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# The Architecture of the Belt and Road Initiative

One Belt One Road, a booster for a new revolution in urban housing


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## ABSTRACT

With the Chinese government's advancement of the Belt and Road Initiative, China and the partner countries of the Belt and Road routes have made great strides in achieving their economic and social aspirations. The Belt and Road Initiative has undoubtedly played an influential role as a booster in urbanization in China, simultaneously accelerating the development of cities and residences in various countries and regions and improving people's quality of life. On the other hand, however, most countries along the Belt and Road routes still face urban housing crises and severe housing shortages caused by rapid urbanization. Although, under the Belt and Road Initiative, many Chinese mainland enterprises have stepped up their efforts in Going out policy[1] to invest in affordable housing projects in countries of the Belt and Road Initiative. They were helping partner countries to build their urban and more housing to meet the severe housing shortage. However, at present, those affordable housing still cannot meet the demand. Indeed, the increasing concentration of urban populations has become a global phenomenon, and we are experiencing severe housing shortages in developed and developing countries. As a result, city development and solving the urban housing problem are the focuses of global attention.

Furthermore, sustainable urban development is becoming increasingly important with the complex inter-related environmental, social, economic, political, spatial, institutional, and physical challenges facing urban areas. Of particular concern is how will the Belt and Road Initiative push forward green and sustainable development in urban and urban housing in the future. To this end, this paper explores the links between affordable housing and the Belt and Road Initiative and the strategies and prototypes for sustainable and affordable housing in partner countries of Belt and Road Initiative. It analyzed current urban housing issues and best practices using a case-study approach. In addition, an in-depth analysis of the approaches in prefabricated housing and cost-effective models for the future will be analyzed simultaneously. In the end, re-imaging the possibility of affordable housing in countries of the Belt and Road in sustainable spatial morphology.



Key words : the Belt and Road Initiative, urban housing, affordable housing, cost-effective models


[1] Going out policy(Chinese: 走出去战略) is the People's Republic of China's current strategy to encourage its enterprises to invest overseas.

**CONTENT**

# INTRODUCTION

Throughout history, every economic development has sparked a new architectural development, such as the first industrial revolution. However, the world economy is recovering slowly and developing differently in today's world. In 2013, Chinese President Xi Jinping proposed the Belt and Road Initiative（BRI）, which response to the trend of world multi-polarization, economic globalization, cultural diversification, and social informatization—promoting global economic development, particularly in developing countries. The phrase 'BRI' will be used in this study to describe the Belt and Road Initiative. There is a perception that the BRI is a revival of the old Silk Roads. Indeed, the Belt and Road are trade routes where massive investments are currently made to connect China with the world. Although the Belt and Road Initiative (BRI) is China's idea, it will benefit the world, and "China's Silk Road urbanism is changing member countries' cities and lives" (Silver and Wiig, 2019). In this context, urban dwellings' development is worthy of deep study. Due to practical constraints, this paper cannot provide a comprehensive review of all BRI countries; however, this dissertation's content is still wide-ranging. Urbanization, urban housing, affordable housing, and a sustainable spatial model in some representative countries are discussed in this paper. Of particular concern is the links between the topic of affordable housing and the topic of the BRI.

This dissertation provides a comparative perspective on housing and planning policies affecting the future of cities, focusing on affordable housing in China and countries with the BRI using the nexus of planning, design, and policy. A rich mosaic of case studies features good practices of city-led strategies for affordable housing provision, as well as member countries of the BRI capitalizing on partnerships to build low-cost housing and revitalize neighborhoods. My thesis is composed of four themed chapters. Chapter One begins by laying out the research of the BRI and looks at how to process the cities and urban housing in China and member countries of BRI. Chapter Two, a critical view on the link between the topic of affordable housing and the topic of the BRI. Chapter Third provides unique perspectives on the diversity of affordable housing approaches in four countries and six cities in Asia and Africa, giving the best practice in affordable housing projects. Simultaneously, compare and analyze these projects to find some points worth learning. Chapter Four summarizes the main research findings and makes recommendations for further research work.

Over one year of study, my ambitions of thesis have become more humble and focused. Nevertheless, I am fascinated by the complexity of urban housing structures in all the countries participating in the BRI, and all endeavors aspire to communicate this passion.

# PART 1_RESEARCH ON URBAN AND URBAN HOUSING DEVELOPMENT CONCERNING THE BELT AND ROAD INITIATIVE

## 1.1 The Belt and Road Initiative research

### 1.1.1 What is the Belt and Road Initiative?

"The Belt and Road Initiative - China's proposal to cooperate with other countries in building a 21st Century Silk Road Economic Belt and a 21st Century Maritime Silk Road - was launched by President Xi Jinping in 2013. The Belt and Road Initiative was a strategic decision by the central leadership as part of a new process of further opening up to the outside world. The initiative focuses on policy coordination, connectivity of infrastructure and facilities, unimpeded trade, financial integration, and strengthened people-to-people ties through a consultative process and joint efforts, with the goal of bringing benefits to all. It aims to build a community of shared interests and responsibility with a shared future. The Belt and Road will be a path to peace, prosperity and openness through innovative programs and friendly engagement" (Keywords to understand China, Chinese:中国关键词，2018).


Figure 1: 21st Century Silk Road Economic Belt & 21st Century Maritime Silk Road
(source: https://www.kwm.com/cn/zh/insights/latest-thinking/chinas-belt-and-road-overview.html )

The connectivity (Chinese: 互联互通) is the bedrock of the Belt and Road Initiative. It comprises multiple nations and ports, six economic corridors[2], and six connectivity routes. The New International Land-Sea Trade Corridor, the Information Expressway, and the China-Europe Railway Express are important transportation routes that support the connectivity network. In addition, significant pipeline, port, and railroad projects also improve the connection network. To this end, China will continue to improve the connectivity with other partner countries. Moreover, China will continue effectively utilizing the Silk Road Fund, special investment funds, and the Belt and Road Special Lending Scheme. It should also create Silk Road theme bonds and assist the Multilateral Cooperation Center for Development Finance in running its business. Additionally, applaud the involvement of national and

[2] The six economic corridors refer to an economic belt planned by China and the countries along the Belt and Road. There were the China-Mongolia-Russia Corridor; the China-Central Asia-West Asia Corridor; the New Eurasian Land Bridge; the China-Pakistan Corridor; the Bangladesh-China- Myanmar Corridor; the China-Indochina Peninsula Corridor.

multilateral financial institutions in BRI financing and investment, and promote third-market cooperation. "It is a very ambitious plan – encompassing about sixty percent of the world's population, one-third of the world GDP, and about a quarter of all goods and services moving around the globe" (CGTN, 2018). In the keynote address at the Second Belt and Road Forum for International Cooperation in 2019, Chinese President Xi Jinping stated that "from the Eurasian continent to Africa, the Americas, and Oceania, Belt and Road cooperation has opened up new spaces for global economic growth, produced new platforms for international trade and investment, and offered new ways to improve global economic governance." Although the Belt and Road Initiative (BRI) is China's idea, its benefits and outcomes will benefit the world.

### 1.1.2 Aim of the Belt and Road Initiative

A draft of the official outline can be found here. "The Belt and Road Initiative aims to promote the connectivity of Asian, European, and African continents and their adjacent seas, establish and strengthen partnerships among the countries along the Belt and Road, set up all-dimensional, multi-tiered, and composite connectivity networks, and realize diversified, independent, balanced and sustainable development in these countries" (Xinhua, 2017). On the other hand, BRI is a transcontinental long-term policy and investment program. It is about jointly meeting various challenges and risks confronting humankind and delivering win-win outcomes and joint development. Therefore, Belt and Road Initiative's prospects include peace, sustainable development, and improving people's lives worldwide. Today, the acceleration of the globalization process, accompanied by the development of China's foreign policy and the Belt and Road Initiative, has brought about the win-win situation we see today and the diversity of globalization. Moreover, Xi Jinping noted that under the joint efforts of all countries and international organizations involved in this initiative, more opportunities for prosperity have been created, and people's lives have improved. To respond to the historical trend of economic globalization, China will continue to work with other parties to promote open, green, and clean cooperation in the future. Also, encourage long-term sustainable development.

| **Some of China's challenges that the BRI is expected to help to address** | **The BRI as a part of China's regional and global ambitions** |
|---|---|
| 1. stagnating exports and overcapacity in manufacturing<br>2. under-development of western China<br>3. energy dependency<br>4. potential economic and security costs of tensions in the region | 1. increasing China's leverage in its neighbourhood<br>2. promoting the 'go global'<br>3. internationalizing the RMB<br>4. reforming the global economic governance |

Table1-1 The BRI at the crossroads of challenges and ambitions
(Source: Veysel Tekdal,2017, China's Belt and Road Initiative: at the crossroads of challenges and ambitions)

### 1.1.3 Which countries are participating in the Belt and Road Initiative?

Since its inception in 2013, the Belt and Road Initiative has garnered increasing international attention. The Belt and Road Initiative is essentially an international cooperation initiative open to all countries and regions, with no geographical boundaries. According to BELT AND ROAD PORTAL YIDAIYILU.GOV.CN, "as of April 19, 2022, China has signed more than 200 cooperation documents on the Belt and Road Initiative with 149 countries and 32 international organizations". It covers Asia, Europe, Africa, North America, and South America.

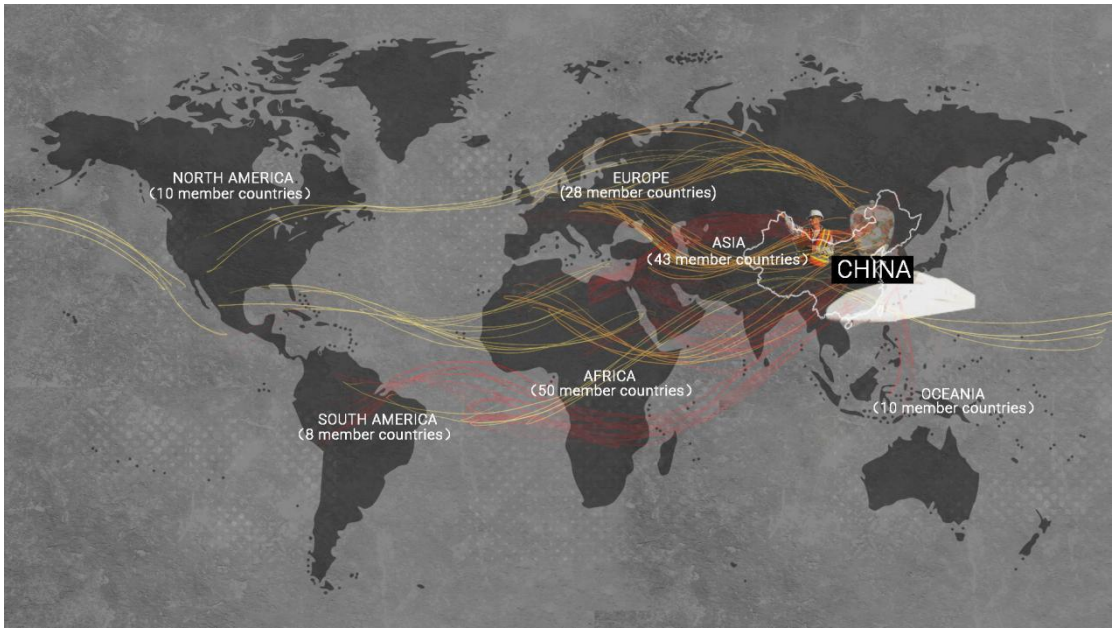


Figure 2: The college of the BRI
(made by author)

Table 1-1 below illustrates all of the 149 member countries of the BRI. According to the table, when it comes to the number of countries on different continents, it is evident that the number of countries in Africa is the highest, reporting 50, while the corresponding number for Asia is 43, followed closely by Europe, which is 28. It is clearly that the Belt and Road Initiative focuses on the regions of Asia, Africa, and Europe currently.

| | **Asia (43)** | 28 | Maldives | 55 | Morocco |
|---|---|---|---|---|---|
| 01 | Pakistan | 29 | Saudi Arabia | 56 | Madagascar |
| 02 | Singapore | 30 | Timor-Leste | 57 | Libya |
| 03 | Israel | 31 | Yemen | 58 | Senegal |
| 04 | Malaysia | 32 | Oman | 59 | Somalia |
| 05 | Kazakhstan | 33 | Iraq | 60 | Mauritania |
| 06 | Turkey | 34 | Georgia | 61 | Costa Rica |
| 07 | United Arab Emirates | 35 | Azerbaijan | 62 | Cote d’lvoire |
| 08 | Uzbekistan | 36 | Bhutan | 63 | Cameroon |
| 09 | Kuwait | 37 | Brunei | 64 | Seychelles |
| 10 | Vietnam | 38 | Syria | 65 | Zambia |

| | | | | | |
|---|---|---|---|---|---|
| 11 | Indonesia | 39 | Bahrain | 66 | Gabon |
| 12 | Jordan | 40 | Lebanon | 67 | The Republic of the Congo |
| 13 | Sri Lanka | 41 | Afghanistan | 68 | Tanzania |
| 14 | Philippines | 42 | Palestine | 69 | Cape Verde |
| 15 | Kyrgyzstan | 43 | Turkmenistan | 70 | Gambia |
| 16 | Thailand | | **Africa (50)** | 71 | Guinea |
| 17 | Myanmar | 44 | Niger | 72 | Djibouti |
| 18 | Cambodia | 45 | Angola | 73 | Algeria |
| 19 | Bangladesh | 46 | South Africa | 74 | Sierra leone |
| 20 | Armenia | 47 | Kenya | 75 | South Sudan |
| 21 | Laos | 48 | Uganda | 76 | Ghana |
| 22 | Iran | 49 | Nigeria | 77 | Mozambique |
| 23 | Qatar | 50 | Ethiopia | 78 | Namibia |
| 24 | Mongolia | 51 | Egypt | 79 | Chad |
| 25 | Republic of Korea | 52 | Tunisia | 80 | Zimbabwe |
| 26 | Tajikistan | 53 | Rwanda | 81 | The Central African Republic |
| 27 | Nepal | 54 | Sudan | 82 | The Democratic Republic of the Congo |
| 83 | Liberia | 106 | Montenegro | 129 | Solomom Islands |
| 84 | Mali | 107 | Lithuania | 130 | Cook Islands |
| 85 | Lesotho | 108 | Croatia | 131 | Micronesia |
| 86 | Comoros | 109 | Czech Republic | | **North America (10)** |
| 87 | Benin | 110 | Belarus | 132 | Antigua and Barbuda |
| 88 | Equatorial | 111 | Hungary | 133 | Trinidad and Tobago |
| 89 | The State of Eritrea | 112 | Macedonia | 134 | Costa Rica |
| 90 | Guinea-Bissau | 113 | Bulgaria | 135 | EL Salvador |
| 91 | Botswana | 114 | Serbia | 136 | Grenada |
| 92 | Togo | 115 | Slovakia | 137 | Barbados |
| 93 | Burundi | 116 | Russia | 138 | Jamaica |
| | **Europe (28)** | 117 | Moldova | 139 | Dominica |
| 94 | Italy | 118 | Poland | 140 | Dominican Republic |
| 95 | Malta | 119 | Romania | 141 | Cuba |
| 96 | Cyprus | 120 | Ukraine | | **South America (8)** |
| 97 | Luxembourg | 121 | Bosnia and Herzegovina | 142 | Venezuela |
| 98 | Portugal | | **Oceania (10)** | 143 | Peru |
| 99 | Greece | 122 | New Zealand | 144 | Ecuador |
| 100 | Bosnia | 123 | Papua New Guinea | 145 | Uruguay |
| 101 | Latvia | 124 | Niue | 146 | Guyana |
| 102 | Albania | 125 | Fiji | 147 | Bolivia |
| 103 | Estonia | 126 | Vanuatu | 148 | Chile |
| 104 | Slovenia | 127 | Samoa | 149 | Suriname |
| 105 | Austria | 128 | Tonga | | |

Table 1-2 List of the countries along the Belt and Road
(made by author; source: BELT AND ROAD PORTAL YIDAIYILU.GOV.CN )

## 1.2 Urbanization

### 1.2.1 Urban population growth

The map below shows the world's population growth rate in 2020. We see some countries (mainly in Europe) today where the natural population growth (not including migration) is slightly negative. However, the majority of countries are the opposite. Worldwide, the population is growing. According to the latest UN prediction on the world's population, by 2030, the world's urban population will increase to 8.5 billion. Population growth will continue to present challenges to urban planning, mainly from large-scale rural to urban migration and finding sustainable housing solutions.

