A sustainable residential community that promotes urban dwellers’ well-being – new city development in Nanjing China

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A sustainable residential community that promotes urban dwellers’ well-being

– new city development in Nanjing China

By

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Date
Abstract

The process of rapid urbanization has brought not only opportunities for the development of urban areas but also challenges for the design of quality urban space, especially for residential neighborhoods and public spaces. For the past four decades, the most common housing option for urban dwellers in China has been an apartment in a high-rise concrete tower in a gated residential community. This type of housing model initially improved the living conditions for residents and helped to solve the land shortage issue; however, that model can no longer fulfill residents’ demand for well-being or maintain a sustainable way of living.

This thesis examines the current condition of the newly developed residential projects in Nanjing and identifies some of the problems of the current model of housing development. Those problems include reduced mobility of pedestrians and automobiles, land-usage issues caused by building hybrid open spaces, and a lack of places that promote social interaction.

The method for opening these gated residential communities and for creating a better housing option for the general public has been a controversial subject in the realm of urban planning and architecture design. Learning from the successful precedents of mixed-used urban projects and quality public space, as well as the theory of new urbanism and sustainable development, this thesis provides a new option for sustainable residential communities in the new urban area of Nanjing—namely, one that promotes the well-being of urban residents.

Key words: Gated residential community, well-being, sustainable development, public space
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Introduction

As the rapid population and economic growth brings opportunity for urban development, it also brings challenge to the urban built environment to sustain residents’ demand of healthy lifestyle and well-being. To understand the future trend of urban development and why the current housing model can no longer fulfill residents’ needs, the process of urbanization in China, and the development process of the residential community and urban public space must be studied.

This section provides background information about the rapid urbanization process in some large cities in China, including the evolution of residential communities and public spaces through history. This background information reveals a future trend in the expansion of new cities and in the development of modern urban dwelling areas.

I. Urbanization process and city expansion

1. Urbanization in China

Urban transition, also known as the urbanization process, is the shift in the population from small rural villages to large and densely built urban areas (Montgomery et al., 2003). According to the Department of Economic and Social Affairs of the United Nations, the world urbanization rate increased from 30% in 1950 to 55% in 2018, and for the past century, the main contributors to continue the urbanization process have shifted from developed countries to developing countries. Experts from the United Nations also projected that by 2050, almost 90% of the world’s urbanization growth will happen in Africa and Asia (UNDESA, 2018).

China, of all developing countries, has been one of the most significant contributors to the world urbanization rate for the past four decades (Xiao et al., 2018, Tan et al., 2016,
UNDESA, 2018). Figure 1 shows that under the influence of economic reform policy, the rate of urbanization in China has increased rapidly since 1978. In the 1980s, only 17.92% of the total population lived in urban areas in China, but that number had increased to 59.15% by 2018, surpassing the world average of 55%.

Researchers have also projected that the urban population in China will continue to grow at a steady pace. By 2050, 80.03% of the total population in China will live in developed urban areas, while the world average will be 68% (Ritchie and Roser, 2018, UNDESA, 2018).

The shift in population has also provided opportunities for the development of new urban areas and for city expansion. Table 1 shows that from 1978 to 2018, the total number of cities in China had increased by 2.42, from 193 cities to 661 cities.
In addition to the number of cities, Table 1 also indicates that the structure of cities has also changed thoroughly. For example, in 1978, more than 66% of developed urban areas in China were small cities, with a population of less than half million, and only one city was defined as a megacity, with over five million urban dwellers. Over the past four decades, most newly developed and previously built urban areas have expanded to become medium- to large-size cities. In 2018, 478 urban areas in China had an urban population of over half a million, and the total number of megacities had increased to 15. For instance, Nanjing is one of the megacities that expanded rapidly since 1978, and it has typical newly developed urban districts and unique historical town centers.

Table 1
City size and the number of cities with growth in China

<table>
<thead>
<tr>
<th>City Scale</th>
<th>Urban Population (Million)</th>
<th>Number of cities in 1978</th>
<th>Number of cities in 2018</th>
<th>Differences</th>
<th>Increase rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Megacity</td>
<td>More Than 5M</td>
<td>1</td>
<td>15</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Large cities</td>
<td>1M - 5M</td>
<td>28</td>
<td>213</td>
<td>185</td>
<td>6.6</td>
</tr>
<tr>
<td>Medium cities</td>
<td>0.5M - 1M</td>
<td>35</td>
<td>250</td>
<td>215</td>
<td>6.1</td>
</tr>
<tr>
<td>Small cities</td>
<td>Less than 0.5M</td>
<td>129</td>
<td>183</td>
<td>54</td>
<td>0.48</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>193</td>
<td>661</td>
<td>468</td>
<td>2.42</td>
</tr>
</tbody>
</table>

Table 1. City scale standard and number of cities growth in China. Source: National Bureau of Statistics, 2018

2. City expansion in the city of Nanjing

Nanjing, the capital of Jiangsu province, is in the southeast region of China and at the lower reaches of the Yangtze River. This city was the state capital of six dynasties through the history of China, and each dynasty brought opportunities for urban development to Nanjing (Su, 2008).

These distinct redevelopment phases have brought a sense of uniqueness to Nanjing, and the urban zoning and street grids from hundreds of years ago still affect the urban form and
structure in Nanjing today. For instance, the ancient city wall that was built during the Ming dynasty (1368–1421) still defines the old town center of Nanjing, which covers an area of 150 square kilometers (58 square miles). Figure 2 shows the old urban district’s three main axes, which were planned in three different eras. The central axis of the south part of the old city was developed during the Southern Tang dynasty (937–975), about 1050 years ago. The north-south axis of the west part of the city was planned during the Ming dynasty (1368–1421), and the axis from the north-east to the west was planned around the 1920s.

![Figure 2. Three main axes of the old city district Source: Base map from Google maps](image)

Even though most parts of the city have been severely damaged and rebuilt because of wars and natural disasters, the urban fabric in the old town center has also been well preserved. Figure 3 shows the historic preservation district at the south part of the old city area, where attractions for tourists can be found, such as ancient educational facilities, old markets, and
private gardens. In that district, most city blocks are smaller than 300 by 300 ft, and most of the residential buildings are two-to-four-story low-rise buildings.

In the other parts of the old urban area, except the central business area, most of the urban blocks are still densely built and smaller than 600 by 600 ft, while most of the residential buildings are mid-rise concrete block buildings, with four to seven stories of height. However, in the newly developed area of Nanjing, created during the rapid urban expansion of the last 40 years, the urban fabric is different from the old city district.

Figure 4 and Table 2 indicate that while the urban population in Nanjing has increased from 1.77 million in 1978 to 6.82 million in 2018, the land area of the city of Nanjing also has expanded to over 7.8 times its 1978 size. That increase has resulted in an urban area that has grown from 840.28 square kilometers (324.4 square miles) to 6587.02 square kilometers (2543.3 square miles), and that growth has caused the urban population density to decrease by over 50% in 40 years (Nanjing Bureau of Statistics, 2018, Su, 2008, Du, 2016, Luo & Wei, 2009). In the
meantime, the urban form and structure of the newly built urban districts in Nanjing have changed thoroughly.

Figure 4. Urban expansion in Nanjing Source: Base map from Google maps
Table 2
Urban expansion and population growth in Nanjing

<table>
<thead>
<tr>
<th>Year</th>
<th>Urban population (million)</th>
<th>Urban area (sq. km)</th>
<th>Urban density (People/sq. km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>1.77</td>
<td>840.28</td>
<td>2113</td>
</tr>
<tr>
<td>1988</td>
<td>2.39</td>
<td>948.21</td>
<td>2521</td>
</tr>
<tr>
<td>1998</td>
<td>2.73</td>
<td>975.82</td>
<td>2800</td>
</tr>
<tr>
<td>2008</td>
<td>5.34</td>
<td>4723.07</td>
<td>1132</td>
</tr>
<tr>
<td>2018</td>
<td>6.82</td>
<td>6587.02</td>
<td>1037</td>
</tr>
</tbody>
</table>

Table 2. Urban expansion and population growth in Nanjing since 1978. Source: Nanjing Bureau of Statistics, 2018

For instance, the Hexi New City district is one of the typical newly developed urban areas in China. This new town is southwest from the old city wall of Nanjing and covers an area of 94 square kilometers (36.3 square miles). It has a population of more than half a million.

The area used to be farmland and undeveloped lands; however, after the rapid urban development and rebuilding, this area has become one of the major urban dwelling and commercial areas in Nanjing. In the meantime, the urban form of the Hexi district has changed from the design in the old town center of Nanjing.

