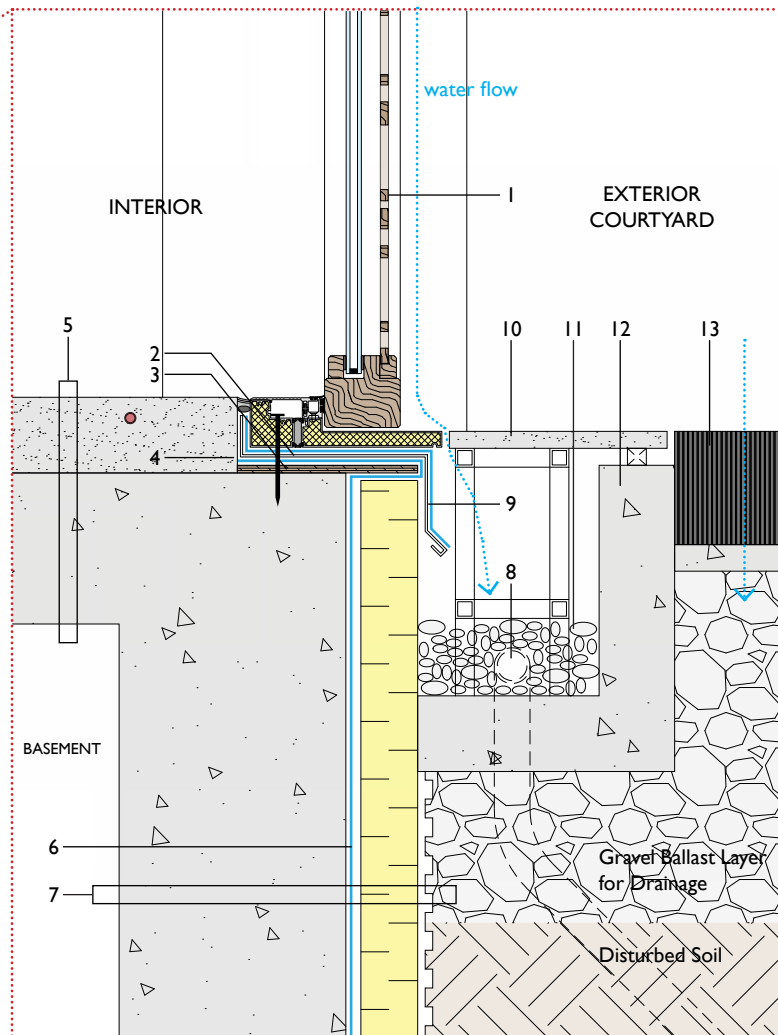
Materiality

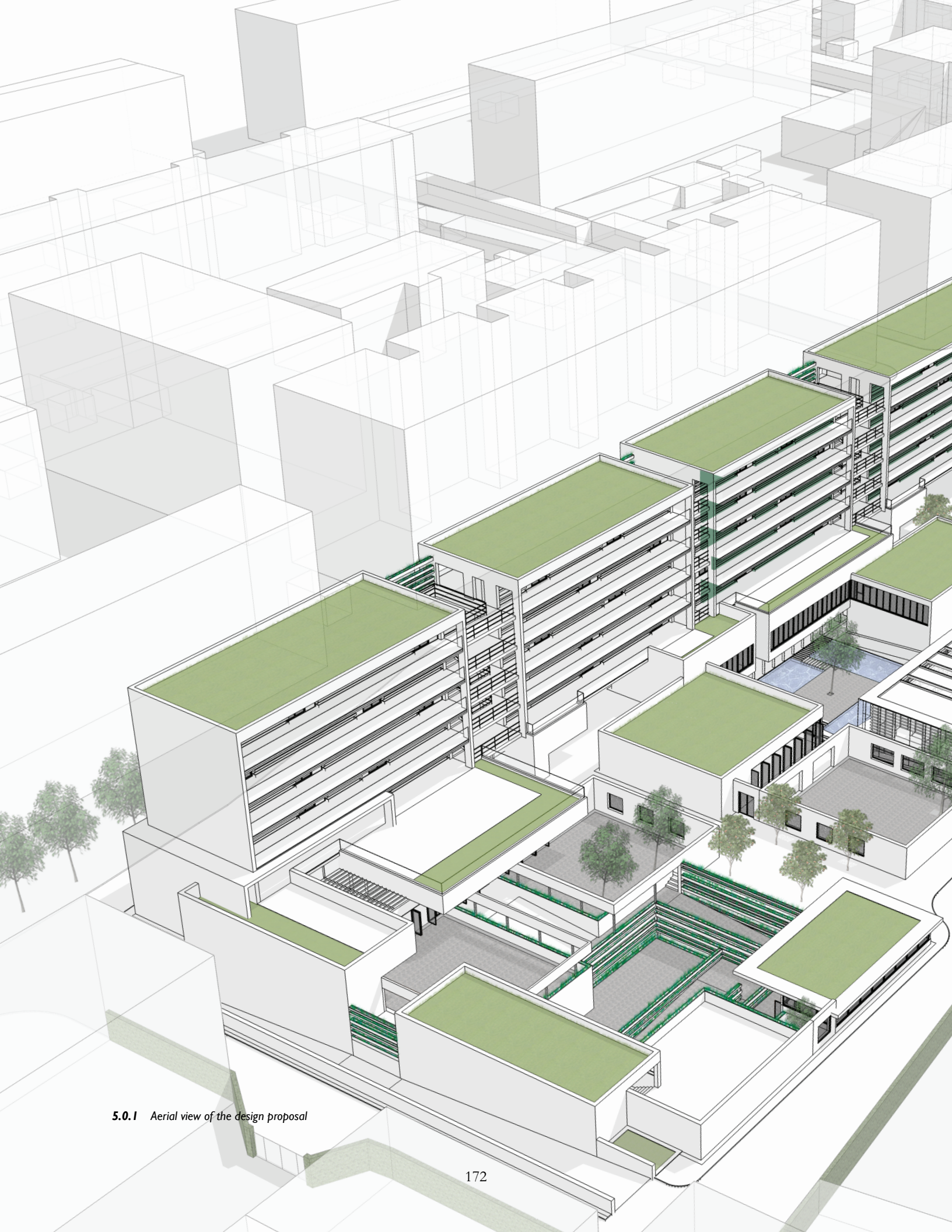
1. Concrete;
2. Residential Planter Wall - courtyard in the vertical direction;
3. Brick;
4. Traditional Window Frames - excellent solar shading devices that create a sense of place, as well as interesting light patterns as the shadow casts on different surfaces;
5. Ground Treatment - reuse roof tiles from the traditional courtyards as a permeable paving system.