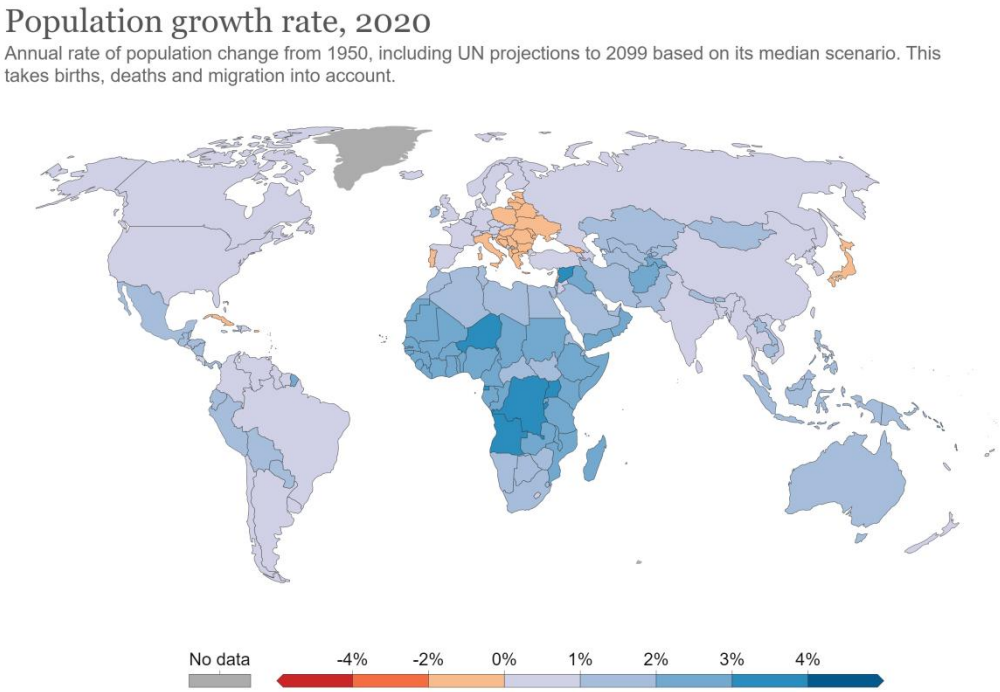


Figure 3: Population growth rate, 2020
(source: United Nations - Population Division (2019 Revision) )

The line graph below illustrates the general trend of the number of people worldwide living in urban and rural areas between 2000 and 2020. The horizontal axis is time, and the vertical axis is the number of the population. The blue line represents the urban population, and the red line represents the rural population. As we can see, between 2000 and 2020, both of them increased. In 2007, the number of people living in urban areas overtook those living in rural areas. In 2020, more than 4.3 billion people (over half of the world) live in urban areas. Overall, the increased concentration of urban populations is a global trend. According to a new, United Nations data set launched. "Projections show that urbanization, the gradual shift in residence of the human population from rural to urban areas, combined with the overall growth of the world's population, could add another 2.5 billion people to urban areas by 2050, with close to 90% of this increase taking place in Asia and Africa." Increasing urban populations require adequate essential services,

infrastructure, and affordable housing, so city leaders must act quickly to plan for growth.

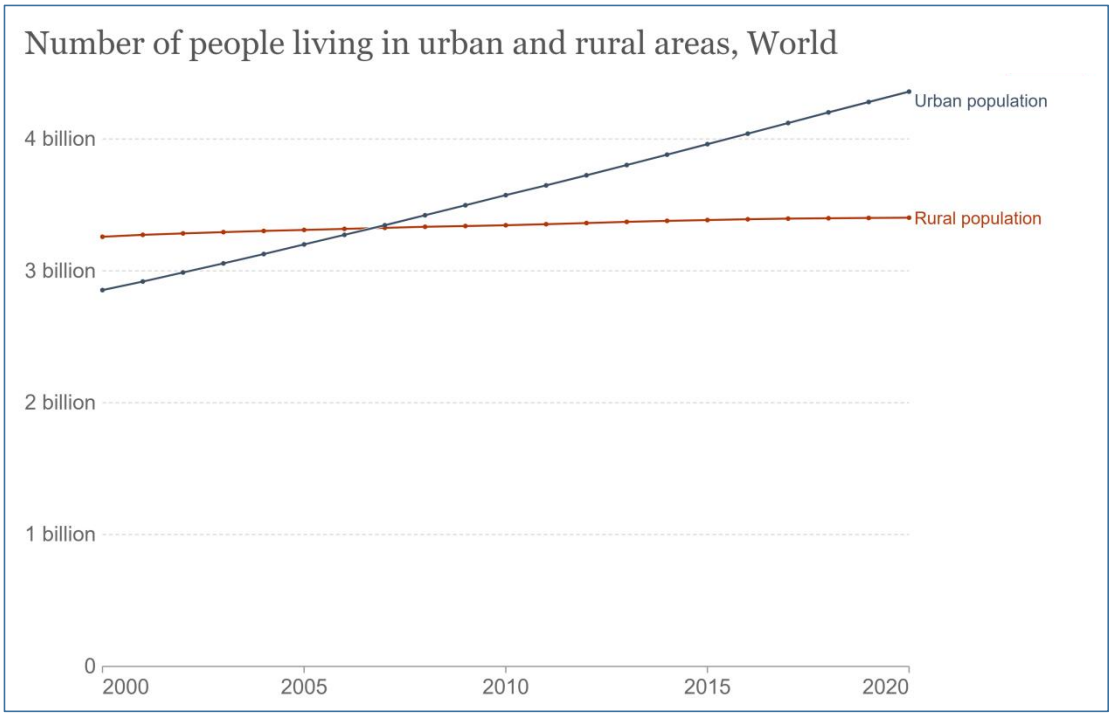


Figure 4: Numbers of people living in urban and rural areas, world (2000-2020).
(source: World Bank based on data from the UN Population Division )

### 1.2.2 Rapid Urbanization

Surveys conducted by Salim Soltani (2021) have shown that spatial urbanization is increasing over the last years all over the world. In particular, the urbanization process is occurring rapidly in Asia and Africa. There is a trend where millions of people migrate to cities from underdeveloped areas to seek higher salaries as well as a well-founded hope of revolutionizing their economic lives. Alternatively, as people become richer, they tend to move from rural to urban areas. Today, cities are home to roughly half of the world's population, and the percentage is expected to increased in the future. "68% of the world population projected to live in urban areas by 2050, " says UN.[3] "Ongoing rapid urbanisation has the potential to improve the well-being of societies. Although only around half the world's people live in cities, they generate more than 80 percent of Global Domestic Product (GDP). Cities are also younger: home to relatively more young and working-age adults than rural areas, making them pivotal places to capture demographic dividends. Yet urbanization also presents many human development challenges. It is estimated that nearly 40 percent of the world's urban expansion may be in slums, exacerbating economic disparities and unsanitary conditions. Likewise, poor urban infrastructure - such as unreliable power systems, congested roads and poor public transport, inefficient ports and inadequate schools - reduces cities' competitiveness and economic prospects." (Thangavel Palanivei, September, 06, 2017).

[3] UN: United Nations. The United Nations is an intergovernmental organization whose purposes are to maintain international peace and security, develop friendly relations among nations, achieve international cooperation, and be a centre for harmonizing the actions of nations.

### 1.2.3 Silk Road Urbanization

As UN-Habitat's Joan Clos says in his interview, "Urbanization and industrialization are two transformative processes for wealth generation.". As the Belt and Road Initiative develops， the socio-economic makeup of the city in the member country has shifted dramatically in recent years. Simultaneously, due to stronger economic growth, middle-class populations have increased significantly in the city， and urbanization has grown. "China's Silk Road urbanism is changing cities" (Wiig and Silver, 2019). Some studies predict that cities along the BRI routes are expected to have higher growth rates due to the advancement of infrastructure connections and an expected thriving economy. Elia Apostolopoulou noted, "Through novel combinations of infrastructure and industrial projects with investments in the urban built environment, the BRI is transforming urban space across the global South and North altering the social and urban geographies of cities at a historically unparalleled scale." While the model of industrial parks along the Belt and Road has been proposed to promote the local economy and accelerate urbanization. The city of Khorgos is one of the most outstanding examples of BRI urbanization. The fact that it situates at the China-Kazakhstan border gave it great importance within the new Eurasian land route of the entire project. Its urban configuration is mainly related to a new set of rules of the BRI. Over this area, an SEZ was created in 2011 to boost the region's economic growth. With the BRI institutionalization in 2013, the attractiveness of Khorgos as a trade and exchange point became a reality. Horgos has become an important core node in the core area of the Silk Road Economic Belt, and now it is transforming from a frontier town to a bustling city.

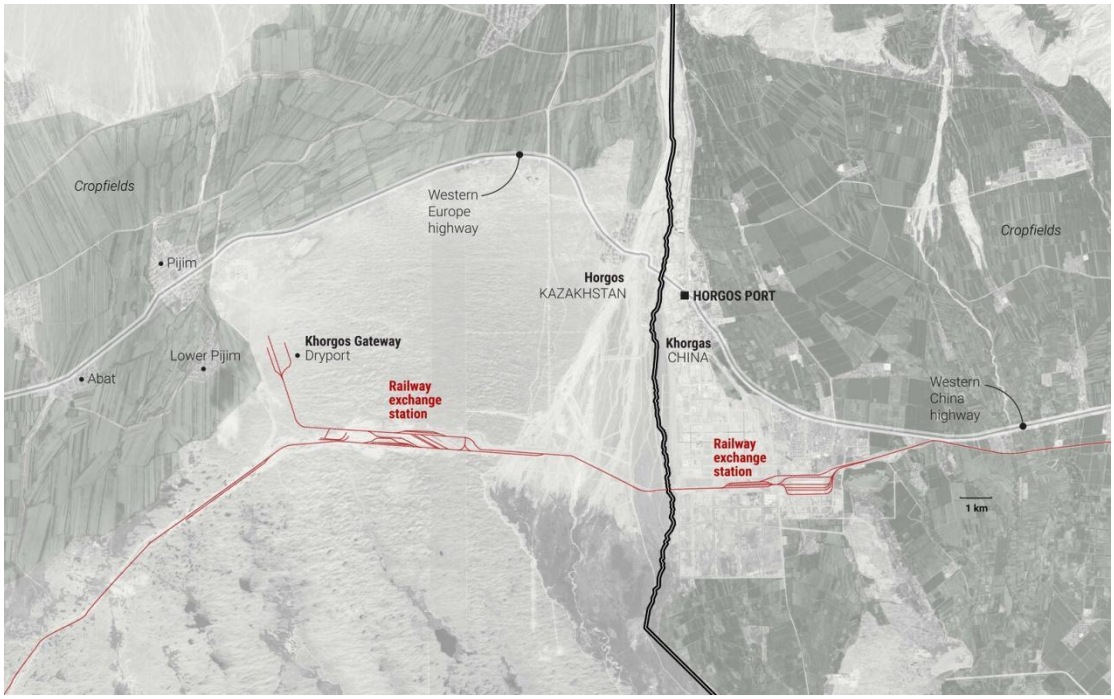

Figure 5: Map of Official of Khorgos Economic Development Zone
(source: https://www.e-flux.com/architecture/new-silk-roads/313106/asymmetrical-flows/ )

## 1.3 Cities in China and member countries of the BRI

Figure 6: Cities of the BRI
(made by author)

From left to right are:
Node city: Lanzhou; Aksu; Kampala;
Primate city: Niamey; Luanda; Nairobi;
Satellite city: Nova Cidade de Kilamba; Lanzhou New Area; Hualing Tbilisi Sea New City;
Metropolis: Tashkent; Dubai; Shanghai;
Port city: Colombo; Gwadar; Lianyungang;

### 1.3.1 Types of urban forms

The geopolitical and economic development, such as the Belt and Road economic corridors and development axes, promote the development and expansion of existing cities, and new cities emerge. You cannot define process of the BRI without mentioning its cities. These urban settlements vary in culture, size and specialty, with certain areas becoming more significant throughout the development of a region. Historically, the size or population of a settlement was general indicator of its importance - however, with the large rural-to-urban migration of the recent years, it has become harder to define what makes a city important. This paper developed several urban typologies from cities in countries of BRI. Although the typologies are not exhaustive, they provide a practical way to categorize the cities' complexity. There are five possible types in total, which reflect the diverse and heterogeneous nature of cities in countries of BRI. These are:

**Node city**

In theory and practice, there is no unified understanding of what node cities mean. UNESCO proposed the concept of Cities alongside the Silk Roads in 2015, mainly referring to important trade and transaction hubs on the Silk Road, such as cities along the 21st Century Silk Road Economic Belt, 21st Century Maritime Silk Road, and the six economic corridors. The cities "attracted traders, and investment, thus becoming important or new centers of economic, trade and industry." Six economic corridors are key economic and trade projects of the Belt and Road Initiative, and a significant part of node city in the six Economic Corridors are the economic and trade industrial parks. For instance, China (Lanzhou) Pilot Free Trade Zone in Lanzhou. The establishment of the Lanzhou Free Trade Zone in China can make full use of the role of the Qinghai-Tibet Railway as an important hub to expand the Tibetan market, and it can also strengthen economic exchanges with India, Pakistan and the Middle East countries through Lhasa, Nathula Pass and Khunjerab Port.

| Economic corridors | Major countries and regions along the way | Main Node World Cities |
|---|---|---|
| the China-Mongolia-Russia Corridor | China, Mongolia, Russia | Beijing, Tianjin, Hohhot, Ulaanbaatar, Dalian, Shenyang, Changcun, Chita... |
| the China-Central Asia-West Asia Corridor | China, Kazakhstan, Uzbekistan, Iran, Kingdom of Saudi Arabia, Egypt... | Urumqi, Alma-Ata, Tashkent, Tehran, Istanbul, Ankara... |
| the New Eurasian Land Bridge | China,Kazakhstan, Russia, Republic of Belarus, Poland | Lianyungang, Xi'an, Lanzhou, Urumqi, Warsaw, Berlin |
| the China-Pakistan Corridor | China, Pakistan | Kashgar Prefecture, Karachi, Lahore, Islamabad, Peshawar, Gwadar, |
| the Bangladesh-China-Myanmar Corridor | China, India, Bangladesh, Myanmar | Kunming, Yangon, Naypyidaw, Mandalay, Dhaka, Kolkata, New Delhi... |
| the China-Indochina Peninsula Corridor | China, Vietnam, Singapore | Nanning, Hanoi, Pingxiang, Yangon, Bangkok, Singapore |

Table 1-3 The Six Economic Corridors and Node cities of the Belt and Road
(source: Research on the development of urban cooperation in the Belt and Road, 2020, p. 3-4)

**Primate city**

Some cities in the BRI are classified as primate cities, such as Niamey, capital of Niger; Luanda, capital of Angola; Nairobi, capital of Kenya; and Kuala Lumper, capital of Malaysia. The term' primate city' was first used by Mark Jefferson in 1939, who defined the 'primate city' as disproportionately larger than any other city in a country, state, or region - at least two times larger than the next largest city. Aside from size and population, "a primate city will usually have precedence in all other aspects of its country's society, such as economics, politics, culture, and education" (The Globalization and World Cities Research Network (GaWC))[4]. Simultaneously, majorities of a country's or region's internal migration occurs in primate cities. Concerning primate city, the topic had been deeply studied by the urban economy professor Paul Bairoch in his scientific book, CTIES and ECONOMIC DEVELOPMENT from the Dawn of History to the Present.