Figure 5 shows that unlike the old city, there is a regulated street grid system in the new city district. Most of the urban blocks are 800 by 800 ft rectangular-shaped blocks. In addition, the building typology in the new district is also different from the old town center. All the residential buildings in this area are newly built high-rise concrete blocks, with more than seven stories and taller than 23 meters (75 feet), while most of the commercial and civic buildings are high-rise or super high-rise steel towers.
In the foreseeable future, the urban area of Nanjing will continue to expand, and many more new towns like the Hexi New City district are already in the future master plan of Nanjing. For example, Figure 6 shows that in the master plan of Nanjing from 2018 to 2035, the old city and the Jiangbei new city area across the Yangtze river will be the two main urban centers in Nanjing (Nanjing Bureau of Planning, 2018). The blue and green circles in Figure 6 indicate that similar to the Hex district, there will be 12 new sub-city centers surrounding the two main city centers of Nanjing.
Figure 6. New town development plan Source: Base map from Google maps
II. Residential community development

Most of the newly built residential properties in China share two critical commonalities: 1) The entire compound is enclosed with walls and gates, and 2) most of the building are groups of mid-rise or high-rise concrete towers. Among other causes for the closed neighborhood practice in China, three of the most essential are historical heritage, code regulation, and real estate marketing (Hassenpflug & Kammerbauer, 2010).

1. Historical heritage.

The philosophy of the closed space is rooted in Chinese culture (Staub & Yu, 2014). Throughout Chinese history, people have understood the essence characteristics of an enclosed environment—namely, security, privacy, and protection. As a result, builders and planners have practiced this philosophy at every level of city development, from urban planning to neighborhood zoning to building design.

In a typical Chinese city in the ancient times, the city wall served not only as the defensive structure that defined the city border but also as a physical barrier that separated the different social classes into individual city parts. For example, Nanjing, along with Beijing and Xi’an, is a typical Chinese city with a rich historical background and the ancient city wall created the boundaries for the social class hierarchy in Nanjing (Hassenpflug & Kammerbauer, 2010, Su, 2016).

For instance, Figure 7 shows that when the city of Nanjing was designed during the Ming dynasty (1368–1421), there were four layers of different city walls, from the city core of Nanjing to the outside: the palace city wall, the emperor’s city wall, the capital city wall, and the outer city wall. The walls divided Nanjing city into four different and enclosed zones (Su, 2016). The heart of the city was the palace city, where the emperor and his family lived. Outside the palace
was the emperor’s city, where the central government facilities and the military campus for royal guards were located. Both the palace and the emperor’s city were heavily guarded and not accessible to those ordinary city residents. The capital city and the outer city, where the general city dwellers lived, were separated from the city core.

The practice of a closed built environment can also be found at the neighborhood level. For example, in the capital city of Nanjing, there were local government facilities, educational campuses, handicraft industry areas, markets, and religious places, and each of those sections was kept apart from the others and protected by lower walls, gates, and fences. This type of zoning also ensured segregation of different social classes: Citizens were only allowed to live in the district where they worked.

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Figure 7. Nanjing city plan in the Ming dynasty Source: Urban Planning History of Nanjing (Su, 2018)
In addition, the sense of exclusive also existed at the building design level. Figure 8 shows a typical Chinese garden house with two courtyards. This type of home often had a front and a back courtyard, walls, and gates, all of which isolated the house from the exterior environment and other buildings.

![Diagram of a two-courtyard house](image)

Figure 8. Diagram of a two-courtyard house

Despite most of the outer city and capital city wall walls being destroyed during wars, the remaining walls serve as a reminder of the spirit of the sense of exclusive, inherited by city planners and builders in China (Hassenpflug & Kammerbauer, 2010). Indeed, this spirit still influences how Chinese designers and planners build cities.

At the beginning of the 20th century, under the influence of Western culture, the concept of the enclosed micro district made its first appearance in China. This concept soon was integrated with the Chinese philosophy of the closed space and became the basic typology for
modern housing development in China. For instance, the Chinese word for a modern residential community is “Xiao Qu,” which can be translated as “enclosed micro district.” Since all the developers started to build enclosed micro district, apartments in concrete block buildings protected by walls and gates have become the general housing option for most urban dwellers in China (Yao & Wei, 2012).

Before the 1980s, most of the land in China was state owned, and all new residential projects in urban areas were developed by state-owned enterprises and factories. This type of housing was also called “Dan Wei,” or “Da Yuan,” which means “public housing development.” In this type of residential compound, only the workers associated with a specific factory were qualified to rent or purchase an apartment; otherwise, the whole community was closed, and people who were not the employees were prohibited from entering the compound.

The residential district for the Meishan metallurgical company in Nanjing is a typical modern residential neighborhood from the 1980s. This micro district was designed and built on 74 acres land for over 20,000 urban dwellers (Su, 2016), started from 1969. The whole site was at the north side of the Yangtze river outside the old city of Nanjing.

Figure 9 shows that this community was densely built and had over 100 block apartment buildings that were four stories high and made of brick and concrete. This housing compound was also planned to include public facilities, such as a primary and middle school, a day-care center, several dining halls, banks, post offices, shopping malls, and local convenience stores. This type of large-scale housing development is nearly a self-sustained community; within walking distance, the community can meet all the demands of people’s daily life.
Under the influence of the “reform and opening-up” policy, the housing market was gradually opened in China after 1978, and private real estate developers started to bid on land through auctions and to provide more diverse housing options for the general public (Mars, 2008). Thereafter, private developers were able to purchase land with large area and divide the land into several blocks. Therefore, the average area of a residential development site became smaller, the density and floor area ratio became higher, and communities were designed to be more closed and compact.

In this context, the Ruijin new village housing development in Nanjing is a good example of the residential block development in the 1980s. This residential compound was built between
1980 and 1996 at the east side of the old town center of Nanjing. Figure 10 shows the site plan of the Ruijin new village. This neighborhood is located on 25 acres of land, and it has 70 concrete block buildings that provide over 560 apartments. The Ruijin new village is a densely built, enclosed residential neighborhood that is protected by walls and gate. In this community, most of the apartment buildings are four-to-seven-story mid-rise concrete block buildings, and there are a few one-to-two-story public structures at the entrances of the compound.

In contrast to the residential district for the Meishan metallurgical company, most of the residential projects that were planned around this time would have to share public service facilities with other housing compounds. In the meantime, planners tended to choose a more open design for urban dwelling projects; each apartment building was farther apart from each other than in the past. This change was caused by improved local building code and planning regulations.
2. Code and regulations.

Regulations and local guidelines affect the design of modern residential projects in almost every aspect—for example, the building layout, the distance between two apartment towers, or even the height and orientation of a building.

From the late 1970s, rapid economic and population growth created high demand in the housing market in China. However, the code and regulations on both land-use structures and on agricultural land preservation caused a gap between the increasing demand and the supply in the housing market.

Table 3
Urban land-use structure in regulation and different cities in 2018

<table>
<thead>
<tr>
<th>Land function</th>
<th>Codes</th>
<th>Regulation (%)</th>
<th>Beijing</th>
<th>Nanjing</th>
<th>Shanghai</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>R</td>
<td>25.0–40.0</td>
<td>28.89</td>
<td>27.90</td>
<td>28.60</td>
</tr>
<tr>
<td>Administration and public services</td>
<td>A</td>
<td>5.0–8.0</td>
<td>11.76</td>
<td>11.73</td>
<td>7.92</td>
</tr>
<tr>
<td>Industrial and manufacturing</td>
<td>M</td>
<td>15.0–30.0</td>
<td>17.95</td>
<td>21.00</td>
<td>28.81</td>
</tr>
<tr>
<td>Road, street and transportation</td>
<td>S</td>
<td>10.0–25.0</td>
<td>18.51</td>
<td>16.08</td>
<td>7.11</td>
</tr>
<tr>
<td>Green space and plaza</td>
<td>G</td>
<td>10.0–15.0</td>
<td>7.90</td>
<td>10.54</td>
<td>7.40</td>
</tr>
</tbody>
</table>

Table 3. Urban land-use structure in regulations and different cities. Source: MOHURD, 2018

According to the Chinese urban land use planning standard (GB 20137-2011), both residential and industrial land should have the most percentage in the urban land-use structure system. Table 3 shows that in the planning code, 25% to 40% of urban construction land should be developed as residential areas and that 15% to 30% should be for industrial and manufacturing purposes. Additionally, green space and plaza should take 10% to 15% of the total urban land, and 10% to 25% should be devoted to roads, streets, and transportation purposes.
With a large percentage of land being devoted to industrial and manufacturing purposes in the urban land use structure system, this planning code restricts the expansion of residential land and green space and further widens the gap between the demand and supply in the housing market. For example, in Beijing, Nanjing, and Shanghai, the average percentage of the residential area and green space falls below 30% and 10%, while the industrial and manufacturing land percentage is above 20%. However, in the ideal model that promotes the well-being of the urban dwellers, residential land and green space should be considered as the essential components in the land-use structure.