4.2.42

Wall to Foundation at Grade | 1:10

1. Low-E coated thermally broken double glazing behind wood pattern frame
2. Subsill flashing and upturn
3. Plywood shims under door
4. Formed "seat" in concrete slab act as pan flashing
5. **Floor Assembly:**
 - 100 mm concrete topping with radiant floor heating system;
 - 200 mm concrete slab
6. Toweled-on bituminous waterproofing membrane - fully adhered water, air, and vapour control
7. **Foundation Wall Assembly:**
 - Drainage board;
 - 75 mm Extruded polystyrene (XPS) rigid insulation panel;
 - Toweled-on bituminous waterproofing layer - fully adhered water, air, and vapour control membrane;
 - 300 mm concrete foundation wall
8. Drainage pipe
9. Pre-finished aluminum flashing and upturn
10. Threshold consisting of removable concrete panel (drainage tiles) on stainless steel profile
11. Gravel layer for drainage
12. Continuous concrete trough with drainage pipe
13. Traditional roof tile paving system in program courtyards / Permeable concrete pavement in general areas





5.0.1 Aerial view of the design proposal

5 Reflection + Projection





5.0.2 *Resonances of the traditional typology revived in the courtyard of contemporary Beijing*

In addressing the remediation and reinterpretation of the traditional typology in a contemporary city, there is a careful negotiation between what can only be experienced and what can be seen and touched. This balance between the intangible and tangible will dictate the resulting form of the new development.

During the initial design phase, I took the path of many similar projects that put more weight on the physical replication of the traditional courtyard. I was afraid that people would not recognize the typology if I steered too far away from its original form. However, as I studied the courtyard more in depth, learning about its evolution and inherited essences, I came to the realization that the appearance was not as important as the experiences it bestowed. The supersession of the old by the new is a general, eternal and inviolable law of the universe. This principle also applies to architecture as learned from the traditional courtyards in Beijing, a form that underwent constant adaptation and renewal under the new circumstances of each era. The physical form changed but the intangible qualities remained. Preservation of the tangible will only render a frozen image that will eventually become obsolete. Hence, it became necessary to operate a shift in the design strategy, moving towards an approach, which focused more on the sense of place, the qualities, experiences and values that were deemed essential. For these reasons, the thesis proposal resembles nothing like the traditional courtyard houses at first glance. However, as one ventures deeper, the resonances are found through the layers of thresholds, the sceneries in the various courtyards, the viewing frames, the wandering paths between buildings, the air, the vegetation and the quality of light falling in any given spaces.

The traditional courtyard house is a far more complex form than it seems. Decorative on the surface, functional underneath. Every element serves a purpose. Unfortunately, the complexity is lost and stripped down to mere physical appearance in many restoration projects of the hutong districts. To counter these limitations of the current approaches, the design proposal brought the layers from beneath and sought to reestablish the intangible feelings as a way to move forward.

It is also important to note that the intangible experience is generated by people who occupy and interact with the built form. Architecture is merely an empty shell without the interaction of people. Thus, as architects, we do not simply create spaces, but we also create opportunities for people to engage with the built elements. In addition, when defining the traditional courtyard as a heritage, we do not simply refer to the physical form, but rather to the knowledge that it contains at its core. As long as people desire the preservation of this knowledge, the heritage is kept. It is everyone's responsibility to value and preserve it.

Throughout this thesis, the past, present and future of the courtyard typology have been touched upon. With critical perspectives on the making of a sustainable future, the investigation shed light on the importance to be aware of the role architecture plays for the city and its people. If the government were calling for a proposal to develop a new

courtyard type, or rather, a new national style, I would, based on this thesis, offer the following set of five principles with confidence.

Promotion of a harmonious society. The project should promote local culture, encourage social interaction and welcome everyone, which reinforces the country's vision of achieving a "harmonious society." Traditionally, the courtyard was like a multipurpose room where most of the family activities took place. The series of courts became more private as one ventured deeper into the complex. The elders took pleasure in planting, the youngsters played freely in the protected space, and guests were entertained in the public front court. The reinvention of the spacious communal courtyards should inherit such qualities and provide space for various activities to occur. The spatial hierarchy between different courts should establish a level of openness and provide functions that cater to the varying needs.

Promotion of a unique cultural identity. The built form changes constantly, but the intangible qualities remain. The traditional courtyard in Beijing is known for its grey tiled roofs, intricate window patterns and the beautifully carved wooden and stone decorations. It is also known for its changing sceneries, the pictorial view frames and the fortunate connotations of its decorations. In recognizing these formal qualities of the old form, the experiences should be translated through the strategic layout of the different built elements and their interaction with the natural forces, namely the air, water and light. The design should ultimately be a synthesis, an attempt to reconcile the past and the present in a new vernacular architecture that finds a balance between the tangible and intangible, creating an identity unique to the city of Beijing, but not anywhere else.

Energy conservation through the articulation of details. Careful studies of the local conditions produce climate responsive designs that benefit the environment by reducing energy loads, and socially and culturally responsive designs that benefit the community at large. The traditional courtyard typology is a far more complex form than it appears. Upon close examination, every element is designed with energy conservation in mind. The roof form and tile shape facilitate drainage; podiums and level differences in each court direct water movement; the decorative openings allow the passage of air or water; the window patterns control light and heat; and even vegetation offers environmental benefits such as shading and natural cooling. Therefore, the new development should pay greater attention to such details in achieving an energy efficient design, which in turn also preserves the cultural identity. Together with the integration of current technology, energy conservation is maximized. Just like the traditional courtyard, the building itself should be able to teach us how we can live a sustainable life by showcasing the systems in operation.

Creation of a park-like space. It is human to seek nature. Even in the densest city, people find ways to incorporate greens into their lives. Learning from the traditional courtyard house, the court provides an outdoor room that effectively utilizes the land and improves the quality of life. The future development should invite nature in, integrating nature with the basic functions. The designer should explore different ways of integrating greenery into the project by means of courtyards, roof gardens, vertical planter walls, or

other creative articulations. Opportunities should be provided to engage the inhabitants in the act of planting as well – a traditional pastime. This approach will not only benefit the smaller microclimate within by creating a moderate environment and cultivating a strong local culture, but also on a bigger scale by creating heat sinks to relieve the urban heat island effect, if the city is willing to develop such typology at large.

Continuation of the cultural heritage. Knowledge is encoded in cultural heritage, and everyone is involved in its preservation and development. Recognizing that history is an ongoing process: the preservation of the traditional form cannot be a frozen image. The traditional courtyard house in Beijing evolved in history from a protective fortress to a pleasant home that maximizes urban built up area and allows controlled sunlight and ventilation. It also brought forth design innovations such as “double glazing” window configurations for heating and shading, tile shapes for drainage, and so on. Hence, the future development should always consult with traditional forms, learning from things that worked well and developing things that might not be relevant under the new social and economic conditions. Together with new technology, the development can evolve further and offer design innovations to create something new, something of our age. So the heritage can be passed on.