**Satellite city**

An area's principal city is surrounded by smaller towns and cities, which are satellite cities. They differ from mere suburbs, subdivisions, and especially bedroom communities in that municipal governments are distinct from the core metropolis and employment bases sufficient to support their residential populations. Conceptually, satellite cities could be self-sufficient communities outside their larger metropolitan areas. However, a satellite city experiences cross-commuting (that is, residents commuting out of and employees commuting into the city). The phrase 'satellite city' will be used in this study to describe in the new satellite towns constructed by Chinese company under the Belt and Road Initiative.

**Metropolis**

The term Metropolis is generally understood to mean large cities that are centers of social and economic activity in countries and regions and share many of the same characteristics as globalized cities. In short, a large, densely populated urban area is called a metropolis. Moreover, in many other countries, particularly in the metropolises of Asia, living conditions are far more constricted.

**Port city**

Historically, the term ‘port city’ has been used to describe a city built around a port for its defense, to provide infrastructural support, or as parasitic urban sprawl. As a critical node in developing shipping, logistics, trade, and other industries, coastal ports are an essential infrastructure for a country or region to integrate into economic globalization and regional and even global economic resources. 21st-Century Maritime Silk Road involves many ports, such as Piraeus Port in Greece, Djibouti Port in Djibouti, Gwadar Port in Pakistan, Colombo Port in Sri Lanka, and Kyaukpyu Port in Myanmar.

[4] The Globalization and World Cities Research Network (GaWC) is a think tank that studies the relationships between world cities in the context of globalization. It is based in the geography department of Loughborough University in Leicestershire, United Kingdom.

### 1.3.2 Case study

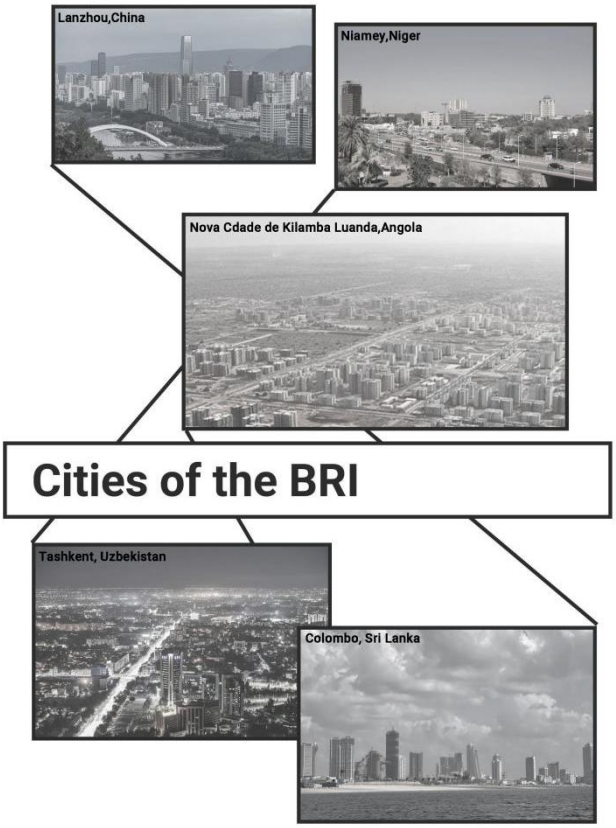


Figure 7: Cities of the BRI
(made by author)

"China's Silk Rold urbanism is changing cities (Wiig and Silver 2019)."Rapid urbanization and urban expansion have recently appeared in countries along the Belt and Road. Therefore, a detailed study of the development of the city is warranted. This part focuses on the urban form and spatial layout of 5 cities in China and partner countries of the BRI. These cities are located in China, African countries, and Asian countries. The illustrations and descriptions of the selected cities mostly show the urban form, structure, and major structuring.

| **Asia** | **Nation** | **City** | **Type** |
|---|---|---|---|
| | China | Lanzhou | Node city |
| | Uzbekistan | Tashkent | Metropolis |
| | Sri Lanka | Colombo | Port city |
| **Africa** | | | |
| | Angola | Kilamba New city | Satellite city |
| | Niger | Niamey | Primate city |

Table 1-4 Cities of the Belt and Road
(made by author)

Cities are often developed in favorable locations. For a long, locations on rivers or by the sea were decisive locational advantages. The existing or future planned infrastructure is also a critical locational advantage. Simultaneously,

### 1.3.2.1 Node city - Lanzhou, China

Lanzhou, in Northwest China, is the capital and largest city of Gansu Province. The Yellow River crosses this city, making it a key regional transportation hub. Lanzhou plays a significant role in connecting areas further west by rail to the country's eastern half. It was historically a significant link on the Northern Silk Road, and now it is a significant hub on the New Eurasian Land Bridge. In Lanzhou, international freight trains have been opened to Kazakhstan and Almaty, China-Europe trains have been opened to Hamburg, Germany, and regular operations have been achieved. Lanzhou has developed into a modern metropolis with increasing international influence and high attraction. The city is also a heavy industry and petrochemical center. The city is in a mountainous valley, and the Yellow River traverses the city center from west to east. The mountainous river valley restricts the north-south expansion of the city. Thus, Lanzhou forms a belt-shaped city along the Yellow River that extends east to west.

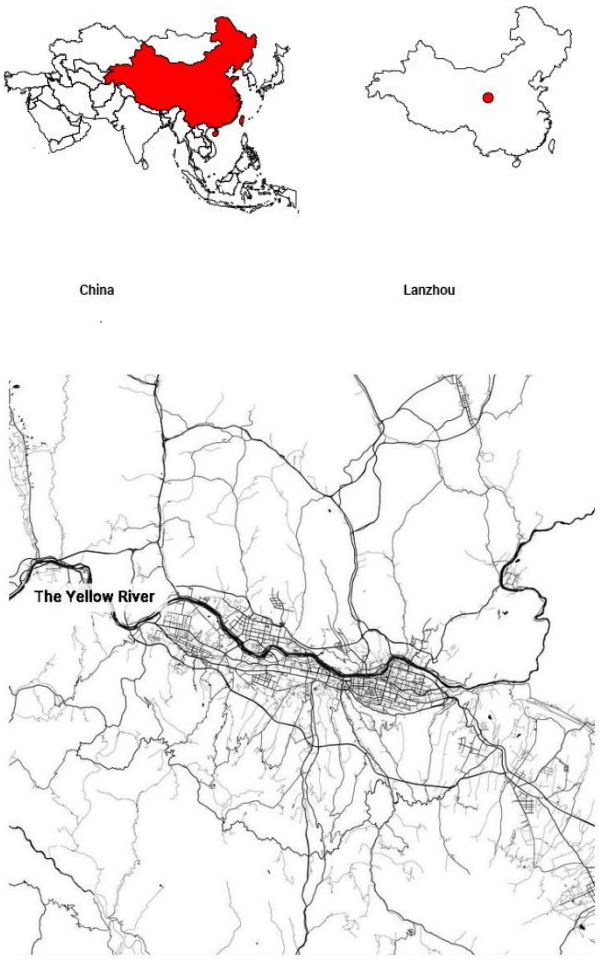


Figure 8: Map of Lanzhou
(made by author)

Figure 9: City view of Lanzhou
(source: Google Images)

**Economic growth**

The Belt and Road strategy has shown great charm and development prospects on the world stage, and Lanzhou, an important town on the ancient Silk Road, plays a vital role as a hub city in the Belt and Road strategy. Firstly, it is a crucial node city facing Europe and Central Asia. Secondly, Lanzhou is located in the center of China's geographic map and on the Asian Continental Bridge. Third, it is an important node city connecting China to Europe. Lanzhou successfully opened international freight trains to Kazakhstan and Almaty, opened the China-Europe trains to Hamburg, Germany, and realized regular operation.

With the development of the BRI, Lanzhou is becoming the demonstration zone of production capacity cooperation. Furthermore, because Lanzhou's petroleum, chemical, equipment manufacturing, non-ferrous metallurgy, and biomedicine support Central and West Asian countries, there are many cooperation projects such as China-Kazakhstan Industrial Park and China-Korea Industrial Park have emerged. These further opened up the space for Lanzhou to open to the west and vigorously promoted the economic and social development of Lanzhou. The Belt and Road promote a robust policy platform. After the Belt and Road Initiative was proposed, Lanzhou New District Comprehensive Bonded Zone, Lanzhou International Port Area, Silk Road Information Corridor, China Lanzhou Free Trade Park, and other platforms were successively completed. As a result, the construction of the Belt and Road has injected vitality and added impetus. Simultaneously, over the past ten years, the regional cooperation of the New Asia-Europe Continental Bridge Economic Corridor has been deepened. Moreover, partnership featuring openness, inclusiveness, mutual benefit, and win-win results has been elevated to a new level, effectively advancing the economic and trade exchanges between Asia and Europe.


Figure 10: 21st Century Silk Road Economic Belt & 21st Century Maritime Silk Road
(source: https://www.kwm.com/cn/zh/insights/latest-thinking/chinas-belt-and-road-overview.html )

**Lanzhou New Area**

There is a severe development space shortage in Lanzhou's central urban area. According to the 2005 Lanzhou City Land Renewal Survey Status Map, the space for the expansion of the main urban area of Lanzhou City is about 20-30 square kilometers. The narrow development space not only leads to high urban land prices, high land use thresholds, and increased construction costs but also dramatically restricts Lanzhou as a transportation information hub in the west, a regional business, and modern logistics center, an energy and chemical base, a non-ferrous metallurgy new material base, The functions of equipment manufacturing base, characteristic agricultural product processing base, biopharmaceutical, and Chinese-Tibetan medicine modernization base shall be exerted.

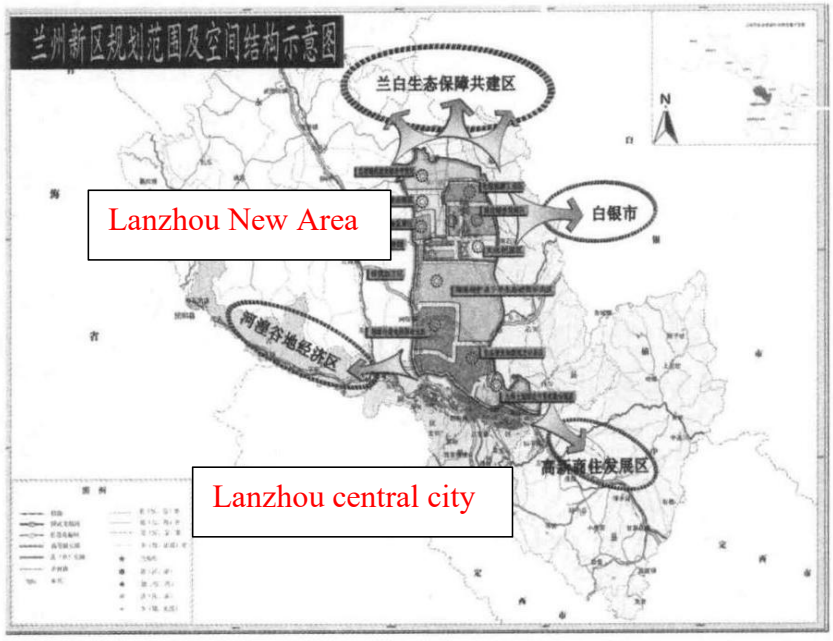


Figure 11: The research on spatial layout planning of new district of Lanzhou
(source: 石培基, & 胡科. (2012). 兰州新区空间布局规划研究. *黄河文明与可持续发展（第 4 辑).* )

Lanzhou New Area was founded in 2012, which is a unique economic and political administration zone directly controlled by the municipal government of Lanzhou, Gansu province. It is located 30 kilometers from Lanzhou's city center.In officially endorsed texts, Lanzhou New Area is the fifth state-level new area in the country. Lanzhou New District, an important connection point between the Silk Road Economic Belt and the Eurasian Continental Bridge, has been urbanized continuously since the State Council approved it in 2012. Driven by factors such as policy, economy, and investment attraction Increasing.

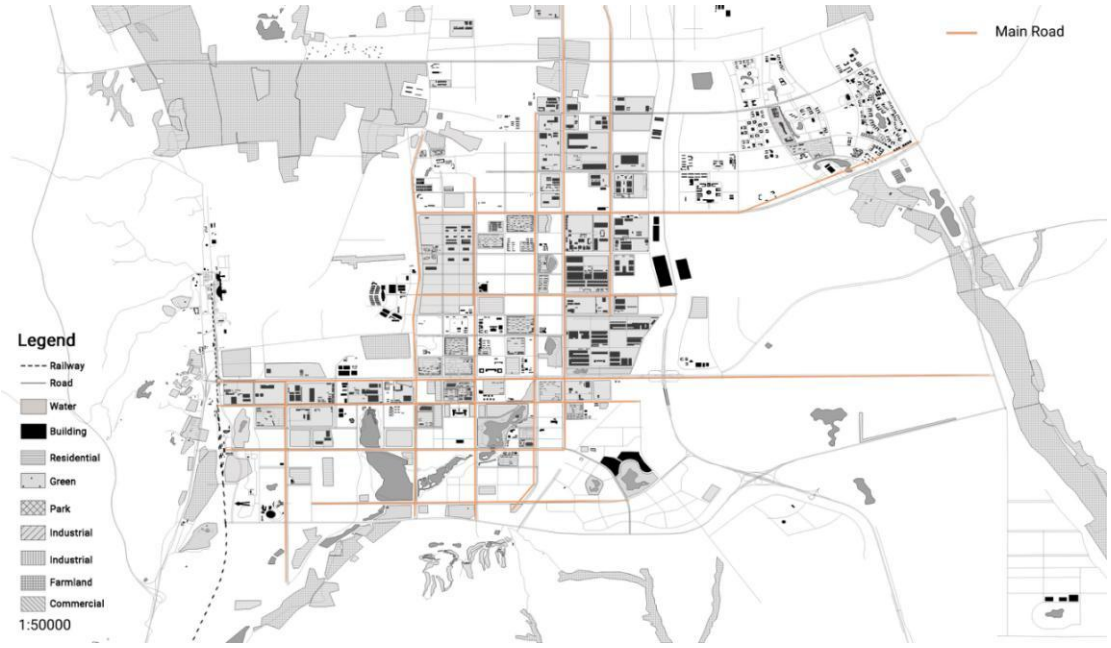

Figure 12: Map of Lanzhou New Area
(made by author)


Figure 13: New build housing project in Lanzhou New Area
(source: Google Images)

### 1.3.2.2 Primate city - Niamey, Niger

Niamey is the capital and largest city of Niger, with a population of over one million people. The city is situated on two plateaus with the Niger River in-between. The original city developed on the eastern side of the river. Niamey is the main hub for the trade and export of agricultural products as well as the political, and cultural centre of Niger. A majority of the population is poor. “The presence of a primate city in a country may indicate an imbalance in development—usually a progressive core and a lagging periphery—on which the city depends for labor and other resources” (Brunn, Stanley, et al. 2003). Nevertheless, with the acceleration of economic development, accompanied by the development of policy and the Belt and Road Initiative, the city's socioeconomic makeup has shifted dramatically. More robust economic growth has fueled migration to the city, leading to a sizable increase in the middle-class population. On the other hand, property in the older, affluent neighborhoods remains unobtainable, forcing the low-to-middle income population to seek affordable housing further from the city center.