For instance, in 2014, New York City had over 42.52% of its total urban area designated for residential use, and over 26.96% of the land was marked either as open space or for outdoor recreational purposes. Meanwhile, industrial and manufacturing land comprised only 3.48% of the urban area. Furthermore, in other major cities in the world, the average percentage of residential land is above 40%, and the percentage of industrial land is below 10% (Huang, Yang, & Zhang, 2017)

Without the option of expanding urban residential areas, the best choice for filling the gap in the housing market is to develop apartment towers with higher floors. Since then, local officials tended to encourage real estate developers to develop more compact housing projects. As a result, the high-rise apartment tower became the building typology for housing projects in China.

Regulations on insolation also have had a significant effect on residential project planning. For example, according to the Nanjing Bureau of Planning, at least two living spaces (e.g., living rooms, great rooms and bedrooms) of every apartment must receive a minimum of two hours of direct solar exposure per day. Thus, the distance between two apartment towers
must be wide enough to allow natural light and heat into every apartment (Li, 2005). Moreover, real estate developers also choose to place apartment towers on a direct south-to-north orientation to maximize natural light during the day from the south.

In this regard, Figure 11 shows the differences between modern residential projects in Shanghai and Berlin (Li, 2005). In Shanghai, all the apartment buildings have the same orientation toward the south, and each building stands on its own as a single unit in the residential compound. In contrast, in Berlin, four buildings have different orientations joint together to form the basic component of a street block.

The two cities also differ in the distance from one building to another. In Shanghai, because of the insolation requirement, the distance between two buildings increases if the apartment tower to the south is higher; in Berlin, because a group of residential buildings have different orientations, the distance between each building can remain the same.
3. Real estate marketing

Other than code and local regulation, marketing can affect the design of a modern residential project and increase the economic value of a property, both developers and homeowners contribute to changes in the housing market. For homebuyers, a higher property value equates to a better outcome of their investment. In contrast, developers’ only goal is to obtain the maximum profit from the development.

For instance, the height of an apartment building is controlled by developers for economic reasons. According to the standard for the design of civil buildings in China (GB 50352-2019), a residential building lower than 27 meters is defined as a low-to-mid-rise civil building, while high-rise civil buildings should be higher than 27 meters and while the threshold for super high-rise civil buildings is 100 meters or higher (MOHURD, 2019). When the average floor height is 3 meters for an apartment building, most developers would like to keep residential buildings under 34 floors, which is under 100 meters, thus falling into the high-rise building definition in the code.

Furthermore, in the code for the fire protection design of buildings (GB 50016-2014), the requirements on refuge area and construction material fire ratings for super high-rise civil buildings are much restrictive than for other types of civil buildings (MOHURD, 2014). Therefore, keeping buildings under 100 meters helps developers to obtain the maximum profit, achieving substantial savings on taxes, fire protection equipment, and building materials.

The level of enclosure of a neighborhood and the orientation of the buildings can also be affected by marketing factors. For urban dwellers, gated communities provide the maximum level of security and privacy. They include unique safety designs, such as a limited number of entrances, higher walls, metal fences, security guards, and cameras. As a result, sealed residential...
micro districts create a safe and quiet living environment for residents. With those security features, visitors outside the community are restricted from entering the property, except guests who are invited. The chance of property crime is also limited to a relatively low level, compared to open residential neighborhoods.

For developers, branding for the housing projects is another factor that affects their decisions. Since there is no planning code to restrict developers from building walls and fences around properties, the builders design higher walls, reduce the number of entrances, and restrict non homeowners from entering the neighborhood. In so doing, developers can brand their projects as high-end luxury residential communities in order to attract more buyers.

For instance, Figure 12 shows the front gate of Liancheng residential micro-district in Nanjing. It is a typical gated housing project that was marketed as a high-end property by the developers. Meanwhile, the same concept can be found in the other countries in the world. Figure 13 shows the Providence gated community in Florida, which is also considered a luxury housing option for urban dwellers.
For the same branding reason, most apartment buildings have the same southward orientation. In Chinese Feng Shui culture, south-facing properties are considered the best and are believed to bring a good and prosperous life to the household. Communities branded as high end have a higher property value, which benefits homeowners.
III. Public space and activities

In addition to the residential community, the public space is also an important component in the modern urban development in Nanjing. Spaces such as parks, playgrounds, community gardens, enclosed courtyards, and streets, all of which create the possibility for a variety of public activities. Among those spaces, streets have always played an important role in the outdoor public life of city dwellers. Similar to the 1950s harmony street scene in New York, which Jane Jacobs describes in her book (Jacobs, 1961), most public activities happen in China on small streets.

Alleys or small streets link different neighborhoods to the main roads of the city and connect buildings and houses within communities. In China, since the main city component is the enclosed micro district, each residential compound is like an independent kingdom: Because communities are not connected to each other, each community has its own public service facilities. Due to the lack of shared public space, streets serve not only as pathways for cars and pedestrians but also as the open space for social activities for urban residents. In this regard, there are three main types of activities: recreational, social, and daily life.

For instance, for the elderly people who do their morning exercises on the small streets in the morning and for the younger generations who jog after work in the evening, the street is a park, an athletic field, and a place for recreational activities. Moreover, for the customers and owners of mobile food carts and for various shops, the street is a market, a food court, and a place for the activities of daily life. Furthermore, for the children running and playing together and for the residents walking around the neighborhood and chatting with each other, the street is a playground, a plaza, a place for social activities.
For the past four decades, local governments have improved the planning and building ordinances on public space development. Governments and developers have also invested heavily in improving existing public spaces and building new recreational facilities for city dwellers. According to the National Bureau of Statistics of China, the public recreational green space per capita in China has grown from 1.5 square meters in 1981 to 14.01 square meters in 2017, with the green space covering about 40.91% of the urban built area. With the development of other public spaces, city residents have more choices over the small streets.

During the rapid urbanization process, the focus of street design has also gradually shifted from people to automobiles. As a result, in most of the “new city” area in China, there are only roads for cars, not for residents. Therefore, the street is no longer considered a place for public activities, and as Figure 14 shows, the enclosed courtyards in gated residential communities and other public facilities are some of the most popular and convenient alternative options for city dwellers.

Figure 14. Inner courtyard of a typical gated community
Problem statement

Despite the advantage in public security and crime prevention, developing gated residential communities still creates problems. For example, it weakens the ability of both the pedestrians and automobiles to move around in the city, wastes land and public space, and reduces the possibility for social interactions.

I. Weakening the mobility in the urban area

How to move urban residents and vehicles around in the most effective way has always been an important topic in the realm of urban planning. In China, with features such as large block size, controlled public access, and inner courtyards and streets, the model of a sealed residential community might have negative effects on the mobility of pedestrians and automobiles in the city area.

The large urban blocks of residential compounds might slow the traffic flow of cars and pedestrians in the urban area. In a typical large city in China, such as Nanjing, the average city block size is 800 by 800 ft in the new city and 600 by 600 ft in the old city. However, in most of the large cities in the world, city blocks are much smaller and denser than in Nanjing.

For instance, Figure 15 shows the difference in city block sizes in several cities. A typical square city block in Barcelona is 435 by 435 ft, similar to the 480 by 350 ft block in Philadelphia, and the 475 by 325 ft block in San Francisco. In fact, the 260 by 260 ft block in Portland only covers one quarter of the area of a typical city block in Nanjing. Even in cities that have rectangular building blocks, such as New York City, with 1000 by 250 ft blocks, and Chicago, with 660 by 330 ft blocks, the average size of an urban block is still smaller than in Nanjing.
Figure 15 shows the route choices for both pedestrians and automobiles in Portland and Nanjing. Small blocks create more crossroads and more opportunities (Jacobs, 1961). For both pedestrians and drivers in Barcelona and Portland, smaller blocks give more options to turn around the blocks and faster routes to get to their destinations. However, for city dwellers in Nanjing, the 800 by 800 ft urban blocks reduce the number of traffic lights on the road, also minimizing their ability to turn to a new street and to change their route. In such a case, the large blocks reduce the mobility of pedestrians and cars.
Figure 16. Route for pedestrians and auto mobiles in Portland and Nanjing.