During the 18th Party Congress that just ended recently, environmental issues and sustainability were again brought up as the top priority in the current development of China. Green initiatives on multiple levels from the nation down to the community and the individual began to roll out. To maximize the potential of the proposed typology, it is not any singular effort, but a collaboration between various parties. The government needs to set policies to end the current modes of development that are out of the context, and to implement policies to promote and strengthen ways to achieve sustainability. Institutions need to advocate green education and equip people with sufficient knowledge of how to conserve energy in order to prevent failures of green designs due to users’ ignorance. Architects should design buildings that are not simply commodities with a pricy tag, but design with social and cultural context in mind. Last but not least, the inhabitants are responsible in learning and actively engaging with the building operation at work.

The thesis proposal, though site-specific and restricted to 18 m high, opens up the possibility of courtyard in the sky. With innovations of the floor plan and level configuration, the potential of such typology renders limitless. Like the ancestors who strived to attain the harmonious relationship between heaven/nature, earth/built environment, and people (*tian di ren he*, 天人合), the new development too seeks the ultimate harmony between these forces for a society that people will want to live and work now and in the future.

While this thesis focuses primarily on the reinterpretation of traditional courtyards in Beijing, the notion of a holistic approach that recognizes both the environmental, cultural and social conditions is deemed more applicable and necessary in cities alike. It is the hope to push against many of the worst impulses of the current “green” developments and to get the momentum started in the right direction on a global scale, bringing us a step closer to a sustainable future.

References

On History and Transformation of the City

- ArchiTeam. "Beijing City." *ArchiTravel*. Accessed August 15, 2012. <http://www.architravel.com/architravel/building/beijing-city>.
- Arlington, L. C., and William Lewisohn. *In Search of Old Peking*. New York: Paragon Book Reprint Corp., 1967.
- Beato, Felice. *Album of Photographic Views in China*, vol. 1. c1860. *Digital Archive of Toyo Bunko Rare Books*. <http://dsr.nii.ac.jp/toyobunko/La-158/V-1/>.
- Beijing University of Civil Engineering and Architecture. "City Streets." Accessed August 15, 2012. <http://dqzy.bucea.edu.cn/xyjc/csdl/index.htm>.
- Beijing University of Civil Engineering and Architecture. "Jiyi Beijing – Hutong" 记忆北京——胡同 [Beijing Memory – Hutong]. Accessed August 15, 2012. <http://tszyk.bucea.edu.cn/htzyk/>.
- Chen Junyuan 陈君远. "Dongfang guangchang chaiqian" 东方广场拆迁 [Oriental Plaza Site Demolition]. May 12, 2012. Accessed August 16, 2012. http://blog.sina.com.cn/s/blog_4aba1d6f01014017.html.
- Chong, Steven. "Liang Sicheng's Beijing: A Counterfactual History." *Knol*. June 13, 2010. Accessed January 8, 2011. <http://knol.google.com/k/steven-chong/liang-sicheng-s-beijing/2e3144udfqrpg/1>.
- Council on Tall Buildings and Urban Habitat. "Buildings in Beijing." *The Skyscraper Centre: The Global Tall Building Database*. Accessed August 15, 2012. http://www.skyscrapercenter.com/create.php?list_status=COM&status_COM=on&status_UC=on&status_UCT=on&status_DEM=on&list_city=CN-BJS&search=yes.
- Dong Guangqi 董光器. *Gudu Beijing 50 nian yanbianlu* 古都北京五十年演变录 [The Ancient Capital of Beijing: A Fifty Year Evolution]. Nanjing: *Dongnan daxue chubanshe* 东南大学出版社 [Southeast University Press], 2006.
- Edelmann, Frédéric, ed. *In the Chinese City: Perspectives on the Transmutations of an empire*. Barcelona and New York: Actar-D, 2008.
- FlorCruz, Jaime and Chen Xiaoni. "Old Beijing disappearing under the steamroller of modernization." *CNN*. April 26, 2010. Accessed August 20, 2012. <http://www.cnn.com/2010/WORLD/asiapcf/04/26/china.beijing.old.city/index.html>.

- Greco, Claudio, and Carlo Santoro. *Beijing The New City*. Milano: Skira Editore S.p.A., 2008.
- He Huazhong 何华中. “*Chengnan jiusi*” 城南旧事 [Memories of Old Beijing]. November 30, 2010. Accessed August 15, 2012. http://blog.sina.com.cn/s/blog_5d49e5eb0100mpu5.html.
- Hu Fei 胡飞. *Zhongguo chuantong sheji siwei fangshi tansuo* 中国传统设计思维方式探索 [Explore the Chinese Traditional Design Thinking]. Beijing: *Zhongguo jianzhu gongye chubanshe* 中国建筑工业出版社 [China Architecture & Building Press], 2007.
- Huaxia.com. “*Kanwo Beijing bian bian bian*” 看我北京 变! 变! 变! [Look at Beijing Change Change Change]. Accessed June 13, 2012. <http://www.huaxia.com/zt/whbl/2004-17.html>.
- Hutong.net. “*Hutong wenhua*” 胡同文化 [Hutong Culture]. Accessed February 2, 2011. <http://www.hutong.net/>.
- Izmzg.com. “*Youyuan de lao Beijing hutong wenhua*” 悠远的老北京胡同文化 [History of Beijing Hutong Culture]. March 3, 2012. Accessed April 10, 2012. <http://www.izmzg.com/zmzg/beijing/wenhua/2012-03-03/3437.html>.
- Kögel Eduard, and Ulf Meyer, ed. *The Chinese City Between Tradition and Modernity*. Berlin: Jovis, 2000.
- Li, Lillian M., Alison J. Dray-Novvey, and Haili Kong. *Beijing: From Imperial Capital to Olympic City*. New York: Palgrave Macmillan, 2007.
- Lin Hok Leung. “A Modern Chinese Cityscape.” *China City Planning Review* 3 (December 1987): p.52.
- Mars, Neville. *The Chinese Dream: a society under construction*. Edited by Adrian Hornsby. Rotterdam: 010 Publishers, 2008.
- Sa Lin 沙林. “*Zhuanfang hutong baoweizhe*” 专访“胡同保卫者”:北京还能与圣彼得堡媲美吗 [Interview with Hutong Protector]. *China Youth Daily*. June 25, 2003. Accessed August 15, 2012. <http://www.china.com.cn/chinese/feature/354362.htm>.
- Schinz, Alfred. *The Magic Square: Cities in Ancient China*. Stuttgart and London: Axel Menges, 1996.