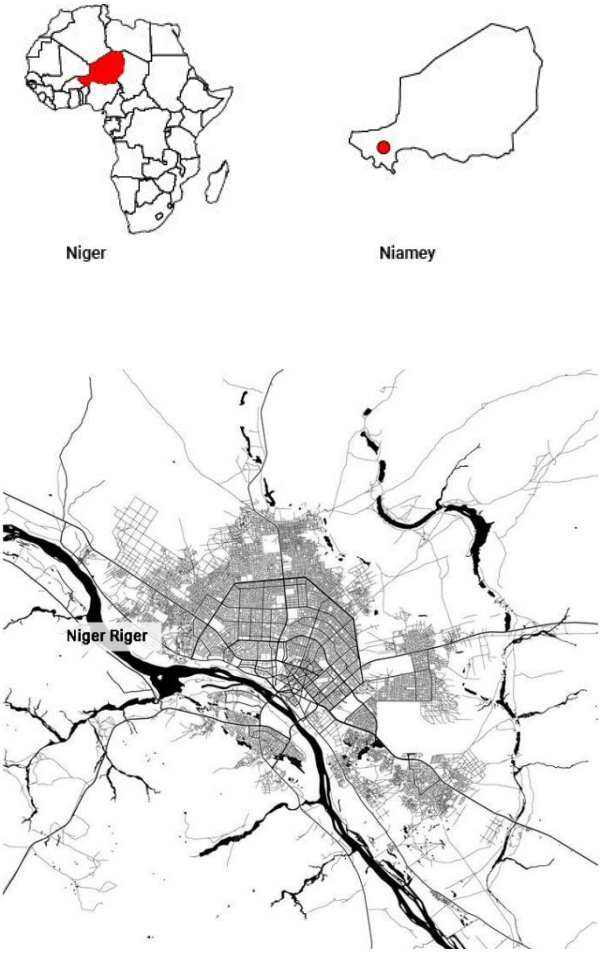


Figure 14: Map of Niamey
(made by author)

Figure 15: City view of Niamey
(source: Google Images)

**Economic growth**

With the influx of investment and the interconnection of the world, the Belt and Road Initiative will bring more benefits to Africa. The global economy is becoming increasingly integrated, and Africa can take this opportunity to realize its transformation. Africa and China have decided to use the Forum on China-Africa Cooperation as an essential platform for the two sides to build the Belt and Road jointly. In order to strengthen the economic integration of the African continent and improve the lives of youth and women in the economic, social, and cultural fields, the Infrastructure and Energy Division of the African Union Commission will promote African connectivity and provide effective infrastructure services. They are promoting all-African infrastructure through major continent-wide projects in the AU Agenda 2063, including the Great Inga Hydropower Project, the African Integrated High-Speed Rail Network (AIHSRN), the African Single Air Transport Market, the Pan-African Electronic Network, and the Cyber Security Project Connectivity, to bring global impact and economic benefits to Africa and beyond. On the other hand, the successful implementation of the African Continental Free Trade Area agreement further promote collaboration between China and African countries. To this end, China has embarked on major projects to promote connectivity between countries. These projects benefit Africa and align with the Belt and Road Initiative. Investing in railways, highways, seaports, ports and airports is crucial for Africa.

**Infrastructure**

"Niamey's transportation infrastructure is very limited. There are no railways, no formal public transportation system and relatively few paved roads ("Doing Business in NIGER: 2012 Country Commercial Guide for U.S. Companies," 2010). There is no nearby port, and one small airport provides service to the public. Most people get around by walking, shared bus systems, or taxi (Author's observation, 2004-2005). It is not surprising that a city with few resources has been unable to keep up with the staggering pace of population growth, which demands infrastructure systems." (Alison Spindler, 2010). In February 2021, the General Seini Knoche Bridge, aided by the Chinese government in Niger, opened to traffic. The bridge spans both sides of the Niger River and connects the north and south areas of Niamey. It was constructed by China Harbour Engineering Co., Ltd. and started in July 2018. The bridge construction project has dramatically eased the traffic pressure in Niamey and promoted the economic development of the sub-region. On the 26th of March，2019，local time in Niger, the groundbreaking ceremony of the Kandaji Hydropower Station project, the largest hydropower station in Niger undertaken by a Chinese company, was held in the project location. The project is located about 180km upstream of Niamey, the capital of Niger. The installed capacity of the power station is 130MW. It can reach 617 million Kw・h, which will significantly solve the shortage of power supply in Niamey, the capital of Niger, and its surrounding areas, help Niger get rid of the plight of electricity dependence on imports, and promote local economic development. During the project's construction, it will also provide thousands of jobs for Niger and cultivate many local technical talents for Niger.

Figure 16: the General Seini Knoche Bridge
(source: https://baijiahao.baidu.com/s?id=1692117322415675321&wfr=spider&for=pc )

## Urban expansion

"Niamey's growth rate has been between 4.22 and 4.55 since 1990 and its urbanization growth rate is projected to increase to 4.96% annual average growth between 2020-2025 ("State of African Cities, 2010," 2010). 83% of Niger's 16 million people live in rural areas (Rural Poverty Portal, n.d), which is far higher than the global average. As climate change continues to worsen conditions in rural Niger, Niamey will liketly continue to absorb large portions of the population for decades to come." (Alison Spindler, 2010). Nevertheless, the socio-economic makeup of the city has shifted dramatically in recent years. Stronger economic growth has fueled migration to the city, leading to a sizable increase in the middle-class population. Property in the older, affluent neighborhoods remains unobtainable, forcing the low-to-middle income population to seek affordable housing further from the city center. According to the UN, 82% of the urban population in Niger live in a slum area ( "State of African Cities, 2010," 2010).


Figure 17: City grow of Niamey,Niger
(source: united 4 design )

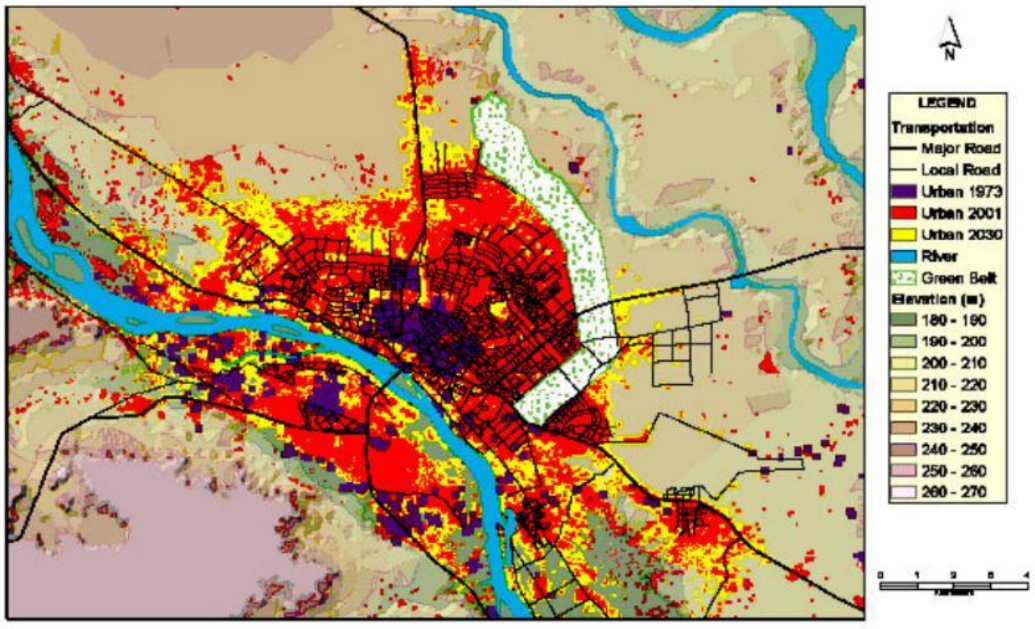


Figure 18: Predicted urban expansion for the city of Niamey for the period 1988 - 2030
(source: INTERNATIONAL JOURNAL OF GEOMATICS AND GEOSCIENCES Volume 5, No 4, 2015 )

### 1.3.2.3 Satellite city - Nova Cdade de Kilamba, Luanda, Angola

Luanda is the capital and largest city of the Southern African country of Angola. Due to ongoing rural-to-urban migration, the city grew with over 8.3 million inhabitants in 2020 (a third of Angolan's population). The city on the Atlantic Ocean coast, Luanda, is Angola's primary port connecting Angola with the rest of the world. Luanda is the main hub for the trade and export of industrial products and Angola's political, cultural, and urban center. Luanda's city structure is composed of various centers. Luanda is a relatively new city founded by Portuguese explorer Paulo Dias de Novais in 1576. The Portuguese colonial planners initially designed the city for approximately 5,000 people. However, Luanda is rapidly expanding to deal with the steep population growth of approximately 5.77 percent per decade. As a result, Luanda is presumed to be a megacity in waiting, with a projected population of 8.9 million in 2025. There are vast wealth disparities amongst the population. Post-civil war Luanda is characterized by a pronounced divide between the city planned for the elite and unplanned sprawl, characterized by low-density self-built musseques.[5] Modern skyscrapers and unfinished towers dominate the city’s coastline but also hide the informality that accounts for the bulk of Luanda’ s urban fabric.When the civil war ended in 2002, the infrastructure was severely damaged, the supplies were scarce, and there was nothing to be done.

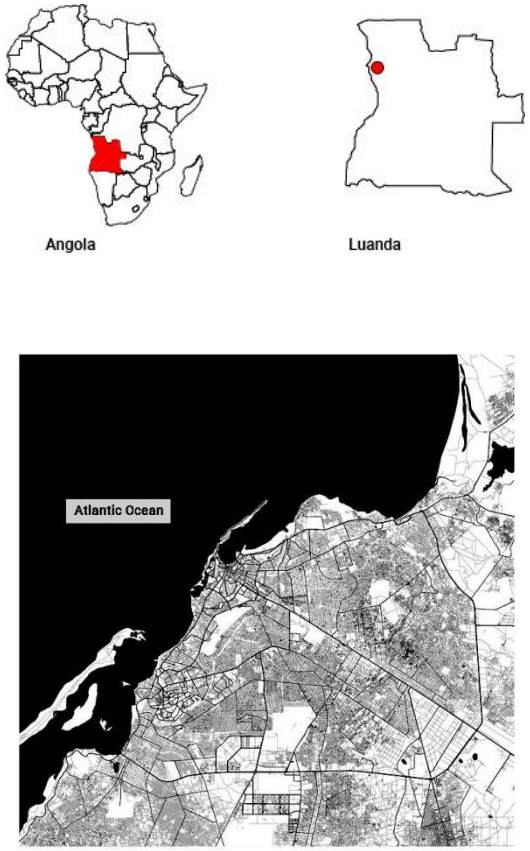


Figure 19: Map of Luanda
(made by author)

[5] Musseques, the Angolan term for slums or self-built squatter settlements, literally translates to places of red earth.

**Economic growth**

With the end of the civil war in 2002, Angola began rebuilding its economy. Under the “One Belt, One Road” initiative, the Port of Cheechel in Algeria has been completed and implemented. The Port of Luanda in Angola is also under construction. These ports are unique in that their location is either connected to major onshore arterial roads or close to industrial parks, thus having a significant impact on the economic development of African coastal areas. The Port of Luanda is the main port in Angola, carrying more than 70% of Angola's import and export traffic. It is a port in Angola that China is involved in building. The port features a bay entrance approximately 1.5 miles wide for easy access. In addition, also under the support of the "One Belt, One Road" initiative, many power plants have sprung up in Africa. Another core area of the Belt and Road Initiative that strategically impacts African economic recovery and sustainable growth is the construction of industrial parks. By building industrial parks in Africa, China helps these countries attract foreign direct investment in manufacturing in strategic areas, promote industrialization, increase income and create employment opportunities. Moreover, to improve the local living standards, comprehensively promote social and economic development.

**Infrastructure**

The Angola power grid project undertaken by the Power Construction Company is in Luanda's capital. The construction includes the construction of three 60kV substations. The main significance of the power grid project is to deliver electricity to the 90,000 residents of the capital and provide a bright social place for families. The Belt and Road core content is to promote infrastructure construction and interconnection. As a Belt and Road project in Africa, Luanda Electrification has become a perfect example of the transformation of the Belt and Road construction from concept to action and from vision to reality. Power Construction Municipal Corporation undertook the Gilongo water supply project in Angola. The 5,000-house Kilamba community is located south of Luanda and densely populated with high water demands. Due to the impact of the new crown pneumonia epidemic, Angola is in a state of national emergency. The people are isolated at home, and the demand for domestic water is particularly urgent. In addition, the frequent failure of the standing motor of the beta water pump has seriously affected the regular water demand of the people. In order to solve the problem of people's domestic water supply during the epidemic, the Ministry of Water Resources and Energy and the owner, Luanda State Water Supply Company, have repeatedly requested help from the project department. Chinese company undertakes construction of a new international airport in Luanda, Angola. Dr. Antonio Agostinho Neto International Airport will be put into operation as soon as possible, enhancing the influence of Angola in the international community, benefiting the Angolan people, and helping the development of the local aviation industry. The municipal highway project in Luanda, the capital of Angola, was undertaken by China Railway Construction 20th Bureau Group. On March 24, 2022, the PK74 marking and signage of the Weight Highway Project, constructed by the No. 1 Company of the China Railway Fourth Bureau, was completed. At this point, the extra works of the 76-kilometer highway in Kitixe and Ambora, Angola, were all completed. They were marking the completion of the project.

**Urban expansion**

Together, these studies indicate that "the Urban Extent of Luanda in 2014 was 50,967 hectares, increasing at an average annual rate of 5.7% since 2000. The urban extent in 2000 was 23,181 hectares, increasing at an average annual rate of 5.6% since 1991, when its urban extent was 14,038 hectares." (the Atlas of Urban Expansion - Luanda). According to the Atlas of urban expansion, "a total of 19,715 of hectares of built-up area was added to the Luanda urban extent between 2000 and 2014. Of that added built-up area, 19% was Infill, 75% was Extension, 0% was Leapfrog, and 6% was Inclusion."