Controlled access and private inner streets and pass ways, which are two of the essential features a sealed residential micro-district, contribute to the privacy and security in the urban area; however, they can also decrease the mobility of people in that urban area.

The paths in a city should be identifiable, be continuous, and have a directional quality (Lynch, 1960). For example, the irregular road network in Boston connects all the neighborhoods, and people can observe the city by moving through its multi-layer road system—from the main streets, such as Beacon Street and Commonwealth Avenue, to the neighborhood streets, such as Chestnut Street and Acorn Street in Beacon Hill.

In most of the large cities in China, such as Nanjing, tertiary streets are the missing element in the road network system because all the potential neighborhood-level streets and pass ways within the parameter of a gated community are privatized and not accessible for residents outside the community. For general citizens, the walls and gates of sealed communities not only block them from entering the compound but also limit their choices for faster routes to their
destinations. As a result, and most of them are forced to choose the main streets for their daily commute, thus causing critical traffic congestion problems in urban areas.

According to the guideline on urban planning and city development from the central government of China in 2016, enclosed residential compounds will be gradually opened, and the government will not encourage the real estate developers to build more such properties in the future. As a result, the inner private roads inside the compounds can be put into public use, thus helping to optimize the transportation networks in the old city and solving traffic congestion problem in the urban areas.

This controversial guideline caused a debate among the whole society regarding to whether developers should open up the existing sealed residential compounds. Urban dwellers worried about potential problems, such as noise and air pollution and public security risks. Residents also believe that due to the prospect of increasing traffic on the inner small streets inside the residential compounds, the traffic congestion problems would not be solved by opening the existing communities.
II. Lack of shared public space

The rapid growth of the population brings not only development opportunities but also serious land-shortage problems. Most of the large cities in China are densely built and overcrowded with urban residents, and every inch of land is precious. However, the typology of the sealed community, which helped to solve land-usage issues in the past, has intensified the land-waste problem in urban areas.

During the housing market development process, local governments and real estate developers tend to develop residential communities more densely, with high-rise apartment buildings. For example, according to the Nanjing Urban Planning Bureau, the floor area ratio for a residential project in the city of Nanjing should be between 1.0 and 2.8, with no less than 30% of open space and green space. By increasing the building density of the residential area, the land-shortage issue in urban areas was improved. However, gated residential communities might not be the best option for solving the land shortage problem in the future, since building more closed neighborhood would also causes another type of land-waste issue—having too much meaningless segregated public space.

Figure 17 shows the theory of the space type hierarchy by Oscar Newman. For an organized residential area, according to the degree of the privacy of the space, there should be four categories of spaces that connect to each other: public, semi-public, semi-private, and private (Newman, 1972). The model of sealed residential groups in China is one example of this theory in practice.
For instance, the city streets and walkways that surround the micro-districts are public spaces; they are accessible to all city dwellers, no matter where they live. In contrast, each of the apartments and townhouses within the compounds is a private space since each housing unit is only accessible to the homeowners. Additionally, semi-private spaces in the apartment building model are shared spaces within the building, which connects each of the apartment units and the outside environment. In this regard, most apartment buildings have strong security features to limit access to the residents of the apartment building.

In theory, semi-public spaces should be a buffer zone between the private and public environment, with a soft barrier between each space, such as a staircase that creates an elevation change or a fence that functions as a visual barrier. However, in the model of sealed residential compounds, controlled gates and concrete walls form a hard barrier, which blocks the smooth transition between the semi-public space and the outside world.
As a result of such barriers, the communal spaces within the walls and gates of residential communities, such as inner courtyards, small parks, recreational facilities, and playgrounds, are not shared with general citizens. Instead, they become private spaces for a small number of residents. Figure 18 shows a typical private courtyard in a sealed residential community in China. Therefore, most real estate developers choose to build exclusive public facilities for their tenants and homebuyers, and those unshared public spaces are commonly not large enough for multi-purpose activities. In other words, too much unshared single purpose public space has caused a critical land-waste problem in urban areas.

Figure 18. Private courtyard within gated community
III. Lack of a place for social interaction

In addition to those traffic issues and land-waste problems, the development of sealed residential communities also reduces the opportunity for necessary daily activities and unplanned optional activities for the urban residents. The physical arrangements and security features of a sealed community, such as high walls, guarded gates, and multistory buildings, give urban dwellers a sense of enclosure and separation, thus weakening the social connection between them.

In modern urban design theory, the principle of soft edges has been widely promoted for residential projects. The transitions between the various categories of public and private spaces should be flowing and gentle, and the main function of communal spaces is to provide the arena for life between buildings—that is, daily unplanned activities (Gehl, 2011). However, in the model of sealed residential groups, security features, such as guarded gates, high brick walls, and metal fences, form hard edges around the housing compounds.

These hard edges limit both the visual and auditory contact between urban dwellers in the private residential area and the outside public environment. Hard edges also prevent local residents from seeing and talking to a stranger, and they reduce the chance of optional daily activities. In fact, most of the open space in residential communities is not open enough for such optional activities. Figure 19 shows that urban dwellers of a gated residential community in Nanjing create extra windows on the fence for daily commercial activity. In contrast, Figure 20 shows the soft edge on the urban block on Newbury street in Boston, promoting social and commercial activities between residents.
Figure 19. Edge of urban blocks in gated community in Nanjing

Figure 20 Edge of urban blocks in Boston
Another issue is that the physical arrangement of high-rise apartment buildings weakens the social connection between the apartment residents. Figure 21 indicates that the level differences not only prevent residents from talking to and seeing other residents on different floors but also affect the connection between apartment dwellers and the outside world. In particular, once a resident lives higher than the fifth floor in a multistory building, it is almost impossible for that resident to have effective communication with others who are on the ground level.

Figure 21. Physical arrangement affects social contact
IV. Summary

From examining the existing model of residential community in the new city part of Nanjing, several problems were identified, such as weakening the mobility in the urban area, land waste issue caused by lack of shared public facility, and lack of a place for social interaction. All problems above were caused by the unique characteristics of gated housing compound. For example:

1) Building walls and gates to separate the community to the outside environment, and block both the pedestrians and automobiles from entering the compound.
2) Having limited number of entrances that cause traffic problem in the daily commute time.
3) Having single-use high-rise apartment tower as the common model.

The next step is to study the previous research and the existing theory on the topic of human well-being and sustainable development, urban public space, new urbanism, as well as the evaluating tool for sustainable development, and to develop the basic principle to promote the human well-being in the urban environment, and solve the current problems in the residential development in the new city area of Nanjing.
Literature review

This chapter provides information about previous studies on the topic of public space and sustainable lifestyle for urban dwellers. The following includes a consideration of human well-being and sustainable urban development, the relationship between the urban built environment and the well-being of residents, and public spaces in urban areas.

I. Human well-being and sustainable development


Figure 22 shows human well-being as a multidimensional concept covering a number of different fields. However, as the purpose of this paper is to discuss the promotion of well-being for urban residents through the sustainable development of urban environments, Figure 23 shows that the concept of human well-being can be defined as the balance between an individual’s challenges and psychological, social, and physical resources (Dodge, et al., 2012). In addition, the concept of sustainable development must include the satisfaction of humans’ physical, emotional, and social demands (Rogers, et al., 2012).
As Figure 24 shows, the common view of sustainable development contains three main aspects: environmental sustainability, economic sustainability, and social sustainability (Giddings et al., 2002). However, as a modern version of the sustainability concept, the United
Nations developed 17 sustainable development goals (SDGs) to address all three dimensions of sustainable development (Purvis et al., 2019). In the #Envision 2030 project, the third goal is to ensure healthy lives and to promote well-being for all ages (UN 2012a,). Thus, the idea of human well-being is deeply embedded in the contemporary principle of sustainable development (Rogers, et al., 2012).

![Three aspects of sustainable development and #Envision2030 by the United Nations](image)

**Figure 24. Three aspects of sustainable development and #Envision2030 by the United Nations**

Human well-being is a subjective concept, and it is commonly measured through self-reports and surveys (Larsen and Eid, 2008). Nevertheless, human health, positive social relationships, and the satisfaction of basic needs are objective concepts that can be measured. Of those factors, good health is the foundation for individuals to live a long, productive, and fruitful life; it also provides opportunities for individuals to achieve well-being (CDC, 2018, Herrman, et al., 2010, WHO, 1949, Breslow, 2006).