- Shirai, Hiromasa, and André Schmidt. *Big Bang Beijing*. Tokyo: Kajima Institute Publishing Co., Ltd., 2007.
- Sit, Victor F. S. *Beijing: The Nature and Planning of a Chinese Capital City*. Chichester; New York; Brisbane; Toronto; Singapore: John Wiley & Sons Ltd., 1995.
- Von Mumm, Alfons. *Photographic Journal*, vol. 1. Berlin, c1902. *Digital Archive of Toyo Bunko Rare Books*. <http://dsr.nii.ac.jp/toyobunko/La-161/V-1/>.
- Wang Bo 王博. *Beijing: yizuo shiqu jianzhu zhexue de chengshi* 北京：一座失去建筑哲学的城市 [Beijing: A Lost City in Architectural Philosophy]. Shenyang: *Liaoning kexue jishu chubanshe* 辽宁科学技术出版社 [Liaoning Science and Technology Publishing House], 2009.
- Wang Yue 王越. “Neijiu waiqi huangcheng situ zixingde Beijingcheng” 内九外七皇城四凸字形的北京城 [City of Beijing]. *China Youth Daily*. March 1, 2012. Accessed August 15, 2012. <http://news.hexun.com/2012-03-01/138838339.html>.
- Wang Zhansheng, and Lin Shengli 王占生、林胜利, ed. *60 nian, wo de Beijing* 60年，我的北京 [1949 – 2009 My Life in Beijing]. Beijing: *Dangjian dudu chubanshe* 党建读物出版社 [Party Building Books Publishing House], 2009.
- Wu Liangyong. *A Brief History of Ancient Chinese City Planning*. Kassel: Gesamthochschulbibliothek, 1986.
- Yang Yin, and Lu Shun, ed. *Find The Old Beijing*. Beijing: China Nationality Art Photograph Publishing House, 2005.
- Zhu, Jianfei. *Chinese Spatial Strategies: Imperial Beijing 1420 – 1911*. London and New York: RoutledgeCurzon, 2004.

On History and Transformation of the Built Form

- Blaser, Werner. *Atrium: Five thousand years of open courtyards*. Basel and New York: Wepf & Co. AG, 1985.
- Chinese Academy of Architecture. *Ancient Chinese Architecture*. Hong Kong: Joint Publishing Company; Beijing: China Building Industry Press, 1982.
- Edward, Brian, Magda Sibley, Mohamad Hakmi, and Peter Land, ed. *Courtyard Housing: Past, Present & Future*. Oxon and New York: Taylor & Francis, 2006.

Institute of the History of Natural Sciences, and Chinese Academy of Sciences. *History and Development of Ancient Chinese Architecture*. Beijing: Science Press, 1986.

Liang Sicheng 梁思成. *Liang Sicheng Quan Ji 梁思成全集* [The Complete Works of Liang Sicheng]. Beijing: *Zhongguo jianzhu gongye chubanshe 中国建筑工业出版社* [China Architecture & Building Press], 2001.

Xue, Charlie Q. L. *Building a Revolution: Chinese Architecture since 1980*. Hong Kong: Hong Kong University Press, 2006.

Zhu, Jianfei. *Architecture of Modern China: A Historical Critique*. Oxon and New York: Routledge, 2009.

On the Architecture and Daily Life

Berliner, Nancy. *Yin Yu Tang: The Architecture and Daily Life of a Chinese House*. Boston; Rutland; Vermont; Tokyo: Tuttle Publishing, 2003.

Blaser, Werner. *Hofbaus in China / Courtyard House in China*. Basel; Boston; Berlin: Birkhäuser Verlag, 1979.

Chang, Amos Ih Tiao. *The Tao of Architecture*. New Jersey; Surrey: Princeton University Press, 1956.

Confucius. *The sayings of Confucius: a translation of the Confucian analects*. Translated by Lionel Giles. Middlesex: Senate, 1998.

Hou, Youbin. *Aesthetics of Ancient Chinese Architecture*. Harbin: Heilongjiang Science Technology Publishing House, 1997.

Hsu, Shan-Tung. *Tao of Feng Shui – Book One: Fundamentals of Feng Shui*. Seattle: Blue Mountain Feng Shui Institute, 1999.

Jia Jun 贾珺. *Beijing sibeyuan 北京四合院* [Beijing Quadrangle]. Beijing: *Qinghua daxue chubanshe 清华大学出版社* [Tsinghua University Press], 2009.

Knapp, Ronald G. *China's Old Dwellings*. Honolulu: University of Hawai'i Press, 2000.

Knapp, Ronald G. *Chinese Houses: The Architectural Heritage of a Nation*. North Clarendon: Tuttle Publishing, 2005.

- Knapp, Ronald G. *The Chinese House*. New York: Oxford University Press, Inc., 1990.
- Knapp, Ronald G., and Kai-yin Lo, ed. *House, Home, Family: Living and Being Chinese*. Honolulu: University of Hawai'i Press, 2005.
- Lou Qingxi 楼庆西. *Huyou zhi yi 户牖之艺* [Art of Door and Window]. Chinese Ancient Architecture Decoration, Book II. Beijing: *Qinghua daxue chubanshe* 清华大学出版社 [Tsinghua University Press], 2011.
- Lou Qingxi 楼庆西. *Zhuangsi zhi dao 装饰之道* [Method of Decoration]. Chinese Ancient Architecture Decoration, Book V. Beijing: *Qinghua daxue chubanshe* 清华大学出版社 [Tsinghua University Press], 2011.
- Ma Bingjian 马炳坚. *Beijing sibeyuan jianzhu 北京四合院建筑* [The Architecture of the Quadrangle in Beijing]. Tianjin: *Tianjin daxue chubanshe* 天津大学出版社 [Tianjin University Press], 2010. First published in 1999.
- Pirazzoli-*t*Serstevens, Michèle. *Living Architecture: Chinese*. Translated by Robert Allen. London: Macdonald & Co. Ltd., 1972.
- Sheng, Xuewen. "Chinese Families." Accessed October 20, 2011. http://www.corwin.com/upm-data/4949_Adams_Chapter_5_Chinese_Families.pdf.
- Sustainable Urban Housing in China. "Sustainable: vernacular architecture in China." *MIT Building Technology*. Last modified February 11, 2001. Accessed October 20, 2011. <http://chinahousing.mit.edu/english/china/vernacular/index.html>.
- Wang Qijun 王其钧. *Tujie zhongguo minju 图解中国民居* [Graphic Chinese Vernacular]. Beijing: *Zhongguo dianli chubanshe* 中国电力出版社 [China Electric Power Press], 2008.
- Wang Qijun 王其钧. *Tushuo minju 图说民居* [Picture Book of Chinese Dwellings]. Beijing: *Zhongguo jianzhu gongye chubanshe* 中国建筑工业出版社 [China Architecture & Building Press], 2004.
- Wang Qijun 王其钧. *Zhongguo chuantong jianzhu zuqun 中国传统建筑组群* [Building in Groups]. Beijing: *Zhongguo dianli chubanshe* 中国电力出版社 [China Electric Power Press], 2009.
- Xu Lunhu 徐伦虎. *Zhongguo gujianzhu mima 中国古建筑密码* [Code of Ancient Chinese Architecture]. Beijing: *Cebu chubanshe* 测绘出版社 [Surveying and Mapping Press], 2010.

Ye Zurun 业祖润. *Beijing minju* 北京民居 [Folk Houses in Beijing]. Beijing: *Zhongguo jianzhu gongye chubanshe* 中国建筑工业出版社 [China Architecture & Building Press], 2009.

Zhao Guangchao 赵广超. *Buzhi zhongguo mu jianzhu* 不只中国木建筑 [Chinese Wood Architecture]. Hong Kong: *Sanlian shudian (xianggang) youxian gongsi* 三联书店 (香港) 有限公司 [Joint Publishing (H.K.)], 2000.