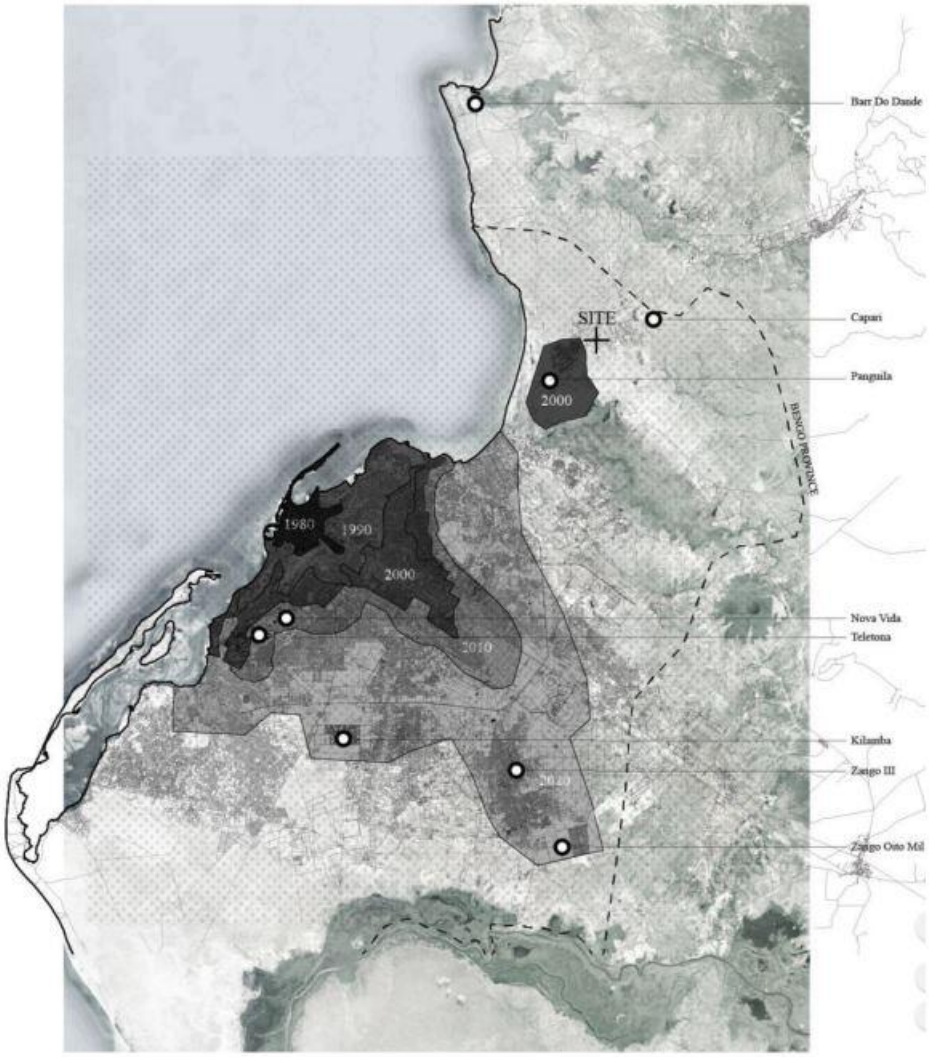


Figure 20: Map of the urban expansion of Luanda since 1960
(source: Kareem Mitchell, 2020, Housing on the horizon, pp 30 )

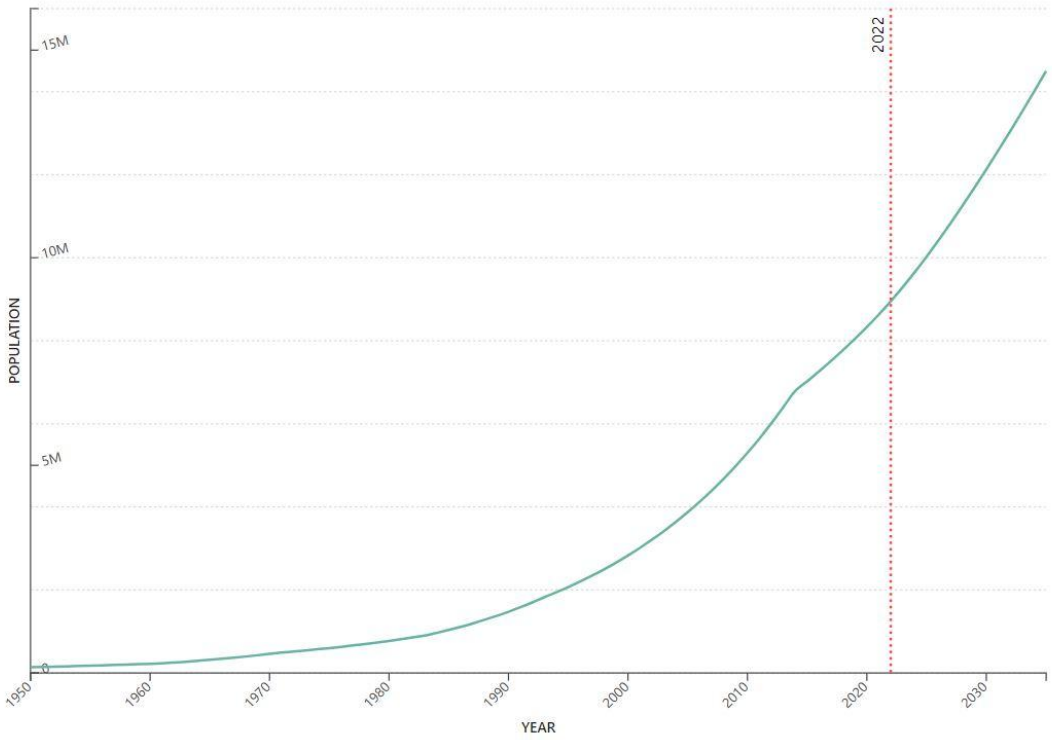


Figure 21: Population of Luanda
(source: https://worldpopulationreview.com/world-cities/luanda-population )

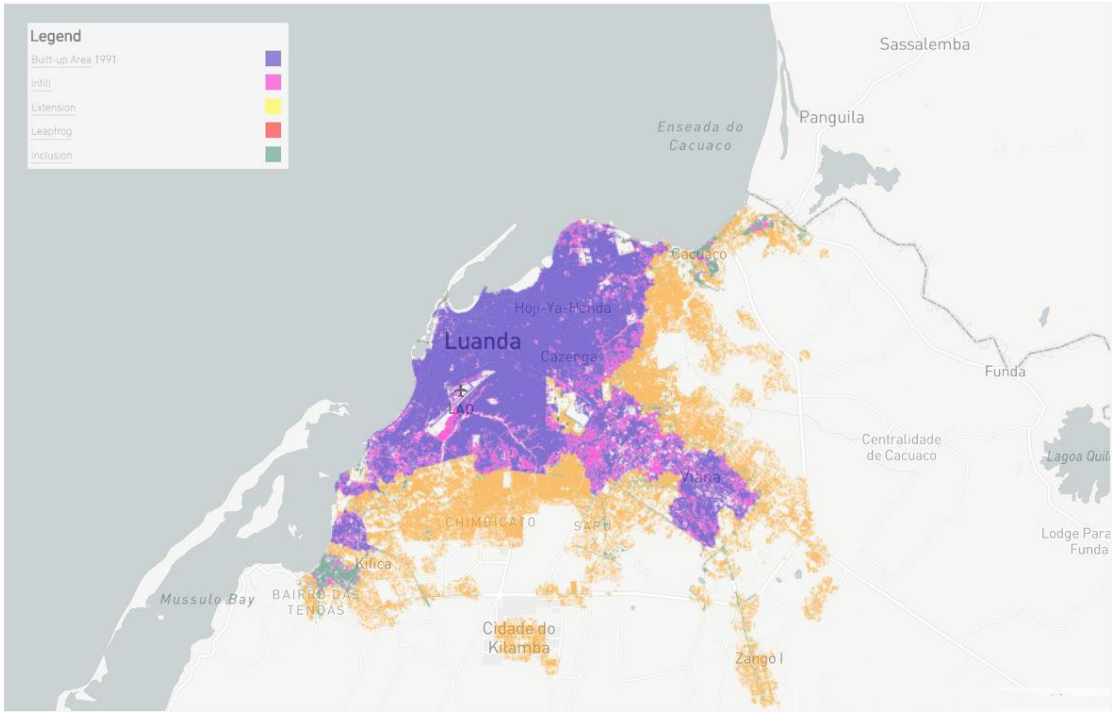


Figure 22: Composition of Added Area
(source: http://www.atlasofurbanexpansion.org/cities/view/Luanda )

**Satellite city - Nova Cidade de Kilamba (Kilamba New City)**

In recent years, rapid urbanization occurring mainly in Asia and Africa. Africa has had the fastest urban growth rates. As a result, many African countries have built more new cities to meet rapid urbanization. Substantial attention has been paid to China's involvement in urban construction in African countries as one of the Belt and Road Initiative projects. For example, Rachel Keeton and Steffen Nijhuis study the contemporary African New Towns. In their study, Rachel Keeton and Steffen Nijhuis noted, "New Towns in development across Africa are overwhelmingly designed according to twentieth-century planning models ranging from functionalist Chinese grids to American gated communities."

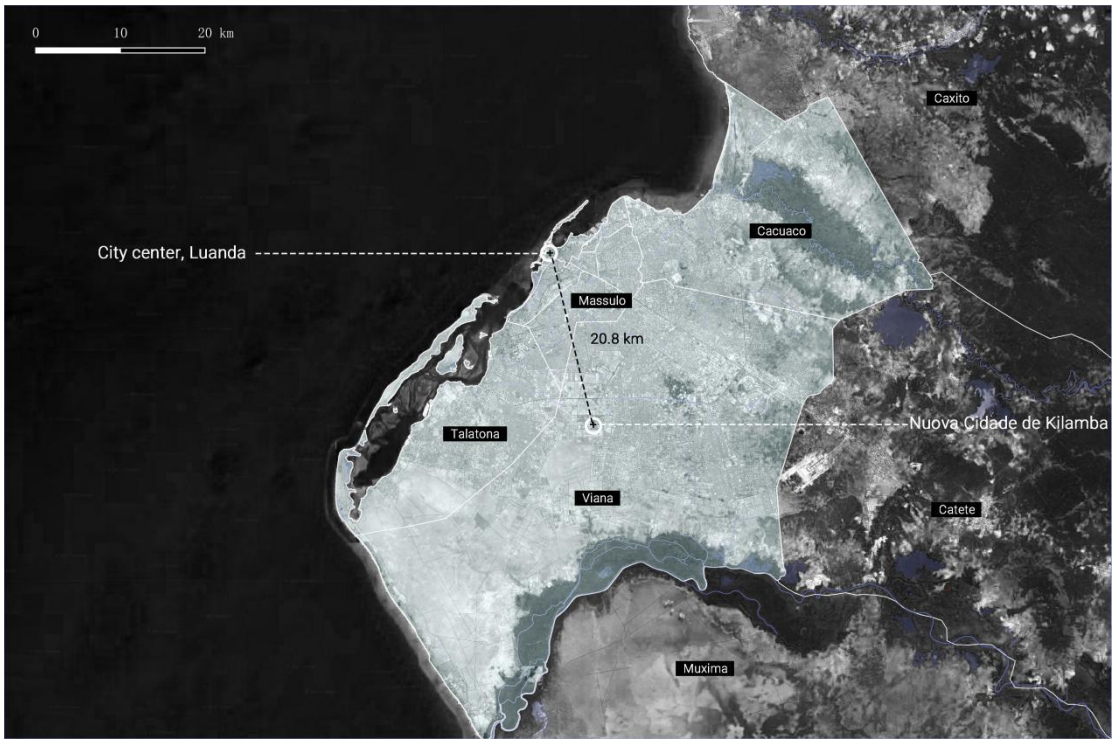


Figure 23: The distance between Luanda and Kilamba
(made by author)

Figure 24: Nova Cidade de Kilamba
(source: https://www.businessinsider.com/chinese-built-ghost-town-kilamba-angola-2012-7?op=1&r=US&IR=T )

In this paper, Kilamba New City (Nova Cidade de Kilamba) as planned urban developments for more than 30,000 residents with mixed programs on greenfield sites developed as a single identity with some degree of political autonomy. Other authors have addressed this development alternatively as new cities and satellite cities. Hence, it is also called a satellite city in this thesis. A fast-growing population and rapid urbanization put unprecedented pressure on Africa's largest cities. In this context, housing an increasing number of urban dwellers has become a major challenge for most African governments. Angola has partnered with China to address its housing shortage and is building several satellite towns from scratch around the country's main cities. In addition, China has been actively involved in Angola's post-war reconstruction process, covering projects like urbanization and social housing. For example, the flagship 3.5-billion-us-dollar Kilamba New City project by Chinese civil engineering company CITIC Construction[6] has turned a backward rural area into a modern satellite town of the nation's capital, Luanda. Nova Cidade de Kilamba (Kilamba New City) is a commune with a population of 56,183 (2014 census) and covers an area of 30.5 square kilometers. It is the municipal seat of Belas Municipality and a large housing development site almost 20 km from Luanda.

Figure 25: Satellite map of Nova Cidade de Kilamba
(source:
http://www.sinistraeuropea.it/articolo/23/kilamba-la-citt%C3%A0-africana-fantasma-da-500-mila-abitanti-costruita-dai-cinesi.php )

[6] In an effort to implement national strategies, CITIC Construction has teamed up with outstanding partners to extend overseas business.

### 1.3.2.4 Metropolis - Tashkent, Uzbekistan

Tashkent is the capital and largest city of Uzbekistan, as well as the most populous city in Central Asia, with a population of 2,694,400 (2021). It is in northeastern Uzbekistan, near the border with Kazakhstan. Tashkent means Stone City in Uzbek and has a history of 2,500 years. Regarding population, Tashkent is the largest city in Central Asia and an important economic and cultural center. Tashkent is the fourth largest city in the former Soviet Union, after Moscow, St. Petersburg, and Kyiv. The political, economic, cultural, and transportation center of Uzbekistan. Tashkent is one of the important commercial hubs on the ancient Silk Road, and the famous "Silk Road" passed through here. In ancient China, Zhang Qian, Fa Xian, and Xuan Zang all left their footprints. Tashkent is located east of Uzbekistan, west of the Chatkar Mountains, in the center of the oasis in the valley of the Chirchik River, a tributary of the Syr Darya. The city is divided into 11 districts. The city center is the seat of Uzbekistan, the administrative organs of the city, and the commercial and cultural district.