Activities that promote a healthy lifestyle are also effective ways to improve human well-being (CDC, 2018, Tellegen, et al., 1988, Herrman, et al., 2010), and the quality of the built environment is one the essential factors affecting urban dwellers’ health and well-being (WHO, 1986).
II. The urban built environment and well-being for urban residents

With more than 50% of the world population living in urban areas, the quality of the urban built environment has become an essential factor in the health and well-being of urban residents (Kjellstrom, et al., 2007, McMichael, 2000, Rogers, et al., 2012, Bai, et al., 2012). Figure 25 shows the key determinants of human well-being and health (Barton and Grand, 2006). It demonstrates that not only activities but also the built environment and natural environment are the foundation for someone to achieve health and well-being.

In the #Envision 2030 project by the United Nations (2012), one of the essential goals relating to sustainable cities and community development is to provide universal access to safe,
inclusive, and accessible green, public spaces—in particular for women, children, older persons, and persons with disabilities.

Planning urban areas to become sustainable also has the potential to affect residents’ well-being in a positive way (Bai, et al., 2010, Seto, et al., 2010). Figure 26 represents the concept of community well-being at the neighborhood level. In this regard, Qiao, et al. (2019) examined the connection between personal well-being and the built environment condition in Beijing. They found that the level of happiness and quality of life for the residents were highly associated with their satisfaction level in the condition of the built environment.

![Neighbourhood Types Diagram](image)

**Figure 26. Community well-being at the neighborhood level**

Similar results can be found all over the world (White et al. 2013, Leyden et al. 2011, Zidansek 2007). For example, according to Cloutier et al. (2013), in all the cities in the United States that they have examined, the happiness (or well-being) of residents was highly associated with sustainable development in the urban area.

One piece of evidence that the design of the built environment can affect residents’ physical well-being is that, compared to large, sprawling cities, urban dwellers in walkable and
densely built cities tend to have better health (Garden and Jalaludin, 2009, Ewing, et al., 2003). As physical health is the foundation of an individual’s well-being, the urban environment should encourage more physical activities, such as active travel (Burton, 2015, Mason and Kearns, 2013).

Furthermore, by promoting walking, the sustainable urban development may have a positive effect on the mental well-being of urban dwellers (Sugiyama and Thompson, 2007, Cerin, et al., 2009). Figure 27 shows the relationship between environmental perception, walking, and mental well-being. Especially for elderly residents, well-designed urban areas with local amenities and built environments perceived as safe for neighborhood walking have a strong connection with mental and physical well-being in older populations (Curl and Mason, 2019, Lampinen, et al., 2006).

Figure 27. The relationship between a walkable environment and well-being

Moreover, the development of public green spaces in urban areas has a significant impact on residents’ physical, mental, and social well-being (White and Depledge, 2013, Kabisch et al, 2015, Fleming et al., 2016, Lee and Maheswaran, 2011, Wang, et al., 2019, Larson et al., 2016). Figure 28 shows the functions, characteristics, and outcomes of the urban green space (Lee, et
al., 2015)—namely, that natural environments and green space in urban built areas provide opportunities for urban residents to have contact with nature and to satisfy their need for fresh air and natural light as well as to have a place for walking and talking to others (Tzoulas, et al., 2007, Coutts and Hahn, 2015).

![Figure 28. Characteristics, functions, and outcomes of urban green space](image)

Zhang et al. (2009) claim that a lack of social interaction is one of the most serious problems in the model of high-density gated residential neighborhood. In that context, the connection between outdoor public space or green space and apartment buildings has a great impact on the social well-being of urban dwellers.

However, the research of Ma et al. (2018) indicates that the impact of green space on well-being is not the same for all the urban residents. It depends on the accessibility of the space and how often someone uses it. The more frequently that someone engage in the activities such as walking or jogging in a city park or public green space, the better chance for that person to achieve well-being.
III. Public space in the urban area

Ruskin. (2012) states that a well-designed public realm can provide residents excellent places to live, work, and play; strengthen neighborhood connections; encourage healthy lifestyles; boost local economies; and reduce the demand for fossil fuels. In other words, the design quality of public spaces in urban areas is highly associated with the concept of placemaking, human well-being, and the three aspect of sustainable development.

Public space design may enhance a sense of place and neighborhood attachment by increasing neighborhood satisfaction (Jennings et al., 2016, Hur, et al., 2010). A place must have its unique sense identity and authenticity, and the sense of a place can be seen in urban design elements that reflect its own unique history, such as unique buildings, natural spaces, or vibrant public spaces. For instance, in New York City, the recognizable buildings, street grid system, well-designed public spaces, and river view create a rich and welcoming urban image (NYC Department of City Planning, 2019).

People often find themselves attached to a location with a sense of place, and planning public spaces, especially good green space, might strengthen the connection between residents and the local community (Bonaiuto el al., 1999, Kim and Kaplan, 2004). Indeed, the quality of a public green space might have greater influence on residents’ neighborhood satisfaction than the quantity of the green space (Zhang et al., 2017).

Additionally, Arnberger and Eder. (2011) used a survey to examine the connection between urban public space, neighborhood satisfaction, and community attachment in both the urban and suburban areas of Vienna. They found a positive relationship between the quality of urban green spaces and neighborhood satisfaction rating and the social attachment.
In this context, Bertolet. (2011) says, “True cities, small and large alike, have the power to bring people together.” Providing good shared public spaces should be viewed as one of the essential factors that help cities to accomplish that goal (Bain et al., 2012). Many researchers define the primary function of public spaces as satisfying people’s social needs (Carr et al., 1992, Dines & Cattell, 2006). In urban areas, public parks, plazas, squares, libraries, community centers, and streets all have unique roles that connect people.

Figure 29 shows that depending on the level of privacy, the system of space hierarchy contains four levels of spaces: public, semi-public, semi-private, and private (Newman, 1972). However, in the modern typology of the gated residential community, the inner courtyard (i.e., a hybrid open space) is enclosed within a perimeter walls and gates, making the semi-public space of the neighborhood physically inaccessible for the general public outside the community, thus discouraging residents from using that space.
Researchers argue that intentionally building more hybrid public space will cause the crime rate to decrease because unwanted users will be excluded (Oc and Tiesdell, 1999, Staeheli and Mitchell, 2008, Huang, 2014). However, Jacobs. (1961) indicates that building hard edges between buildings and streets would block the view and reduce the number of people observing the street. So, while crime may be limited inside the walls, the street outside the community would not be a safe public space for urban dwellers to use.

In densely built urban areas, streets and pathways provide more opportunities for shared public space for city residents (Bain et al., 2012, Loukaitou-Sideris and Ehrenfeucht, 2009). Designing streets and urban spaces on the human scale (as opposed to the automobile scale) would bring more life to cities (Gehl and Rogers, 2010). In the context of this possibility, Sadik-Khan and Solomonow (2017) describe the process of converting the streets in Times Square of New York City from pathways for cars to open spaces for pedestrians and tourists as a “battle.” Now, though, Times Square is one of the best people-centric public spaces in the world and has become the model project for other cities.
Theory and methods

I. Theory

1. New Urbanism

Since the publication of The Charter of the New Urbanism in 1996, the theory of new urbanism has been the guideline for residences all over the world to address problems regarding the relationship between the built environment and humans in their regions, cities, towns, and neighborhoods. According to the Congress for the New Urbanism (2019), the new urbanism movement provides principles that promote the creation of “sustainable, human-scaled places where people can live healthy and happy lives.”

In the scope of this thesis project, human-centric urban environment design, placemaking, and sustainable development are three of the many essential characteristics of the new urbanism movement that can be applied to the modern residential neighborhood development in Nanjing.

Human-centric design is one of the main principles of the new urbanism movement. Designing urban environments on a human scale means having walkable blocks and streets, mixed-use and mixed-age neighborhood development, residential and commercial spaces in close proximity, and accessible open space that is shared by everyone.

Other than human-scale design, placemaking is another important principle in the theory of new urbanism. A place can be a neighborhood cafe where people can sit and talk to each other all day or a family-friendly community park where parents can let their children play without worrying about safety issues. People will always find themselves attracted to places that have their own unique identity, and the sense of a place strengthens the attachment between residents and the environment. Well-designed public spaces are essential in placemaking, and plazas,
squares, streets, parks, sidewalks, and cafes should all be designed for people and should be able to host daily activities and social interactions.

Another principle of the new urbanism movement is sustainable development. The Congress for the New Urbanism also developed the canons of sustainable architecture and urbanism to outline the operating principles for all three aspects of sustainable development. For example, a new urbanism project must preserve the relationships between urban development areas and natural lands in order to provide a clean water supply, preserve clean air, and allow access to natural resources. For the economic aspect, the first level of a mixed-use development is always devoted to local businesses in order to maintain the economic vitality of that area. Social sustainability is also important in a new urbanism project; the design of public space should promote social interactions and daily activities.