Zhao Qian, Gong Wei, and Yu Fei 赵倩、公伟、於飞, ed. *Tushuo Beijing sibeyuan* 图说北京四合院 [Illustration of Courtyard of Beijing]. Beijing: *Zhongguo shuili shuidian chubanshe* 中国水利水电出版社 [China Water Power Press], 2008.

Zhao Yangyang 赵杨旻. “*Chuantong minju yongxu celue*” 传统民居永续策略 [Sustainable Strategies of Traditional Typology]. Accessed October 20, 2011. http://www.ad.ntust.edu.tw/grad/think/HOMEWORK/Master/architectural_thinking_100_1/m10013m01/My%20Web%20Sites/mysite/傳統民居永續性理念研究.htm.

Zwenger, Klaus. *Wood and Wood Joints*. Basel: Birkhäuser, 2012.

On Placemaking and Maintaining the Spirit of the Place

Feuchtwang, Stephan, ed. *Making Place: State Projects, Globalization and Local Responses in China*. London: UCL Press, 2004.

Garnham, Harry Launce. *Maintaining the Spirit of Place*. Arizona: PDA Publishers Corporation, 1985.

Hassenpflug, Dieter. *The Urban Code of China*. Basel: Birkhäuser GmbH, 2010.

Lennard, Henry L., and Suzanne H. Crowhurst Lennard. *The Wisdom of Cities*. California: International Making Cities Livable Council, 2004.

Ma, Laurence J. C., and Fulong Wu, ed. *Restructuring the Chinese City: Changing society, economy and space*. Oxon and New York: Routledge, 2005.

Radović, Darko. “The Likely and Desirable Future of Beijing’s Hutongs.” Paper presented at International Making Cities Livable Conferences, California, 2002.

Wu Liangyong 吴良镛. *Jianzhu, Chengshi, Renjubuanjing* 建筑、城市、人居环境 [Architecture, City, and the Built Environment]. *Shijiazhuang: Hebei jiaoyu chubanshe* 河北教育出版社 [Hebei Education Press], 2003.

Zhu, Jianfei. “Geometries of Life and Formlessness: The theoretical legacies of historical Beijing.” In *Eco-Urbanity: Towards Well-mannered Built Environments*, edited by Radović, Darko, 125 – 140. Oxon and New York: Routledge, 2009.

On Building Typology

Firley, Eric, and Caroline Stahl. *The Urban Housing Handbook*. Chichester; New York; Brisbane; Toronto; Singapore: John Wiley & Sons Ltd., 2009.

Logan, John R., Yiping Fang, and Zhanxin Zhang. “Residence Status and Housing in Urban China – the Case of Beijing.” *Populations in China* 3 (2009): p497 – 510. Accessed October 20, 2011. <http://eps.revues.org/index4434.html>.

MVRDV, and The Why Factory, ed. *The Vertical Village*. Rotterdam: NAI Publishers, 2012.

Schneider, Friederike, ed. *Floor Plan Manual, Housing*. Basel; Boston; Berlin: Birkhäuser, 2004.

Wu, Rufina, and Stefan Canham. *Portraits from Above – Hong Kong’s Informal Rooftop Communities*. Berlin: Peperoni Books, 2008.

Wu, Rufina. “Beijing Underground.” Master thesis, University of Waterloo, 2007.

On Narratives

Lao She 老舍. “*Xiang Beiping*” 想北平 [Fond Memories of Beijing]. 1936. Accessed November 2, 2011. http://blog.163.com/richard_zhou@126/blog/static/56523754201063104841497/.

Meyer, Michael. *The Last Days of Old Beijing: Life in the Vanishing Backstreets of a City Transformed*. New York: Walker Publishing Company, Inc., 2008.

Segalen, Victor, and Claude Debussy. *Segalen et Debussy*. Edited by Annie Joy-Segalen and André Schaeffner. Monaco: Éditions du Rocher, 1962.

Tel, Jonathan. *The Beijing of Possibilities*. New York: Other Press, 2009.

Wittgenstein, Ludwig. *Philosophical Investigations*, 3rd ed. Translated by G.E.M. Anscombe. New York: Basil Blackwell & Mott, Ltd., 1958. Accessed November 2, 2011. <http://gormendizer.co.za/wp-content/uploads/2010/06/Ludwig-Wittgenstein.-.Philosophical.Investigations.pdf>.

On Preservation and Revitalization

Alexander, Andre, Hirako Yutaka, Pimpim de Azevedo, and Lundrup Dorje. *Beijing Hutong Conservation Study*. Beijing: Beijing Communications Press, 2004.

Broudehoux, Anne-Marie. "Neighborhood Regeneration in Beijing: An Overview Of Projects Implemented in the Inner City Since 1990." *McGill University*. June 27, 2011. Accessed October 20, 2011. <http://www.mcgill.ca/mchg/student/neighborhood>.

Chong, Steven. "Preservation of Beijing's Hutongs: An Alternate Approach." *Knol*. January 3, 2010. Accessed January 8, 2011. <http://knol.google.com/k/steven-chong/preservation-of-beijing-s-hutongs/2e3144udfqrpg/10>.

Lau, S.Y. Stephen, Andrew K. Platten, T. Erica Lau, and Jun Wang, ed. *International Sustainable and Urban Regeneration: Case Studies and Lessons Learned 2008*. Hong Kong: Hong Kong College of Technology, 2008.

Rabbat, Nasser O., ed. *The Courtyard House: From Cultural Reference to Universal Relevance*. Surrey: Ashgate Publishing Limited, 2010.

Tung, Anthony M. "Erasing Old Beijing: a conservation tragedy?" *World Monuments Fund*. Accessed October 20, 2011. http://www.wmf.org/sites/default/files/wmf_article/pg_38-45_hutongs.pdf.

Wang, Bing. "The Ju'er Hutong Project in Beijing: Redevelopment in a Transitional Market." In *Regenerating Older Suburbs*, edited by Richard B. Peiser with Adrienne Schmitz, 185 – 191. Washington, D.C.: ULI-the Urban Land Institute, 2007.

Wu, Liangyong. *Rehabilitating the Old City of Beijing: A Project in the Ju'er Hutong Neighbourhood*. Vancouver: UBC Press, 1999.

Zhang, Yan, and Ke Fang. "Politics of housing redevelopment in China: The rise and fall of the Ju'er Hutong project in inner-city Beijing." *Journal of Housing and the Built Environment*, Vol. 18, No. 1 (2003): 75 – 87. Springer. Accessed October 20, 2011. <http://www.jstor.org/stable/41107112>.

Zheng, Lian. *Housing renewal in Beijing*. Montreal: McGill University, 1995.

On Energy and the Environment

Arvesen, Anders. "Direct and Indirect Energy Consumption of Households in Beijing." Master thesis, Norwegian University of Science and Technology, 2008. http://www.ntnu.edu/c/document_library/get_file?uuid=855b55a8-d82e-42f7-b2d4-ccab6d108a53&groupId=163835.