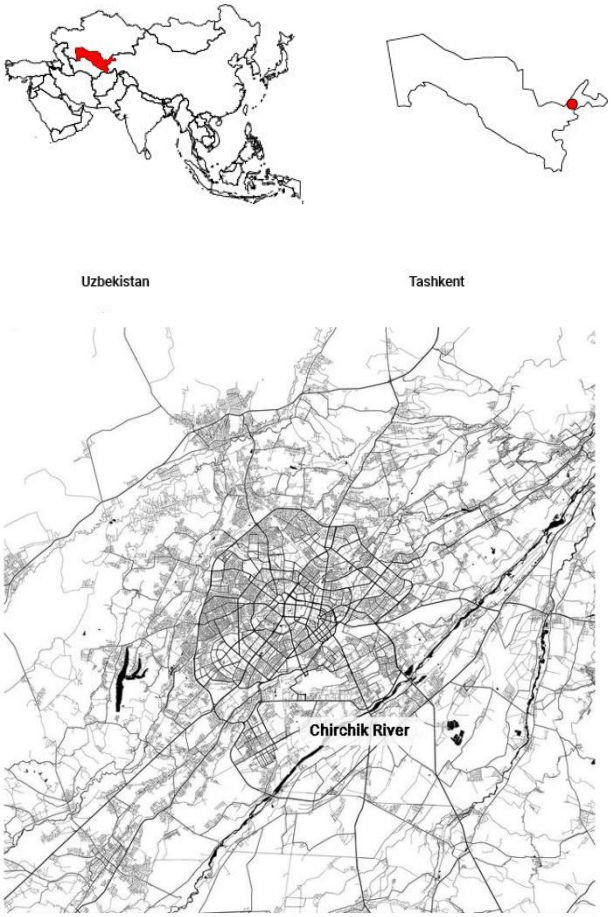


Figure 26: Map of Tashkent
(made by author)

Figure 27: City view of Tashkent
(source: Google Images)

**Economic growth**

Uzbekistan is not only a significant country in Central Asia but also an important country along the "Belt and Road." Since independence, Uzbekistan has been committed to integrating into economic globalization and actively participating in the construction of regional integration. Tashkent is Uzbekistan's most prominent industrial city and is the country's agricultural and textile machinery manufacturing base. Its industrial output value accounts for 25% of the total industrial output value of the country. In recent years, China and Uzbekistan have achieved remarkable results in the joint construction of the Belt and Road Initiative. Many major cooperation projects include the A/B/C third line of the China-Ukraine Natural Gas Pipeline, which was completed and completed. On the other hand, the division of the Jizak Free Economic Zone - Pengsheng Industrial Park has gradually expanded its production scale and upgraded it to a national-level overseas economic cooperation zone. As a result, it has played an exemplary and leading role in the practical cooperation between the two countries.

**Infrastructure**

Uzbekistan is an ancient country on the Silk Road. It is located at the crossroads of Central Asia's transportation hub and is a node of the Belt and Road route to expand westward. Since China proposed the Belt and Road initiative in 2013, China and Uzbekistan have reached a consensus on significant projects covering energy, transportation, chemical industry, and other fields. The China-Central Asia natural gas pipeline and China Industrial Park. A large number of cooperation projects have entered the practical stage. Although there are no complete statistics, according to our rough estimation, the average annual scale of the "One Belt, One Road" projects of Chinese companies in Uzbekistan has exceeded 10 billion yuan in recent years. "According to a project manager in Navoi state, dozens of Chinese companies engaged in investment and economic and technological cooperation in Uzbekistan, and there are more than a dozen large companies familiar to everyone, such as PetroChina and its affiliated companies. , CITIC Construction Company, China Coal

Science and Industry, Zhongyuan International, China Railway, CAMCE (7.430, -0.10, -1.33%). The "Anglian-Papu" railway tunnel passes through the mountains and traverses Central Asia. It is the first railway tunnel in Uzbekistan's history, a major achievement of China-Uzbekistan's joint construction of the "Belt and Road," and an important international transportation corridor along the Silk Road. China-Uzbekistan Central Asia - part of Europe. The main tunnel, Kamchik Tunnels, is 19.2 kilometers long.

**Urban expansion**

Between 1985 and 2013, Tashkent's formal urban settlements grew by 20%, and the city's density increased from 998 to 1,320. According to the Atlas of urban expansion, “the urban extent of Tashkent in 2013 was 102,000 hectares, increasing at an average annual rate of 1.3% since 1999.” (Atlas of urban expansion). “Under the authoritarian rule of Islam Karimov, strict restrictions on rural populations made it difficult to migrate into the city, which somewhat limited the growth of informal settlements. Since the ruler’ s death in 2016, however, it is difficult to tell how much informal settlements are growing and exactly what portion of the city they currently occupy.” [7]

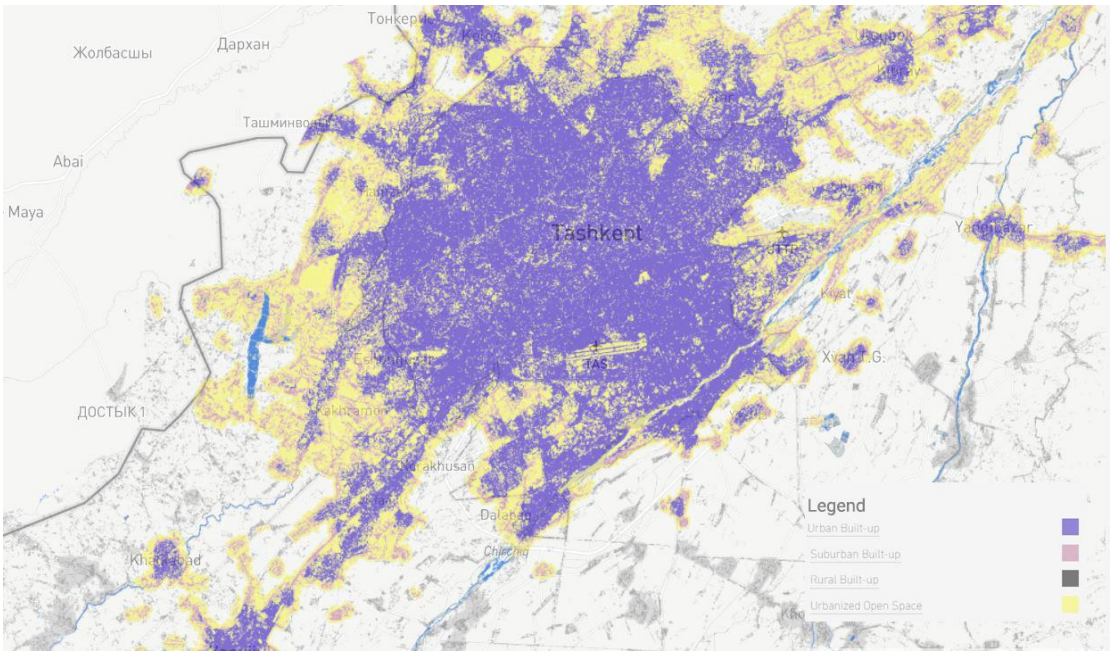


Figure 28: Urban extent (2013)
(source: http://www.atlasofurbanexpansion.org/cities/view/Tashkent )

[7] Source from: Hotspot cities project, https://hotspotcitiesproject.com/cities/tashkent.html.

### 1.3.2.5 Port city - Colombo, Sri Lanka

Colombo is the largest city in Sri Lanka and is recorded as the commercial capital of Sri Lanka in many countries. It has a population of 642,163 people and a large area of 2,234,289 people (2001). In the north, the Kelani River separates Colombo from the Indian Ocean on the southwest coast of Ceylon Island. Colombo is the gateway to Sri Lanka and is known as the "Crossroad of the East." Moreover， it is not only an important port in the Indian Ocean but also a world-famous artificial seaport. Sri Lanka was an essential stop on the ancient Maritime Silk Road. Countless ships carrying Chinese spices and tea stopped here before sailing to Europe for trade. With the completion of the land reclamation project, a series of new facilities have successively landed in the port city. The green space in the central park, the artificial beach, the sports training center, the yacht marina, the pedestrian bridge, and the port city have ushered in a new stage of development.

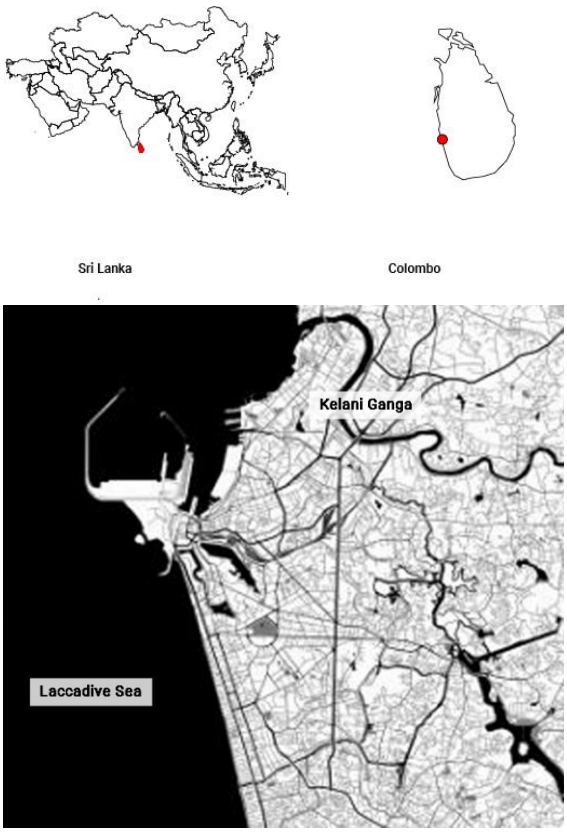


Figure 29: Map of Colombo
(made by author)

Figure 30: City view of Colombo
(source: Google Images)

**Economic growth**

In recent years, many projects of the Belt and Road have brought positive contributions to the economic development of Sri Lanka. For instance, the Colombo International Container Terminal Project has enabled the Port of Colombo to achieve rapid development and promoted the development of the local economy. In addition, Sri Lanka and China have jointly developed large-scale development projects such as Colombo Port City and Hambantota Port that have created many new business and employment opportunities for the island and led to the country's economic transformation.

**Port City Colombo**

The Associated Newspapers of Ceylon writes: “Port City Colombo is a brand new city development built as an extension of the Central Business District of Sri Lanka’s vibrant commercial capital, Colombo. Spanning 269 hectares of reclaimed land from the sea, Port City Colombo will be South Asia’ s premiere residential, retail, and business destination, offering unmatched planned city living along the warm waters of the Indian Ocean. The development will comprise five different precincts including the Financial District, Central Park Living, Island Living, The Marina, and the International Island.”. Colombo Port City is expected to the entire city development and construction in 2041. The project missions are: to build the project on sustainable values, to create a healthy environment with future-ready infrastructure to enhance living convenience, and to furnish an exemplary city providing the highest quality commercial, entertainment, medical, education, and lifestyle opportunities and a place that fuses the culture and energy of a nation with international best practice. The Colombo Port City is currently being built here, a large-scale investment project jointly launched by China Harbour and the Sri Lankan government. Sri Lanka's Port City project is unprecedented in its history. This landmark project in Sri Lanka will create over 80,000 jobs and attract over US$15 billion in investment. Completing the land reclamation project marks significant progress in the overall construction of the

port city project and demonstrates Chinese solutions and technologies on the world stage.

Figure 31: Blueprint of new CBD
(source: Google Images)

Figure 32: City view of reclaimed site
(source: Google Images)

## 1.4 Economic growth and residential development

### 1.4.1 Economic growth

UN Secretary-General Antonio Guterres noted that "the Belt and Road Initiative is a significant opportunity for the world." In addition to boosting investment and consumption growth, the joint construction of the Belt and Road has also increased fiscal revenues for countries of the BRI and stimulated global economic growth. Significantly, Chinese investment in developing countries will promote the accelerated development of local economies. Indeed, the BRI has a pivotal role in economic development. The socio-economic makeup of the city in the member country of the BRI has shifted dramatically in recent years. More substantial economic growth has fueled migration to the city, leading to a sizable increase in the middle-class population.

### 1.4.2 Residential “pushes” and “pulls”

While population growth is a fundamental factor behind residential development, it is also widely agreed that rising economic circumstances stimulate markets for better housing. In effect, both factors play the roles of “push” and “pull” in influencing residential development from different directions. For the first 30 years of the past half century, there seems to be more of a push from population growth, when residential construction only satisfied the needs of the rising population. However, the economic pull effect played a more critical role in recent, rapid housing development, especially as population growth tended to stabilize. Housing became more concerned with lifting living standards.

**Africa**

According to research, “the provision of affordable land and housing at scale remains a challenge to most countries, especially those in Africa. While the continent is the most rural region in the world, it is urbanising fast. Every day for the coming fifteen years, Africa’s cities will have to accommodate an average of extra 40,000 people. Urbanisation will continue to place immense strain on affordable urban land and housing provision in the coming decades.” (UN-HABITAT, 2011). Angola is one of the most outstanding examples. “Angola is one of the fastest urbanizing countries in Africa; 64% of its population currently lives in cities. Rapid ongoing urbanization, coupled with severe housing shortages, has produced sprawling informal settlements throughout the nation’s capital, Luanda. The bulk of this housing is the vast majority of residents lack title to the land they occupy. Very little of the city’s housing stock benefits from municipal infrastructure ( sewers, water, electricity, etc.) Despite sporadic efforts by the government to augment the country’s housing stock, severe housing shortages and low-density sprawl have produced inefficient and unsustainable urban patterns.” (Kareem Mitchell, 2020). In the vast majority of postwar African countries, rebuilding the cities is urgent. Rapid urban population growth and urbanization result in access to sufficient affordable housing is a critical contemporary challenge—a considerable number of the low-to-middle income population seek affordable housing further from the city center.

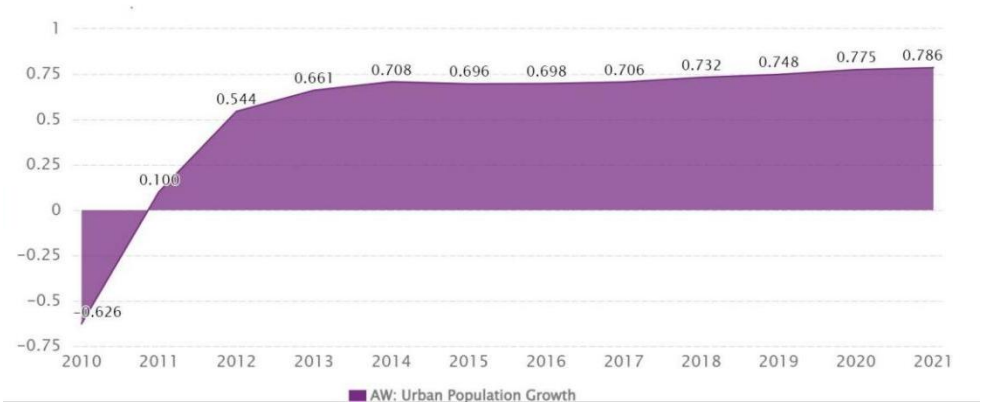


Figure 33: Urban Population Growth in sub-Saharan Africa
(source: World Bank )

## China

Like all postwar countries, China has experienced rapid urban population growth and inadequate housing construction. Through learning from the experience of Western countries, the Chinese government has gradually made progress in solving the housing problem. However, "China's housing has been statically balanced nowadays, but regional demand varies greatly. As the population flows into the metropolitan area, there will be severe housing shortage in the future. In 2020,the housing to household ratio of urban housing in China is 1.09, and the housing-to-household ratios of first-tier cities, second-tier cities, and third-tier cities are 0.97, 1.08 and 1.12 respectively. Simultaneously, in light of the already scarce and increasingly expensive housing, it is clear that the demand for new flats will continue to grow in future." Recently, to solve the housing difficulties of low- and middle-income people, the Chinese government has prioritized building affordable rental housing. They focus on large cities where new citizens and young people are relatively concentrated and have a net population inflow. Opinions of the General Office of the State Council on Accelerating the Development of Affordable Rental Housing》 issued by the Ministry of Housing and Urban-Rural Development of the People's Republic of China (Chinese: 中华人民共和国住房和城乡建设部) has been published in 24th June 2021. Therefore, various methods are adopted to increase the supply and effectively alleviate the housing difficulties of new citizens by reasonably determining the construction goals of affordable rental housing for young people. Furthermore, as the economy develops, people who live in the city look forward to better quality and more sustainable housing.