Two essential documents provided principles and guidelines to policy makers and urban planners: the New Urbanism Agenda created by the United Nations and the Charter of the New Urbanism by the Congress of the New Urbanism. In the scope of this design project, some of the principles in the documents can be utilized.

For instance, on the neighborhood and district scale the following should be true:

1) Neighborhoods should be compact, pedestrian friendly, and mixed-use.
2) Daily activities should occur within walking distance, about 5 minutes of walking distance or a quarter mile radius, especially for the elderly and the young.
3) All civic, institutional, and commercial activity should be embedded in neighborhoods, not isolated in remote, single-use complexes.
4) A range of parks should be distributed within neighborhood.
In addition to the neighborhood and district level, projects at the block and street scale are also guided by certain principles:

1) Individual projects should be linked to their surroundings.

2) The design of streets and buildings should reinforce safe environments, but not at the expense of accessibility and openness.

3) Street and squares should be safe, comfortable, and interesting to pedestrians.
2. Sustainable development standard

LEED v4.1 for Cities and Communities is one of the leading rating systems for evaluating sustainability and residents’ well-being and quality of life in a city or community. The goal of LEED for Cities and Communities is also aligned with global programs such as the 2030 sustainable development goal by the United Nations. The rating system is also associated with the Congress of the New Urbanism for promoting sustainable urban development and healthy lifestyles.

Figure 30 shows that the rating system of LEED for Cities and Communities has also been integrated with other complementary rating standards, such as the STAR Community Rating System and LEED v4 for Neighborhood Development in the realm of urban development as well as the PEER and SITES rating systems for green energy and infrastructure performance.

The LEED rating system is data driven and performance based; it is also deeply rooted in the triple bottom line of the sustainable development movement. Figures 31 and 32 show the project checklist for new projects in cities and communities as well as the checklist for neighborhood development. The checklist indicates that green infrastructure and energy
performance are weighted the most in the scoring system; however, in the scope of this project, the principles and ideas under the neighborhood pattern and design category can be applied to the design of the residential community in the new city part of Nanjing.

For instance, some of the principles are as follows:

1) Compact, mixed use and transit-oriented development.
2) Walkability and bikeability.
3) Access to civic and public space and recreational facilities.
4) Connected and open community.

Figure 31. LEED for ND checklist
Figure 32. LEED for Cities and Neighborhood checklist
3. Summary

In light of the new urbanism movement and the rating systems of LEED for Cities and Communities and LEED for Neighborhood Development, it is evident that some of the ideas and principles are related to each other and can be applied to this design project. For the purpose of promoting human well-being and sustainable development through the design of urban residential communities, the design principles and matrix are as follows:

1) The proposed neighborhood should be compact, with mixed-use buildings and facilities.

2) All the daily activities should occur within walking distance, about a quarter mile or 5 minutes of walking.

3) The street and pathways should be pedestrian oriented; the neighborhood should have good walkability and bikeability.

4) The well-designed public spaces and recreational facilities should be safe, comfortable, and accessible for everyone.

5) The community design should reinforce a safe environment without losing the accessibility and openness.

6) The proposed project should be connected to the surrounding environment.

The next step is to study some successful precedents on mixed-use urban developments, quality public spaces, urban blocks, and open residential neighborhoods. The possible design strategies should then be developed based on the design principles above.
II. Methods

1. Precedent studies

1.1. Compact and vertical mixed-use urban development

Marin Gateway

The Marin Gateway is a mixed-use, transit-oriented urban development in Vancouver, Canada. This urban project was designed by Perkins & Will and built in 2016. The total floor area for this project is 872,952 square feet. Figure 33 shows the view from above the development, revealing that the site is divided into two parts by a north-south oriented inner street. That inner street is the main entrance to both parts of the compound.

Unlike other typical transit-oriented developments designed near a transit hub, Marin Gateway integrated a subway station into the design and became a transit hub itself. The east part...
of the building compound is connected to the subway system to provide convenient access for residents, shoppers, and workers.

In order to meet the needs of the surrounding neighborhood, this mixed-use urban development contains a complementary mix of programs. For example, as Figure 34 shows, this project has two neighborhood plazas, one high street for pedestrians, a 3-story retail space, a 15-story tower of office space, and two residential towers at 25 and 35 stories.

Figure 34. Section shows program of the project
The two neighborhood plazas and the pedestrian corridor were designed as the heart of this multifunctional urban development by bringing together a diverse mix of employees, shoppers, transit riders, and residents into the pedestrian-centric environment and into the retail spaces.

Figure 35 shows that the high street was designed as the main entrance to the compound, placing it slightly above ground level to create a soft barrier between the compound and the outside public spaces. Meanwhile, the neighborhood plazas are located on the rooftop of the retail space. While the plaza on the apartment tower side of the compound is only accessible to residents, the plaza on the office side is accessible to the general public.

![Image](image_url)

Figure 35. Pedestrian corridor as the main entrance

The takeaway of this project is that the mechanism of mixed-use development helps to create a combination of public spaces with different levels of privacy. The placement of the commercial and retail space on the ground level and the elevation of the pedestrian-oriented streetscape design ensure that the inner environment of the compound is accessible to everyone.
The Mashhad City Complex is an award-winning proposal for a mixed-use urban complex in Mashhad, Iran. AGi Architects and Shift Process Practice designed this project in 2016, and the proposed total floor area is 127,015 square feet.

Figure 36 shows that this mixed-use city complex has an interesting mix of programs: 1) the 3-story retail space has two stories below the ground level, a clinic on the ground level and the south side of the compound; 2) there is a 7-story residential space above the commercial space; 3) and hotel apartments are located on both ends of the property, above the commercial space and the clinic. Furthermore, the configuration of this project gives a sense of street life to the residents on the upper apartment floors.

The inner chain of inner courtyards is the key idea and the core space of this mixed-use project. As Figure 37 shows, a series of inner courtyards on the ground level join together and form a pedestrian pathway through the complex, introducing people to the retail space under the ground level.
Figure 37. Courtyards serving as the pedestrian pathway

Figure 38 shows the view from above, revealing that most of the green spaces are separated into small pieces: the green plazas are distributed on the rooftop above the commercial area throughout the whole development. The green spaces on the upper floor are semi-public spaces for the residents, while the green plazas on the ground level are accessible to everyone.

Figure 38. Green rooftop plazas
1.2. Quality public spaces

Shanghai Greenland Center

The Shanghai Greenland Center, a green urban valley complex in Shanghai, was designed by Nikken Sekkei and built in 2017. The whole compound was built on a 215,278 square feet of land, and the total proposed floor area is around 3,282,023 square feet. Figure 39 shows the birds-eye view form the south side, revealing that the program of this development contains two office towers on the right side of the compound and one service apartment tower on the left side. The first three floors above the ground level and two underground levels are devoted to commercial use, and the green rooftops of the commercial spaces function as the public space for daily activities.

Figure 39. Function flow in the plan
This transit-oriented urban development sits above a two-line subway station and a bus terminal. The main focus of this project was to create a pedestrian-oriented environment for the residents, subway riders, and employees inside the complex. Figure 40 and Figure 41 show the flow between each functional section inside the compound.

![Diagram](image)

Figure 40. Function flow in the plan

The urban corridor between the service apartment and office is designed wide enough to be an urban park that functions as the heart of this complex. The office and service apartment entrances and the bus terminal are connected to the urban park and the subway entrance through three different urban corridors.
An urban park where urban dwellers lead natural lives was the core idea throughout the design of this compound. Figure 42 shows that the urban park contains both an urban corridor and green rooftops. A wide urban corridor, which is also a part of the green urban park, sits in the middle of the compound and divides the site into two parts, with the service apartment tower on the left side and the two office towers on the right.

The other parts of the urban green park are the green rooftops of the commercial space. These rooftops are segregated into different sections with different elevations. General urban
dwellers have full access to the whole park and use the park not only as the pathway to their destinations but also a place to stay and relax. Figure 43 shows that the design of the urban park gives this complex a sense of a place, that people of all ages can relax and find calm in the built environment.

![Figure 43. Daily activities in the urban park](image)

The central idea of this study is to connect major access points and attractions with pedestrian-oriented corridors. When the pedestrian corridor is wide enough to include family-friendly streetscapes, the corridor can be turned into an urban park and have a sense of a place that attracts the general public to stay.
Mixed Use 107 Apartment Units

This mixed-use urban residential complex is in Paris, France. The project was designed by Nunc Architects in 2015, and the proposed floor space is 79,007 square feet. Figure 44 shows the site plan, revealing that the compound covers the entire lot of the site. As a result, the only green space open to general public is on the left side of the compound.