Boake, Terri Meyer. "Environmental Site Design." Class lecture, Principles of Environmental Design from University of Waterloo, Cambridge, March 2, 2011.

Brubaker, Richard. "Sustainability in China: More than Winning a Cleantech War." *Policy Innovations*. September 29, 2011. Accessed on May 2, 2012. <http://www.policyinnovations.org/ideas/commentary/data/000222>.

Centre for Renewable Energy Development. Accessed on May 2, 2012. <http://www.cred.org.cn/cn/>.

China Green Building. Green Building Map. Accessed on May 2, 2012. <http://www.gbmap.org>

Chinalawinfo Co., Ltd. "Five-year plan for energy development approved." October 26, 2012. <http://www.lawinfochina.com/search/displayinfo.aspx?id=10371&lib=news>.

Chinalawinfo Co., Ltd. "State Council issues plan for energy conservation and emission reduction to 2015." October 26, 2012. <http://www.lawinfochina.com/search/displayinfo.aspx?id=10348&lib=news>.

Diener Syz Real Estate. "China's 12th Five-Year Plan and its implications for the real estate market." Accessed on May 2, 2012. http://www.dienersyz.com/wp-content/uploads/DS_Newsletter_Q2_2011.pdf.

- Duxbury, Nancy, and Eileen Gillette. "Culture as a Key Dimension of Sustainability: Exploring Concepts, Themes, and Models." *Centre of Expertise on Culture and Communities*. February 2007. Accessed on May 2, 2012. <http://cultureandcommunities.ca/downloads/WP1-Culture-Sustainability.pdf>.
- Economic Daily. "Environment Section." *China Economic Net*. <http://en.ce.cn/National/environment/>.
- Geng Nuo 耿诺. "Beijing tigao zhubuzhai jieneng sheji biaoqun" 北京提高住宅节能设计标准 [Beijing Raising Energy Efficient Design Standard]. CNTV. February 23, 2011. Accessed on May 2, 2012. <http://news.cntv.cn/20110223/108154.shtml>.
- Huang cheng 黄橙. "Laoyuanluo yeneng lingpaifang, xiaogaiyaoyunniangdahuanbao" 老院落也能“零排放” 小改造酝酿大环保 [Zero emission courtyard house, minor modifications achieve sustainability]. *Science and Technology Daily*. August 11, 2010. Accessed on April 28, 2012. http://www.stdaily.com/kjrb/content/2010-08/11/content_217403.htm.
- Jin, Ruidong, and Shakil Alyas. "China Building Green Practice." *Natural Resources Defense Council*, 2010. Accessed on May 2, 2012. <http://www.aceee.org/files/proceedings/2010/data/papers/2032.pdf>.
- Keeley, James, and Zheng Yisheng, ed. *Green China: Chinese insights on environment and development*. London: International Institute for Environment and Development, 2011. Accessed on May 2, 2012. <http://pubs.iied.org/pdfs/17509IIED.pdf>.
- Kostka, Genia, and Sarah Eaton. "China's Green Rise: Growing Ambition, Growing Challenges." November 5, 2012. <http://opencanada.org/features/the-think-tank/essays/chinas-green-rise-growing-ambition-growing-challenges-2/>.
- Kostka, Genia, and Sarah Eaton. "China's Green Rise: Growing Ambition, Growing Challenges." *Canadian International Council*. November 5, 2012. <http://opencanada.org/features/the-think-tank/essays/chinas-green-rise-growing-ambition-growing-challenges-2>.
- KPMG China. "China's 12th Five Year Plan: Energy." Accessed on May 2, 2012. <http://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Documents/China-12th-Five-Year-Plan-Energy-201104.pdf>.
- Lawrence Berkeley National Laboratory: China Energy Group. "Publications." Accessed on April 28, 2012. <http://china.lbl.gov/publications>.

- Mann, Samuel. "Computing for Sustainability." March 15, 2009. Accessed on May 2, 2012. <http://computingforsustainability.com/2009/03/15/visualising-sustainability/>.
- PR Newswire. "Consolidating Strengths in Tongzhou to Create a Modern, International New City." October 18, 2010. Accessed on April 28, 2012. <http://en.prnasia.com/story/37242-0.shtml>.
- Reynolds, John S. *Courtyards: aesthetic, social, and thermal delight*. New York: John Wiley & Sons, Inc., 2002.
- Shi, Nan, and Taofang Yu. "Energy Saving and Emission Reduction: Chinese Low Carbon Strategy in 11th Five Year Plan Period." In *Sustainable City / Developing World*, edited by Chris Gossop, 118 – 141. The Hague: ISOCARP, 2010.
- Tan, Hongwei, Jane Yin Jiang, Jianxin Hu, and Yingchu Qian. "Here Comes the NEXT in China's Rapid Urbanization." Paper presented at GreenBuild International Conference and Expo 2011, Toronto, October 6, 2011.
- The Green Leap Forward. <http://greenleapforward.com>.
- Wang Xi 王曦. "Xunzhaolingnengbao jianzhu de linghun" 寻找零能耗建筑的灵魂 [Find the Essence of Zero Energy Architecture]. *NEWSCCN.com* 中华建筑报. June 15, 2011. Accessed on April 28, 2012. <http://design.newscn.com/2010-12-20/27861.html>.
- Whittaker, Iona. "Growing Green Design in Beijing: A Conversation with Architect Li Hu." *ARTINFO China*. October 1, 2010. Accessed on April 28, 2012. <http://www.blouinartinfo.com/news/story/35839/growing-green-design-in-beijing-a-conversation-with-architect-li-hu/>.
- Xu Nan. "Green credentials of China's new ruling committee gives cause for hope." *chinadialogue*. November 16, 2012. Accessed on December 3, 2012. <http://www.chinadialogue.net/blog/5348-Green-credentials-of-China-s-new-ruling-committee-gives-cause-for-hope/en>.
- Zhu Pengfei 朱鹏飞. *Jianzhu shengtaixue* 建筑生态学 [Arcology]. The Architecture & Urban Planning Series. Beijing: *Zhongguo jianzhu gongye chubanshe* 中国建筑工业出版社 [China Architecture & Building Press], 2011.
- Zhulong.com. "Chuantong sibeyuan li de beidongshi jieneng sheji" 传统四合院里的被动式节能设计 [Passive design strategies in traditional courtyard house]. November 3, 2010. Accessed on April 28, 2012. http://jz.zhulong.com/topic_shyjn.html.

On Maps

Beijing ditu mingguo chunian 北京地图·民国初年 [Map of Peking 1912]. 1:15 850. As reproduced by, Beijing: *Zhongguo ditu chubanshe* 中国地图出版社 [SinoMaps Press], 2008.

Xince Beijing neivaicheng quantu 新测北京内外城全图 [Map of Peking 1921]. 1:15 000. As reproduced by, Beijing: *Zhongguo ditu chubanshe* 中国地图出版社 [SinoMaps Press], 2008.