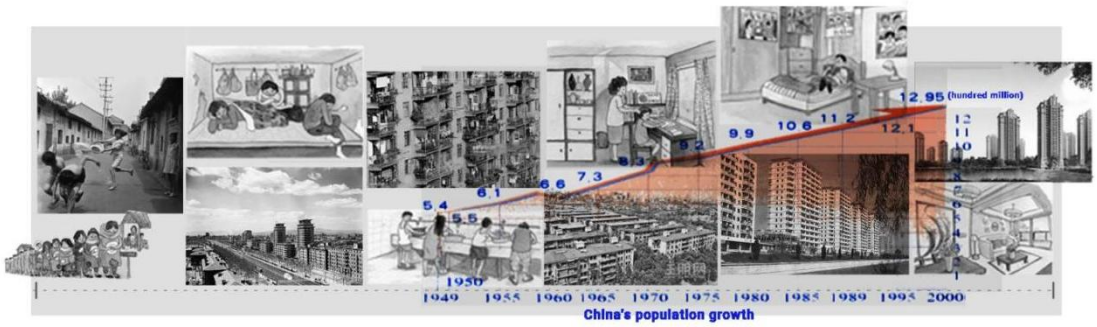


Figure 34:The process of residential building development in China
(made by author)

## 1.5 Summary

This chapter aimed to introduce the development of urban and urban dwellings under a unique background - the Belt and Road Initiative- and investigate the effects of urbanization and economic growth. Currently, the Belt and Road Initiative is perceived by a huge number of countries as a policy with good development potential. The Belt and Road Initiative promotes the member countries' economic development and focuses on infrastructure projects to realize connectivity. China's influence in the world is multiplying on many levels. Chinese companies are creating new highways, urban infrastructure, Special Economic Zones, and mass housing developments from the Eurasian continent to Africa, the Americas, and Oceania. By leveraging Belt and Road's platform, China's advantageous production capacity, advanced technology of developed countries, and enormous demands of developing countries can be effectively connected. Urbanization often accompanies economic development. On the other hand, infrastructure is the core of the Belt and Road Initiative, while the lack of infrastructure hinders the development of many countries worldwide. Infrastructure projects can help beneficiary countries fully leverage their resource endowment and integrate into the global supply. When infrastructure is built, shopping malls open, small-scale public facilities are provided, and places, where residents can work are created, the cities will come to life. Cities must build and upgrade extensive transport, water, power, and telecommunication networks to meet the demands of economic development and population growth. In order for societies to progress and for living standards to improve, this infrastructure is essential. So what partner countries needs fits perfectly with what China is providing. Therefore, the BRI will be a significant chance for the countries of the BRI.


Figure 35: The Influence and Main Policies of the Belt and Road
(made by author)

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# PART 2_ LINKS BETWEEN THE TOPIC OF AFFORDABLE HOUSING AND THE TOPIC OF THE BELT AND ROAD INITIATIVE

## 2.1 Affordable housing

### 2.1.1 What is the affordable housing?

According to the Economic times, “Affordable housing refers to housing units that are affordable by that section of society whose income is below the median household income. Though different countries have different definitions for affordable housing, but it is largely the same, i.e. affordable housing should address the housing needs of the lower or middle income households. Affordable housing becomes a key issue especially in developing nations where a majority of the population isn’t able to buy houses at the market price.” Affordable housing (Chinese: 保障性住房) is one of the most outstanding Chinese investment projects of the Belt and Road.


Figure 36: Low-cost affordable housing projects of Chinese investment (made be author)

### 2.1.2 The policy and institutional imperatives

“Going out and Bring in is a strategy for openness that integrates moves to bring in outside resources with the drive to go global. We should attract foreign investment into China while at the same time encouraging competitive Chinese firms to expand overseas and take advantage of overseas markets and resources. He also called for a broader vision for going global, focusing not only on European and North American markets but also on business opportunities in the developing world. In addition, he emphasized that as we try to increase the export of goods, we should also do our best to explore all opportunities for economic and technological cooperation abroad. "Since the 18th CPC National Congress, Xi Jinping has repeatedly highlighted our continued commitment to this approach, as he put forward the concept of a community of shared future for humanity and the Belt and Road Initiative, among other proposals that reflect Chinese wisdom. This will keep China on a path to greater openness” (Keywords to understand China, 中国关键词，2018). Furthermore, the "going out" strategy is also known as the international business. It refers to Chinese enterprises making full use of two markets and resources at home and abroad and

actively participating in international competition and cooperation through foreign direct investment, foreign project contracting, and foreign labor cooperation. It is developing China's sustainable economic development through cooperation. China and member states have signed multilateral and bilateral cooperation documents and established multilateral cooperation platforms and investment projects. Simultaneously, Chinese and foreign local governments and enterprises have carried out cooperation projects.

### 2.1.3 Chinese investment

"The Silk Road Fund (Chinese:) is a state-owned investment fund of the Chinese government to foster increased investment in countries along the One Belt, One Road, an economic development initiative primarily covering Eurasia. The Chinese government pledged US$40 billion to create the investment fund established on 29 December 2014." Chinese policy banks are stepping up their funding of the BRI project and reaching gigantic figures. From a geographic perspective, Africa and the Middle East are the largest recipients of BRI investments, though the importance of East and West Asia has also grown in recent years. As China's global economic footprint extends even further, more and more countries and regions are participating in the Belt and Road Initiative to achieve shared prosperity and sustainable development.

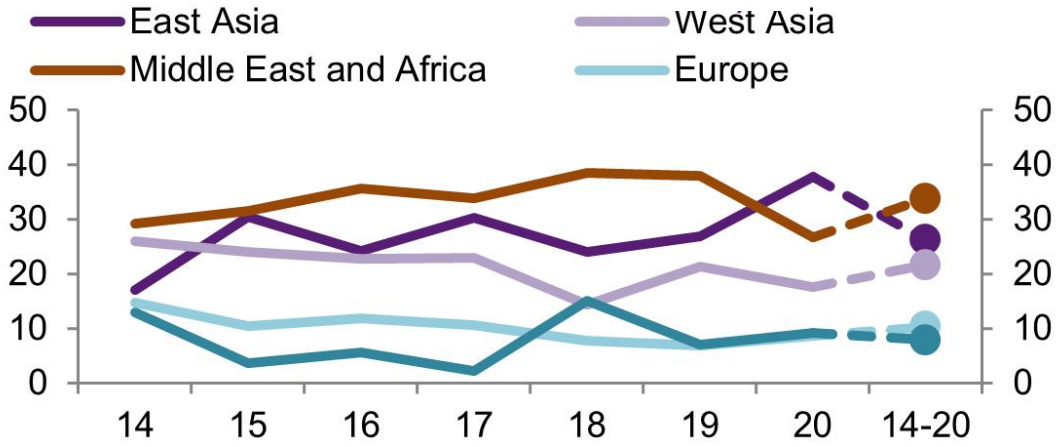


Figure 37: China's investment in the Belt and Road by Region
(source: Natixis, China Ministry of Commerce )

High-quality development of foreign contract projects. Toward a high-quality development of the Belt and Road joint construction, foreign contracted projects also urgently need to be transformed and upgraded to achieve sustainable development. Hence, in 2019, the introduction of a new measure. -- the High-Quality Development of Design and Consultation for Contracted Foreign Projects (Chinese: 关于促进对外承包工程高质量发展的指导意见)[8]. Increasingly, foreign-contracted projects are becoming more efficient, effective, and influential. As a result, it has become essential support for the Belt and Road Initiative and a necessary practice form of

[8] In 2019,19 departments including the Ministry of Commerce, the Ministry of Foreign Affairs, and the National Development and Reform Commission have jointly issued the Circular on Promoting the High-Quality Development of Design and Consultation for Contracted Foreign Projects. source from: https://wenku.baidu.com/view/b7152dad6629647d27284b73f242336c1eb93017.html.

going out policy.Ministry of commerce. PRC (Chinese: 中华人民共和国商务部) stated that continuing to develop high-quality development of foreign contract projects would remain the top priority for the Belt and Road in the next few years.

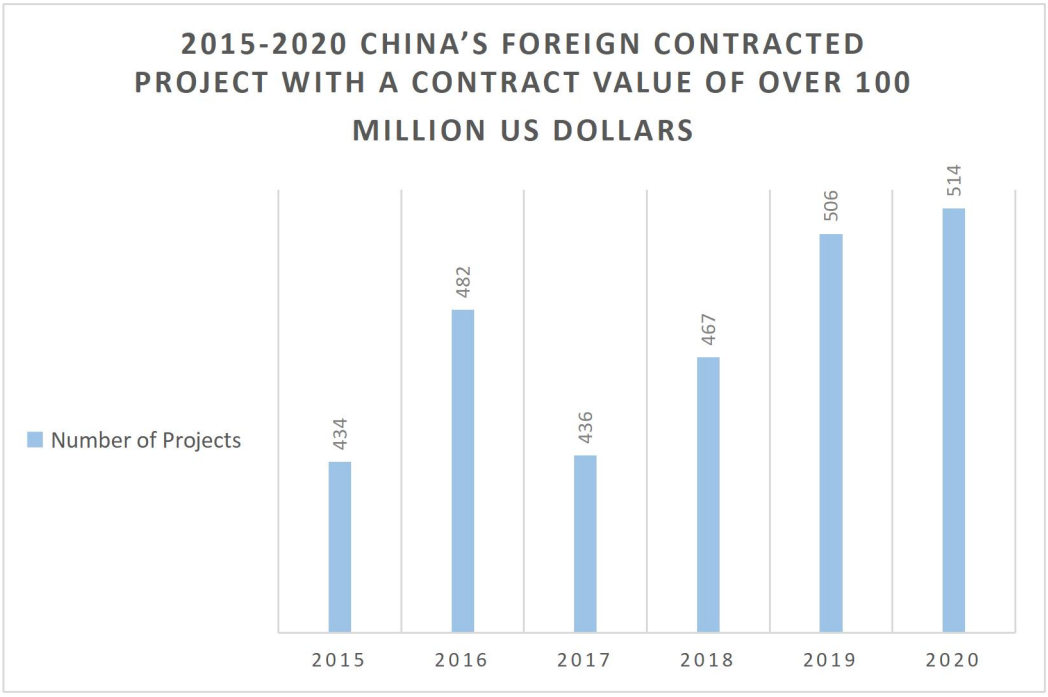


Figure 38: 2015-2020 china's foreign contracted project with a contract value of over 100 million us dollars
(made by author, source: Ministry of commerce. PRC)

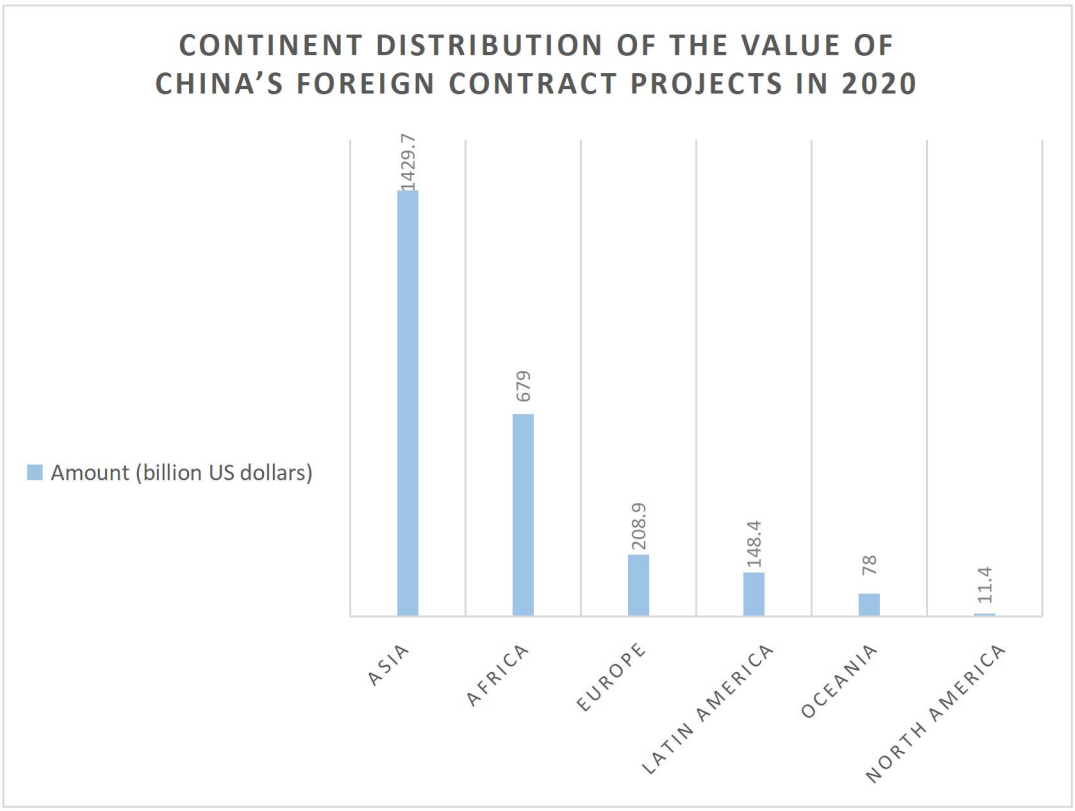


Figure 39: CONtinent distribution of the value of china's foreign contract projects in 2020
(made by author, source: Ministry of commerce. PRC)