While one side of the first floor is designated for retail purposes, the other side of the building is designated for a day-care center. Additionally, the residential space of the upper floor provides 107 apartments of various sizes. The four apartment towers are located on each corner of the building, thus surrounding the inner courtyard of the compound. Both the courtyard on the
ground level and the green roof above the retail space are the key spaces in this project; they can promote positive neighborhood relations. Figure 45 shows that the day-care center is connected to the inner courtyard, thus transforming the courtyard in the middle of the project to an activity space for children.

![Figure 45. Day-care center is connected to the courtyard.](image)

In this apartment complex, different public spaces have different elevations, and each space has its own unique purpose. For example, Figure 46 shows that the open space on the right side of the building is on the ground level, and that space is the public space for general public. Similarly, the inner courtyard on the ground level is the semi-public space for the children in the
day-care center and the apartments. Finally, the green rooftops above the retail space serve as a semi-private space for the residents in the upper apartments.

Figure 46. Day-care center is connected to the courtyard.

Figure 47 shows that the inner courtyard designated for the day-care center allows parents to let their children play outside without worrying about safety.

Figure 47. Inner courtyard of the compound.
1.3. Open residential neighborhoods

“sue&til” – New city of wood housing

The “sue and till” project is an award-winning mixed-use housing development that was designed by ARGE suetil, Soppelsa Architekten, and weberbrunner architekten ag in 2015. The project was built in Winterthur, Switzerland, in 2018, and the total floor area is 570,487 square feet.

Because this urban project is based on the concept of vertical mixed-use development, the first level of the complex is a public commercial space, and the upper floors provide around 300 apartment units. Additionally, the project is designed with over 200 underground parking spaces. Since this project is currently the largest timber construction in Central Europe, the apartment building is only 6 stories high, with the top level serving as a penthouse. Figure 48 shows the front facade of the building, and Figure 49 shows the vertical circulation between each functional area.

Figure 48. Front facade of the building
Figure 49. Section of the building

Figure 49 shows the site plan of this urban project. It includes five apartment blocks and three layers of green space, with one inner courtyard and two other green space outside the apartment compound. This mechanism gives each courtyard different levels of privacy and a different sense to the residents.
Figure 51 and Figure 52 show different parts of public space in this project. The inner courtyard is well designed as family-friendly space, and the other part serves as an open space for multifunctional daily activities.
1.4. Urban blocks and transit system

Super blocks

The superblocks project in Barcelona, Spain, is part of the city’s new urban plan. The basic mechanism is to control the traffic flow inside nine city blocks and to form a superblock. The purpose of this plan is to reduce the traffic congestion in the urban area and to promote a healthy lifestyle for the residents by improving air quality, increasing the public space coverage, and reducing the noise pollution in the urban residential area. Figure 53 shows that a superblock covers an area of around 400 meters by 400 meters and that it consists of nine residential blocks of 150 meters by 150 meters.

Figure 53. A superblock plan
By implementing traffic-control strategies, such as Figure 52 shows, the speed limit is set to 10 kilometers per hour inside the blocks, and private vehicles and large carrier cars are restricted from entering the superblock. As a result, the car-oriented urban blocks are transformed into a pedestrian- and bicycle-centric area.

This plan has brought many benefits to the residents of Barcelona. For example, Figure 55 shows that from 2013 to 2018, air and noise pollution were significantly reduced in the urban area due to the superblocks project. The walkability and accessibility to public space in the urban environment was also improved. Figure 56 shows that the area of public space available to residents increased from 31,575 square meters in 2016 to 54,276 square meters in 2018.
Figure 55. Benefits from the superblocks project

Figure 56. Accessibility to public spaces
1.5. Summary and design strategies

After identifying the problems by examining the existing residential development in the new city part of Nanjing and after developing a series of design principles that can be applied to the design project, several precedents were studied to develop possible design strategies to solve the current problems and to achieve the goal of promoting residents’ well-being.

Table 4 shows some of the possible strategies for applying the design principles:

<table>
<thead>
<tr>
<th>Principles</th>
<th>Possible strategies</th>
<th>Precedent</th>
</tr>
</thead>
</table>
| Compact development, with mixed-use buildings and facilities              | 1. Vertical mixed-use typology  
2. Mid- to high-rise residential buildings                                     | Marin Gateway  
Mashhad City Complex  
Greenland Center |
| Daily activities within walking distance                                    | 1. Layers of walking distance  
2. Vertical mixed-use design with ground level for commercial activities | Marin Gateway  
Mashhad City Complex  
Greenland Center |
| Pedestrian-oriented neighborhood with good walkability                     | 1. Pedestrian-oriented streets and pathways  
2. Traffic control  
3. Elevation change                                                         | Marin Gateway  
Mashhad City Complex  
Greenland Center Superblocks |
| Well-designed public space for everyone                                   | 1. Layers of green space  
2. Urban park  
3. Green roof  
4. Dedicated playground                                                      | Greenland Center  
Mixed Use 107 Apartment Units Sue & Til Superblocks |
| Safe environment without losing accessibility and openness                | 1. Open neighborhood  
2. Multiple entrance points  
3. Ground level for commercial activities                                     | Sue & Til Superblocks |
| Connected to the surrounding environment                                  | 1. Complementary programming  
2. Connected to public transportation                                          | Marin Gateway  
Greenland Center  
Mixed Use 107 Apartment Units Superblocks |
2. Site analysis

2.1. Site selection

The selected site is located at the heart of the Hexi New CBD district in Nanjing, which is southwest from the old city wall of Nanjing. Figure 57 shows the zoning map, in which the target site is classified as commercial and business use and in which the adjacent blocks are mostly classified as primary residential land and public service land.

Figure 57. Zoning map of Nanjing.

Figure 58 shows that the whole site consists of four regular urban blocks of 850 feet by 650 feet, two of which are half developed and two of which are vacant land. The target site is 850 feet by 3000 feet and covers a land area of 2,550,000 square feet. The whole site is divided into three different parts and is intersected by two streets running through it. The street between
section A and B is a four-lane street with protected bike lanes and sidewalks on each side, and the width of the street is 70 feet. Meanwhile, the street between section B and C is a six-lane street, with a protected bike lane and sidewalks on each side, and the width of the street is 100 feet.

![Figure 58. Target site and the adjacent development.](image)

This site was selected for several reasons: 1) It is located at the heart of the Hexi New CBD area. With tremendous potential for commercial and business activities, this urban area has the chance to be a successful urban development. 2) The site is adjacent to residential land and public service land. With a large number of people living in this area, the site has the potential to implement mixed-use development to improve the living condition of urban residents. 3) With an average street block size of 850 feet by 650 feet, mixed-use development and pedestrian-oriented neighborhood design have the potential to improve the walkability in this area. Additionally, it may improve the well-being of local residents.
2.2. Natural factors

Figure 59 shows that the weather in Nanjing is warm and humid and that there is significant rainfall throughout the year. Most precipitation falls in July, with an average of 155mm, and December is the driest month of the year, with an average rainfall of 25 mm. With an average high of 91 °F, July is the warmest month, and the coldest temperature can reach 32 °F in the wintertime. Water features could be used in the design to ensure a cooling effect in the hot summertime.
The wind rose diagram of Nanjing shows that the wind speed in Nanjing is not especially strong, mostly remaining under 12 mph. Most wind come from the east throughout the year, so enlarging the opening from that direction would help to reduce the heat in the summer.
The solar diagram in Nanjing shows that most days are cloudy or partly cloudy throughout the year. The building could be oriented to the south to take advantage of the sunny days in the winter and to maximize the natural sunlight in the day.
2.3. Built-environment factors

The built-environment diagram suggests that this area has a good mix of building functions, such as commercial, residential, office, and public service.

![Built environment diagram](image)

Figure 62. Built environment diagram of buildings reachable in 15 minutes of walking

The diagram shows that because of the large street block size, residents inside the neighborhood are not able to reach the destinations for their various of daily activities in less than 5 minutes of walking. By expanding the walking circle to 10 minutes or 15 minutes, residents can reach business and commercial areas as well as public facilities, such as schools,
hospitals, parks, and recreational facilities. Additionally, there is already a three-story shopping center and four high-rise office towers on the north side of the site.

This area has a mature housing market, and most of the urban blocks are developed as residential neighborhoods. Many of the residential neighborhoods are designed with mixed-use buildings on the one side of the compound, with the first floor devoted to commercial use.

The traffic flow diagram shows that the traffic condition is heavy on the south and west side of the compound. The traffic on the neighborhood street at the north and east side of the target site is light.