Su Jiarong 苏甲荣. *Beiping shi quantu mingguo sanshinian* 北平市全图·民国三十年 [Map of Peking 1941]. Shanghai: *Rixin yudi xueshe* 日新舆地学社, 1941. As reproduced by, Beijing: *Zhongguo ditu chubanshe* 中国地图出版社 [SinoMaps Press], 2008.

1950 *Beijing shi jiedao xiangtu (fuzhiban)* 1950 北京市街道详图 (复制版) [Map of Beijing 1950 (Reproduction)]. Shanghai: *Yaguang yudi xueshe* 亚光舆地学社, 1950. As reproduced by, Beijing: *Zhongguo ditu chubanshe* 中国地图出版社 [SinoMaps Press], 2004.

Beijing shi junmin liangyong jiaotong dituce 北京市军民两用交通地图册 [Traffic Map of Beijing for Dual Uses]. Beijing: *Xingqiu ditu chubanshe* 星球地图出版社 [Star Map Press], 2011.

Beijing shi dituce 北京市地图册 [Beijing Atlas]. Beijing: *Zhongguo ditu chubanshe* 中国地图出版社 [SinoMaps Press], 2012.

Capital Library of China Collection. *Qianlong Quantu* 乾隆京城全图 [The Complete Map of Peking, Qianlong Period]. 1750. Accessed October 14, 2011. <http://www.bjmem.com/bjm/jcyt/qlqt/>.

On Plans and Policies

Baidu. “Energy Reduction Strategies during the 12th Five Year Plan.” *Baike*. Accessed on May 2, 2012. <http://baike.baidu.com/view/6441377.htm>.

Beijing Municipal Bureau of Land and Resources. “*Beijingshi tudiliyong zongtiguibia (2006–2020)*” 北京市土地利用总体规划 (2006—2020年) [Beijing Land Use Planning 2006–2020]. January 8, 2010. Accessed on December 15, 2011. <http://www.bjgtj.gov.cn/tabid/3195/InfoID/60349/Default.aspx>.

- Beijing Municipal Bureau of Land and Resources. “*Tudiliyong xianzhuang ji gongxucixingshi*” 土地利用现状及供需形势 [Current Land Use Condition and Demand Trends]. January 5, 2010. Accessed on December 15, 2011. <http://www.bjgtj.gov.cn/tabid/3195/InfoID/61217/Default.aspx>.
- Beijing Municipal Commission of Development and Reform. “*Beijing chengshi zongti guihua*” 北京城市总体规划（2004年-2020年） [The General Urban Plan of Beijing 2004 – 2020]. Accessed on December 15, 2011. http://www.bjpc.gov.cn/fzgh_1/csztgh/200710/t195452.htm.
- Beijing Review. “Circular Economy Promotion Law of the People’s Republic of China.” Last modified December 4, 2008. http://www.bjreview.com.cn/document/txt/2008-12/04/content_168428.htm.
- Beijing-China 首都之窗. “*Beijingshi baozhangxing zhufangzhengce zhinan*” 北京市保障性住房政策指南 [Guide to Low-income Public Housing Policy in Beijing]. Accessed November 10, 2012. <http://zhengwu.beijing.gov.cn/zwzt/bjsbxzf/t1094084.htm>.
- China Green Buildings. “Ministry of Construction Green Building Evaluation Standard – The ‘Three Star’ System.” February 24, 2009. Accessed on May 2, 2012. <http://chinagreenbuildings.blogspot.ca/2009/02/ministry-of-construction-green-building.html>.
- China Law & Practice. “PRC Renewable Energy Law.” Accessed on May 2, 2012. <http://www.chinalawandpractice.com/Article/1692548/Issue/8508/PRC-Renewable-Energy-Law.html>.
- Chinalawinfor Co., Ltd. “Energy Conservation Law of the People’s Republic of China (2007 Revision).” Accessed on May 2, 2012. <http://www.lawinfochina.com/display.aspx?lib=law&id=6467>.
- Evans, Meredydd, Bin Shui, Mark Halverson, and Alison Delgado. “Enforcing Building Energy Codes in China: Progress and Comparative Lessons.” *Pacific Northwest National Laboratory*. August 2010. Accessed on May 2, 2012. http://www.pnl.gov/main/publications/external/technical_reports/PNNL-19247.pdf.
- Gu, Chaolin, Xiaohui Yuan, and Jing guo. “China’s Master Planning System in Transition: Case Study on Beijing.” *46th ISOCARP Congress*. Accessed on May 2, 2012. http://www.isocarp.net/Data/case_studies/1657.pdf.

- Ma Li. “*Beijing zhongxin cheng guibu jianyi: jiucheng renkou jianzhi bajiushiwan*” 北京中心城规划建议：旧城人口减至八九十万 [Central Zone Planning Proposal: Population Control in Historic Centre]. *Xinhua Net* 新华网. August 16, 2007. Accessed November 1, 2011. http://news.xinhuanet.com/local/2007-08/16/content_6540206.htm.
- MOHURD. “Code for acceptance of energy efficient building construction.” January 16, 2007. Accessed on May 2, 2012. <http://www.bjgr.cn/autopics/201010/12881559272.pdf>.
- PPP IRC. “China Circular Economy Promotion Law.” Accessed on May 2, 2012. <http://ppp.worldbank.org/public-private-partnership/library/china-circular-economy-promotion-law>.
- Sun Qian 孙乾. “*Beijing fazhan bizou quyuchengshiqun zhanlue*” 北京发展必走区域城市群战略 [Polycentre Strategy in Future Beijing Developments]. *Jing Hua News* 京华时报. November 11, 2012. Accessed November 11, 2012. http://epaper.jinghua.cn/html/2012-11/11/content_1824393.htm.
- The Central People’s Government of the People’s Republic of China. “Regulation on Energy Conservation in Civil Buildings.” August 1, 2008. Accessed on May 2, 2012. http://www.gov.cn/zw/gk/2008-08/07/content_1067038.htm.
- The Central People’s Government of The People’s Republic of China. “China’s Five Year Plans: Looking Back and Looking Ahead.” Accessed on May 2, 2012. <http://www.gov.cn/2011lh/sewgh.htm>.
- Wang Yajun, and Lv Jia 王亚钧、吕佳. “*Beijing chengshi kongjian fazhan zhanluegouxiang*” 北京城市空间发展战略构想 [Beijing Urban Spatial Strategies]. *Chinacity.org.cn*. March 24, 2011. Accessed on May 2, 2012. <http://www.chinacity.org.cn/csfz/fzzl/68163.html>.
- Wu, Weijia. “Beijing 2049: a long-term development prospective.” Paper presented at SP Symposium, San Paulo, Brazil, June 18, 2012. http://www.usp.br/fau/docentes/deprojeto/c_deak/CD/1disc/12sp-symposium/120619-04-wu-beijing-2049/120619-04-wu-beijing-2049.pdf.

On Populations and Density

———. *China in Focus (12) Changes In My Hometown*. Beijing: Beijing Review Publication, 1985.

Beijing Statistical Information Net. “*The Sixth National Population Census, Beijing*.” May 5, 2011. Accessed November 1, 2011. http://www.bjstats.gov.cn/rkpc_6/pcsj/201105/t20110506_201580.htm.

Beijing Xicheng. “The Sixth National Population Census: Xicheng District.” May 30, 2011. Accessed November 1, 2011. <http://www.bjxch.gov.cn/XCHzjxc/XCHxcgk/XCHrkzk.html>.

Beijing Dongcheng. “The Sixth National Population Census: Dongcheng District.” May 23, 2011. Accessed November 1, 2011. <http://www.bjdch.gov.cn/n5687274/n7654063/n7654157/n7654379/9732368.html>.

Beijing Chaoyang. “The Sixth National Population Census: Chaoyang District.” May 20, 2011. Accessed November 1, 2011. <http://www.bjchy.gov.cn/affair/tjxx/bulletin/8a24fe832e9fcd5301300c28cbac130e.html>.

Fengtai Statistical Information Net. “The Sixth National Population Census: Fengtai District.” May 10, 2011. Accessed November 1, 2011. <http://www.ft.bjstats.gov.cn/rkpc6/html/20110511/9675061.html>.

Beijing Shijingshan. “The Sixth National Population Census: Shijingshan District.” May 20, 2011. Accessed November 1, 2011. <http://www.sjs.gov.cn/zjsjs/xwzx/ywbb/66540.shtml>.

Beijing Haidian. “The Sixth National Population Census: Haidian District.” June 20, 2011. Accessed November 1, 2011. http://www.bjhd.gov.cn/govinfo/auto4514/201109/t20110919_328978.html.

Beijing Fangshan. “The Sixth National Population Census: Fangshan District.” May 17, 2011. Accessed November 1, 2011. <http://www.bjfsh.gov.cn/zwgk/tztg/82213.html>.

Tongzhou Statistical Information Net. “The Sixth National Population Census: Tongzhou District.” June 30, 2011. Accessed November 1, 2011. <http://www.tz.bjstats.gov.cn/Page/353/InfoID/14029/SourceId/826/PubDate/2011-06-30/Default.aspx>.

- Shunyi Statistical Information Net. "The Sixth National Population Census: Shunyi District." May 23, 2011. Accessed November 1, 2011. <http://www.sy.bjstats.gov.cn/rkpc/level3.jsp?id=4642>.
- Beijing Changping. "The Sixth National Population Census: Changping District." May 10, 2011. Accessed November 1, 2011. <http://www.bjchp.gov.cn/tabid/260/InfoID/60745/frtid/326/Default.aspx>.
- Daxing Statistical Information Net. "The Sixth National Population Census: Daxing District." May 18, 2011. <http://www.dx.bjstats.gov.cn/web/rkpcw/pcgb/22981.htm>.
- Mentougou Statistical Information Net. "The Sixth National Population Census: Mentougou District." May 6, 2011. Accessed November 1, 2011. <http://www.mtg.bjstats.gov.cn/Page/509/InfoID/15553/SourceId/1661/PubDate/2011-05-06/Default.aspx>.
- Beijing Huairou. "The Sixth National Population Census: Huairou District." May 23, 2011. Accessed November 1, 2011. <http://www.hrtj.gov.cn/Page/348/InfoID/15767/SourceId/1143/PubDate/2011-05-23/Default.aspx>.
- Pinggu Statistical Information Net. "The Sixth National Population Census: Pinggu District." May 26, 2011. Accessed November 1, 2011. <http://www.pg.bjstats.gov.cn/tjsj/tjgb/cs22/18290.htm>.
- Miyun Statistical Information Net. "The Sixth National Population Census: Miyun District." May 6, 2011. Accessed November 1, 2011. <http://www.my.bjstats.gov.cn/Page/312/InfoID/11739/SourceId/822/PubDate/2011-05-06/default.aspx>.
- Yanqing Statistical Information Net. "The Sixth National Population Census: Yanqing District." May 11, 2011. Accessed November 1, 2011. http://yq.bjstats.gov.cn/pub/rkpc_6/pcdt/tztg/index.htm.
- Caijing.com.cn. "*Beijing daxiang renkou tiaokongzhan*" 北京打响人口调控战 [Beijing initiates battle on population control]. Accessed November 20, 2011. <http://www.caijing.com.cn/2011/beijingrenkou>.
- Density Atlas. "Density Case Studies." Accessed November 9, 2011. <http://densityatlas.org/casestudies/index.php?sort=city&s=desc>.

Duan Chengrong 段成荣. “*Lishishang de Beijing renkou qianyi yu liudong*” 历史上的北京人口迁移与流动 [Beijing’s Population Growth and Migration in History]. Accessed November 1, 2011. http://www.bjpopss.gov.cn/asp_cgzh_100/ReadCGIMore.asp?ID=75&MID=4.

eBeijing. “People’s Living Standard.” Accessed November 3, 2011. <http://www.ebeijing.gov.cn/BeijingInfo/BJInfoTips/ModernBeijing/t934763.htm>.

Jing, Meng. “Beijing’s population surges near 20 million.” *China Daily*. July 23, 2010. Accessed November 1, 2011. http://www.chinadaily.com.cn/china/2010-07/23/content_11038489.htm.

News.cn. “*Beijing jumin renjun zhubufang mianji 30 nian zeng 3 bei*” 北京居民人均住房面积30年增3倍 [Beijing’s average floor area per capita increases three times in 30 years]. November 7, 2008. Accessed November 1, 2011. http://news.xinhuanet.com/house/2008-11/07/content_10320313.htm.

Population Reference Bureau. “2011 World Population Data Sheet.” Accessed on July 22, 2012. http://www.prb.org/pdf11/2011population-data-sheet_eng.pdf.

Wang Minghao 王明浩. “*Beijing: sanhuannei buzai xinzeng gongying zhubuzhaiyongdi, sihuannei yuanzeshang bujizhong jian jingshibang*” 北京：三环内不再新增供应住宅用地 四环内原则上不集中建经适房 [No more increases on residential land use within the Third Ring Road; no more clustered construction of affordable housing within the Fourth Ring Road in general]. *People.com.cn*. March 7, 2012. Accessed on July 22, 2012. <http://politics.people.com.cn/GB/14562/17322883.html>.

Zhang, Li. *Strangers in the City: Reconfigurations of Space, Power, and Social Networks Within China’s Floating Population*. California: Stanford University Press, 2001.

On Statistics: Energy

BP. “Statistical Review of World Energy 2012.” Accessed July 21, 2012. <http://www.bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481>.

Fridley, David, and Nathaniel Aden, ed. “China Energy Databook Version 7.0.” Berkeley: Lawrence Berkeley National Laboratory, 2008. Accessed on May 2, 2012. <http://escholarship.org/uc/item/1xx9p9cq>.