Figure 63. Traffic flow diagram
The design conditions are different on different levels of streets. For example, both main roads on the south side and west side are the main roads throughout the whole district—that is, a 12-lane road with protected bike lanes and sidewalks on both sides of the road.

The neighborhood road on the north side of the target site is a 4-lane street with protected bike lanes and narrow sidewalks. The road in the middle of the target site is a 6-lane road with protected bike lanes and sidewalks.
It is also essential to consider how the surrounding environment affects the design factors. The west side of the target site is a green public park in the CBD area, and it is important to connect that urban park to the proposed design. The north and south side are both residential neighborhoods, and they have public facilities such as schools, a hospital, and day-care center, and a small park. The east side of the property is the business and office district, where most of
the employees will stay during the day; however, there is a subway station near the target site on
the southeast corner.
Figure 67. Urban park and CBD area

Figure 68. Residential neighborhood
2.4. Cultural factors

The Hexi new city is one of the youngest parts in the city of Nanjing. In fact, this area still was farmland and developmental land almost 30 years ago. Most of the current citizens were moved into this district during the rapid urban expansion process. The district covers an area of 94 square kilometers (36.3 square miles), and the population reached 427,089 in 2010. The gender ratio is well balanced in this area, with 47% female and 53% male residents. The household size in this district is small: 41.9% of the households have fewer than two members, and 46.1% of the households have between three and four people.

Figure 69. Gender ratio

Figure 70. Household size
With 75.3% of the population younger than 50 years old, the Hexi new city has been one of the youngest and most vibrant areas in the city of Nanjing. With almost 16% of the population being of school age, there is a great potential the plan more family-friendly public space to improve both the physical and social well-being of the residents.

Figure 71. Age group
Schematic design

I. Idea and inspiration

1. Initial ideas

The initial idea is to use a vertical mixed-use development concept to create a compact neighborhood and to employ the concept of an urban corridor and urban park to create a pedestrian-oriented environment and to ensure circulation. The goal is for this urban proposal to create a sense of a place.

Figure 72. Idea of circulation
On the basis of an analysis of the built environment around the site, it is suggested that a number of major attractions and the destinations need to be connected by the project: the green park near the CBD area on the east side, the subway station on the southwest corner, and the hospital on the south side. The main idea of the circulation plan in this project is to connect those destinations through the urban corridor, while adding entrances for the urban residents in the adjacent residential compounds in this area.

For the circulation inside the compounds and with two sub-streets running through the target site, traffic control strategies need to be implemented. For example, the 4-lane street can
be turned into a pedestrian-oriented street by limiting automobile access. In addition, for the 6-lane street, on-street parking can be added, and the speed limit should be set at a low speed in order to create a safe environment for both pedestrians and bikers.

Because there are two sub-streets running through the site, the target site can be divided into three sections. For section A there are two high-rise office buildings already in the plan, and for section B, the developed building is a four-story commercial space, with two high-rise service apartment towers.

The program should be complementary. After an analysis of the adjacent sites, various spaces should be included in the program: a local community center, a hotel, a family friendly indoor play space, apartments, offices, retail spaces, and pedestrian-oriented public spaces.
2. Massing design

Follow the rule of vertical mixed-use, the initial massing design can be divided into three steps: 1) to fill the site with massing blocks, 2) to break down the blocks according to the circulation flow and different functions of buildings, and 3) to soften the hard edge on the street elevation by opening up corners.

Figure 74. Initial massing design

After a study of the sun effect on the building massing both in the winter and summer, the building orientation, building height, and position were adjusted to maximize the natural light from the south direction into the building, especially the residential space.
Figure 75. Solar study

Figure 76. Adjusted massing design
Figure 77. Adjusted massing design
II. Proposed design

1. Street order

The street between section A and B is a 4-lane street with protected bike lanes. The width of the street is 70 feet from curb to curb. By adding angled on-street parking spaces and a pedestrian safety island, the street will become a safer place for the local residents. In addition, by adding a sitting area behind the greenery barriers, the street itself become a public space for residents.

Similar strategies can be applied to the street between section B and C. The street is a 6-lane street with protected bike lanes and narrow sidewalks. The strategy is to limit the speed as low as 10 km/h, to reduce the width of lanes for automobiles from 12 feet to 10 feet, and to increase the number of on-street parking spaces. Furthermore, adding more sitting space on the wide sidewalk will create a place for residents to stay. By implementing such strategies, the street will become more pedestrian oriented.
Figure 80. Section at street between B and C
2. Functional program

This three-section development follows the rules of mixed-use development, with the first three floors devoted to commercial and retail use. The upper floors are mostly office space and apartment space.

The building height changes throughout the whole site, from section A to section C. The building height change shows the transition from the CBD area to the outside environments.

For section A, with the existing 48-story office building on site and with the location close to the CBD area, a better choice is to build high-rise apartment towers on the top floors, with green rooftop space dedicated to the residents, thus providing better privacy.
For section B, with existing office building, service apartments, and a shopping center on one side, more green public space on the ground level is a better choice. The upper floor apartment tower is lower than the tower in section A since the existing buildings on section B are much lower.

Section C is the farthest from the CBD area, so the height of the building should match the adjacent residential neighborhood. With more retail spaces and a family-friendly indoor playground, this development has the potential to attract more school-age children and their parents to spend more time. Furthermore, the subway station is also located on the end of section C on the ground level.

![Functional diagram of the buildings from south and north](image_url)
3. Circulation and flow

To facilitate people’s movement is the key of this project. As an extension to the urban park in the CBD area, a pedestrian corridor that is wide enough to be a pedestrian park connects the city park to the subway station and the office area on the east side of the site.

![Circulation diagram](image)

The main pedestrian corridor provides convenience for the subway riders to reach their destination quickly. For the shoppers, residents, and general public, the inner pedestrian street provides them with safe pedestrian-oriented environment, so people on site can stay relaxed.

Section A, as the main entrance to the site on the west side, also provides four different access points to the site for the residents in the adjacent neighborhood. Section B has five different entrances to the site, and with smaller inner pedestrian streets, a cozier walking experience is provided. Section C is the end of the pedestrian corridor, connecting the site to the subway station and the office buildings on the east side. With the inner street, the residents and employees can travel from the subway station to their lobby more conveniently.
4. Public space

The public space is also an important feature in the design of this project; with different levels of privacy, the public spaces have different accessibility. Throughout the whole site, the ground level is devoted to general public for their daily activities as well as the green rooftop space over the commercial space. Furthermore, the pedestrian street is elevated for creating a better walking experience for residents.

However, for the green space on the same level as the apartment building, the space is devoted to the apartment residents, since they need a more private space. Furthermore, playing features for children ensure that a family-friendly public space is provided to the residents.
Figure 85. Public space diagram from the south
Figure 86. Public space at ground level

Figure 87. Family-friendly semi-public space at upper level
Discussion

This project is a planning-oriented urban design project, and spatial relationships and the public space hierarchy are the main focus. The outcome of this project is an attempt to provide for urban dwellers in China housing options that differ from the current typology of apartments in gated communities. Additionally, with design strategies such as vertical mixed-use development, compact neighborhood design, dedicated open space, and keeping daily activities within the walking distance, both the physical and social well-being of urban residents can be promoted.

Compared to the current residential project typology, this open neighborhood design creates more possibilities for daily social activities between residents and the general public. The vertical mixed-use design principle not only provides more space for retail and commercial use but also divides public space into different layers by changing the elevations.

The ground level of a mixed-use development is always dedicated to retail, and unlike the gated community design, these public spaces on the ground level are accessible to everyone in the mixed-use project. Meanwhile, the upper level public space is dedicated to residents only in order to create a more private and family-friendly public space for children and parents. Furthermore, with good streetscape design strategies, such as providing sitting areas on the wide sidewalks, angled on-street parking spaces, and pedestrian safety islands for crossing road, the street itself can be used as quality public space for pedestrians.

The problems that were examined in this project are limited, and there are far more problems in the current housing typology in China that are not identified. However, we must keep trying to examine the current living condition of urban dwellers and attempt to provide solutions in the realm of urban planning. The scope of this project is also limited, and there are a
number of factors in real life that can affect the design of a residential project. For example, the next step of this project can be a study of the economic value and sustainability of the mixed-use open neighborhood design. Only by looking more closely at the economic and environmental factors, can true sustainable development be achieved.

Human well-being and sustainable development are the two topics that urban residents will focus on in the future. The current housing option clearly can no longer fulfill residents’ demand. Urban design strategies have the potential to improve living conditions; however, in real life there are far more factors that can affect residents’ well-being, and the power of urban planning is limited.


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