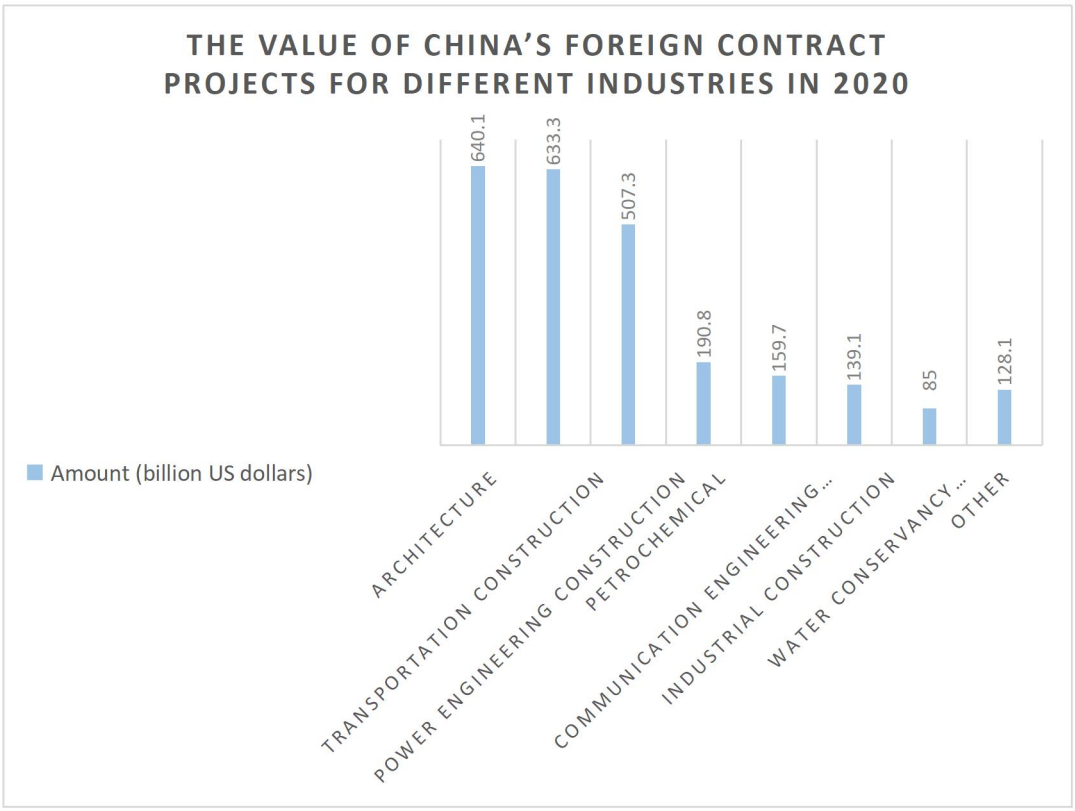


Figure 40: The value of China's foreign contract projects for different industries in 2020 (made by author, source: Ministry of commerce. PRC)

| | PROJECT | LOCATION | COMPANY | FINANCE |
|---|---|---|---|---|
| 1 | Port Bouet new city | Côte d'Ivoire (Asia) | China railway construction corporation limited | $ 4,037,401,012 |
| 2 | Mag City housing project | Dubai (Asia) | China national chemical engineering co, ltd | $ 144,373,360 |
| 3 | Act One &Two housing project | Dubai (Asia) | China national chemical engineering & construction corporation seven, ltd | $ 212,899,202 |
| 4 | Ghana affordable housing project | Ghana (Africa) | China civil engineering construction corporation | $ 1,009,458,533 |
| 5 | Mozambique social housing porject | Mozambique (Africa) | CITIC Construction | - |
| 6 | Saudi Arabia housing project | Saudi Arabia (Asia) | Beijing triumph international engineering co,ltd | $ 43,312,008 |
| 7 | Affordable housing project | Saudi Arabia (Asia) | Powerchina | - |
| 8 | Gezhouba housing project | Dubai (Asia) | China Gezhouba group international engineering co, ltd | - |
| 9 | Indonesia housing project | Indonesia (Asia) | Mcc overseaa ltd | - |
| 10 | SICAP housing project | Senegal (Africa) | China national corporation for overseas economic corporation | - |

Table 2-1 10 overseas large-scale housing construction projects of Chinese companies in 2019 (made by author; source: https://www.sohu.com/a/366741940_100113069 )

## 2.2 Angolan Model

Following its colonial past, and especially its more recent civil war, the Angolan government had to rebuild its economy and proceed with the business of servicing its people. However, despite tremendous increases in oil production, the Angolan state remained unable to provide housing for its burgeoning poor population without foreign help. In this regard, the Angolans turned to the People’s Republic of China and oil-backed housing construction to promote economic exchanges and develop tentatively affordable housing to resolve a post-war housing crisis – in what has become known as the Angolan Model.

### 2.2.1 Nova Cdade de Kilamba, Luanda, Angola

Angola is a distinct outlier within Sub-Saharan Africa. In the 15 years that followed 40 years of intermittent war, the country has taken in over $600 billion in oil revenue. (Onishi, 2017) In 2017, 61% of Angola’s total exports ended up in China. (OEC, 2017) Angola has resources, the capacity to develop those resources, and a reliable market. Naturally, this has conferred enormous wealth on some—the former president’s daughter is Africa’s richest woman. It has also positioned Angola as one of the most important energy partners for China. The country is consistently among the world’s largest crude importer’s top three exporters. Angola, still emerging from a protracted war that devastated its infrastructure, faced with a rapidly growing and urbanizing population, and sitting on Africa’s largest oil reserves south of Nigeria, is a natural Chinese partner. This progress has led to numerous large-scale construction-for-oil projects, Kilamba being the highest profile. Kilamba was born of former President Eduardo dos Santos’s campaign pledge to construct “1 million houses” in the housing-squeezed country. (Benazeraf, Alves 2014) These housings are designed to house 200,000 Angolans, and it was initially tapped as a social housing project. (Louw, 2014) Due to the aforementioned socioeconomic upheaval in Angola, the city is perhaps the world’s most unequal. Many units were to house some of the 75% of Luanda’s residents who live in informal settlements or musseques. However, as will be detailed later, this never happened. Under the current development background, cities' continuous development and expansion is an inevitable trend. China has been actively involved in Angola's post-war reconstruction process, covering projects like urbanization and social housing. The flagship 3.5-billion-US-dollar Kilamba New City project by Chinese civil engineering company CITIC Construction has turned a backward rural area into a modern satellite town of the nation's capital, Luanda. The partnership with China will continue to exist.

Due to rapid urbanization of Luanda and constantly expanding, several satellite city like Kilamba New City have been built. Nova Cidade de Kilamba is a vast housing project on the outskirts of Luanda of Angola, about 30 kilometers away. It is one of the projects built by Chinese companies in Angola. China International Trust Investment Corporation (CITIC) entirely undertook the construction, and the Angolan government was responsible for the infrastructure linking Luanda to Kilamba. The area covering 8.8 square kilometers was initially designed to house 200,000 residents (it has since expanded). Including 750 homogeneous and highly repetitive mid-rise apartment complexes (distinctly differentiated from block to block only by exterior color) buildings, 17 schools, and 240 shops serve residents. The project is fully

funded by China and repaid by the Angolan government with crude oil. Construction was reportedly completed in 2012, but most buildings are largely empty due to high market rates for housing and mortgages. Unfortunately, most of the poor live in Angola, and it does not yet have enough middle class to occupy these units. Combined with the lack of retail and schools in the area, Angolans have no real incentive to move in.

Figure 41: Nova Cidade de Kilamba
(source: https://www.businessinsider.com/chinese-built-ghost-town-kilamba-angola-2012-7?op=1&r=US&IR=T )


Figure 42: Satellite Maps Showing the Growth of Kilamba
(source: Kareem Mitchell, housing on the horizon,2020, pp57)

### 2.2.2 Kilamba Housing Project

Figure 43: Aerial view of Kilamba housing project
(source: http://www.phantom-urbanism.com/nova-cidade-de-kilamba.html )

**Urban configurations**

Nova Cidade de Kilamba (Kilamba New City) is a commune with a population of 56,183 (2014 census) and covers an area of 30.5 square kilometers. It is the municipal seat of Belas Municipality and a large housing development site almost 20 km from Luanda.

**Architecture**

The Angolan Social Housing Project Kilamba Kiaxi PhaseI was signed in November 2007. The project's overall building area was 3.31 million square meters, making it the largest overseas housing project undertaken by a Chinese Engineering Procurement Construction （ETC） contractor. This project covers an area of 5,000 hectares, with a total construction area of 473,300 square meters. It consisted of 710 residential buildings ranging from 6 to 17 floors and was to realize 20,002 flats. It will ultimately comprise 246 ground floor shops; 3 parks; 2 churches; 24 kindergartens; 9 primary schools; 8 secondary schools; 1 sewage treatment plant (45 000t/d); 1 water purifying plant (35 000t/d); Electric system; Telecommunication system; Traffic signal system and 400 civil roads. However, the buildings are repetitive, and the areas are sometimes uninhabited.

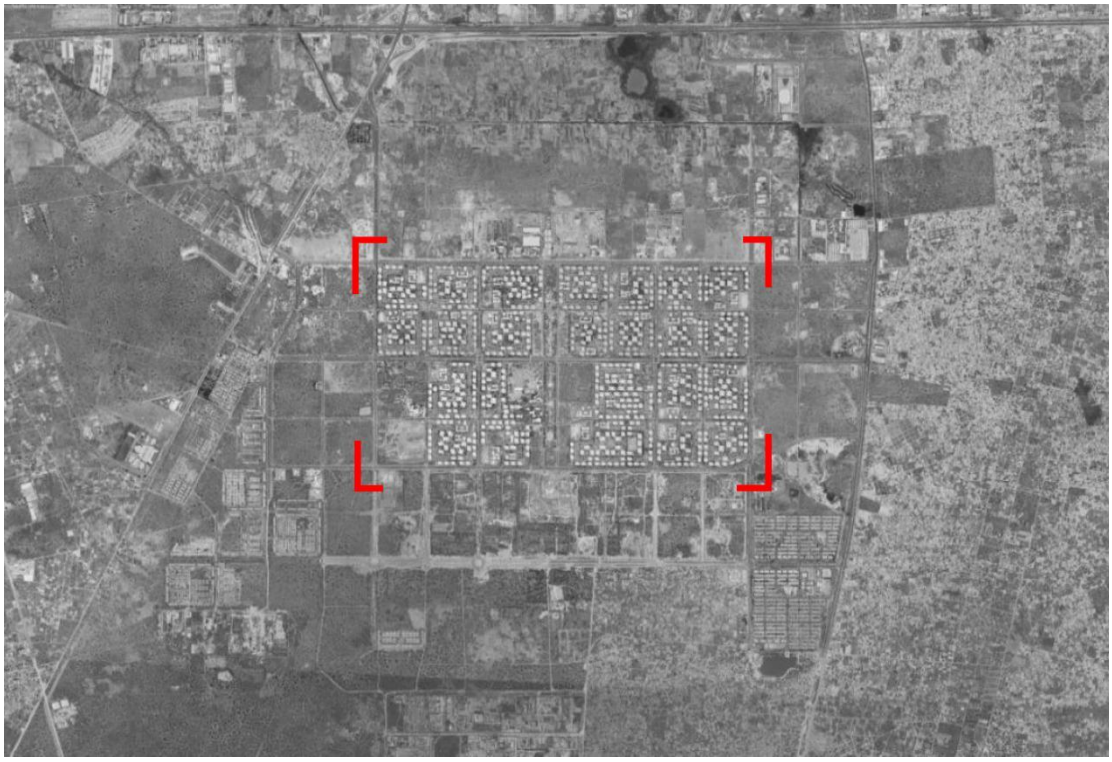

Figure 44: Satellite Mapping of Kilamba housing project
(made by author, source: Google earth)

**Location:** Luanda, Angola

**Completion:** 2012

**Constructor:** Chinese civil engineering company, CITIC

**Construction Area:** 473,300 sqm

**Total number of households:** 80,000 (2015)

**Apartment area range:** 110-150m²

**Other provision:** Commercial building

**Forms of tenure:** Social housing estate

**Average sale price:** $1100/sqm

**Key targets/issues:** Reserving more residential housing for people on lower incomes and potentially reducing shortages

Figure 45: Aerial view of Kilamba housing project
(source: http://www.phantom-urbanism.com/nova-cidade-de-kilamba.html )

Figure 46: Live in Kilamba
(source:http://www.phantom-urbanism.com/nova-cidade-de-kilamba.html )

### 2.2.3 Ghost city phenomenon

Eduardo dos Santos' vision of Kilamba Metro as a mixed-income alternative to Luanda's Musseques did not materialize. However, after years of negative PR, the project's fortunes have improved significantly. Initially, the Kilamba small unit was priced at $125,000. However, with most of the apartment blocks still vacant, Western media has seized on this exciting opportunity to connect Kilamba with an (often apocryphal) ghost town in China. In February 2013, the Angolan government announced the plan to subsidize housing for the poor. This plan has seen prices in Kilamba plummet by almost 50 percent, sparking much interest in the project. Angolans scrambled to buy the apartments, queuing outside offices days in advance. However, the project sales did not go well, and the second half of 2013 was spent in suspense, and confidence in the project began to slow down again. Finally, in 2014, residents began to receive their keys, and in 2015 the city had 80,000 residents. Even though Kilamba has started more inhabited, many problems remain for this new city. First, the lack of roads to Kilamba creates severe traffic jams during rush hours; second, there are still no major medical facilities on site; and third, employment and education remains an issue for those living in this area. Indeed, the Angolan government is trying to look at the accomplishments and pitfalls of Kilamba project searching for solution to solve those issues and improve what could become a housing solution for the countries. On the other hand, getting material of satisfactory quality at local markets is difficult. As a result, the builders had to ship over two million tonnes of materials directly from China, which increased construction costs and construction time.

Figure 47: Eerily quite
(source: https://www.bbc.com/news/world-africa-18646243 )

## 2.3 Summary

This chapter explores the relationship between affordable housing and the Belt and Road Initiative. Since the Belt and Road Initiative was announced, it has actively promoted economic and social development in relevant countries. China and other countries along the Belt and Road have continuously deepened their ties in trade, investment, and aid projects under the "Belt and Road" initiative. UN Secretary-General Antonio Guterres noted that "the Belt and Road Initiative is a significant opportunity for the world." Awareness of the Belt and Road Initiative is not recent, having possibly first been described in 2013 by an economist. But few associate the Belt and Road with residential construction.

The rich resources of the African continent attract trade and investment from all over the world. The vast African continent is seeking more investment, trade opportunities, and aid programs. With the development of the BRI, a new generation of projects is playing a critical role in the reinvention of building and housing typologies and piloting new delivery methods. Although under the "Belt and Road" initiative, many Chinese construction companies have built the bulk of affordable housing in member countries of the BRI; simultaneously, many member countries have also built more affordable housing. However, it still cannot meet the current demand for housing. In this chapter, we analyzed the leading economic, social, and political indicators that describe the situation in Angola that could impact the rapid urbanization and urban housing development.

The world is learning from Le Corbusier to solve the housing problem and gradually evolved it into a standard -- functionalism as the only determinant of form. Especially the affordable housing projects that China has invested in developing countries. As a result, Chinese companies have built almost identical residential patterns across the BRI nations, which spanned a wide range of climates. Moreover, this residential pattern has several apparent characteristics, such as high-rise, low-density, and determinant. This situation is a thought-provoking and painful reality for us. It is a critical perspective on the effect of the BRI. Moreover, taking this perspective is crucial to understanding the effect of the BRI.

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# PART 3_ URBAN HOUSING FORMS IN COUNTRIES OF THE BELT AND ROAD INITIATIVE

## 3.1 Case study

In the vast majority of countries, access to affordable housing is a critical contemporary challenge. Nevertheless, unfortunately, it is becoming increasingly difficult for the vast majority of urban residents to obtain and retain adequate and affordable housing. Chapter 3, seven best practices in affordable housing, have been chosen to be easy to study the various forms of urban housing. Orthophoto and photos of real-world examples illustrate each project. According to these case studies, the traditions of high-density housing in the inner cities are considered. In addition, building types, plot sizes, public spaces, and street spaces ranging from low to high densities are displayed. Affordable housing in urban areas is one of the outstanding social issues of the twenty-first century. Both these two issues further put a strain on insufficient affordable housing resources. To this end, it necessitates a new concentration on high-quality, affordable housing developments in urban sites.

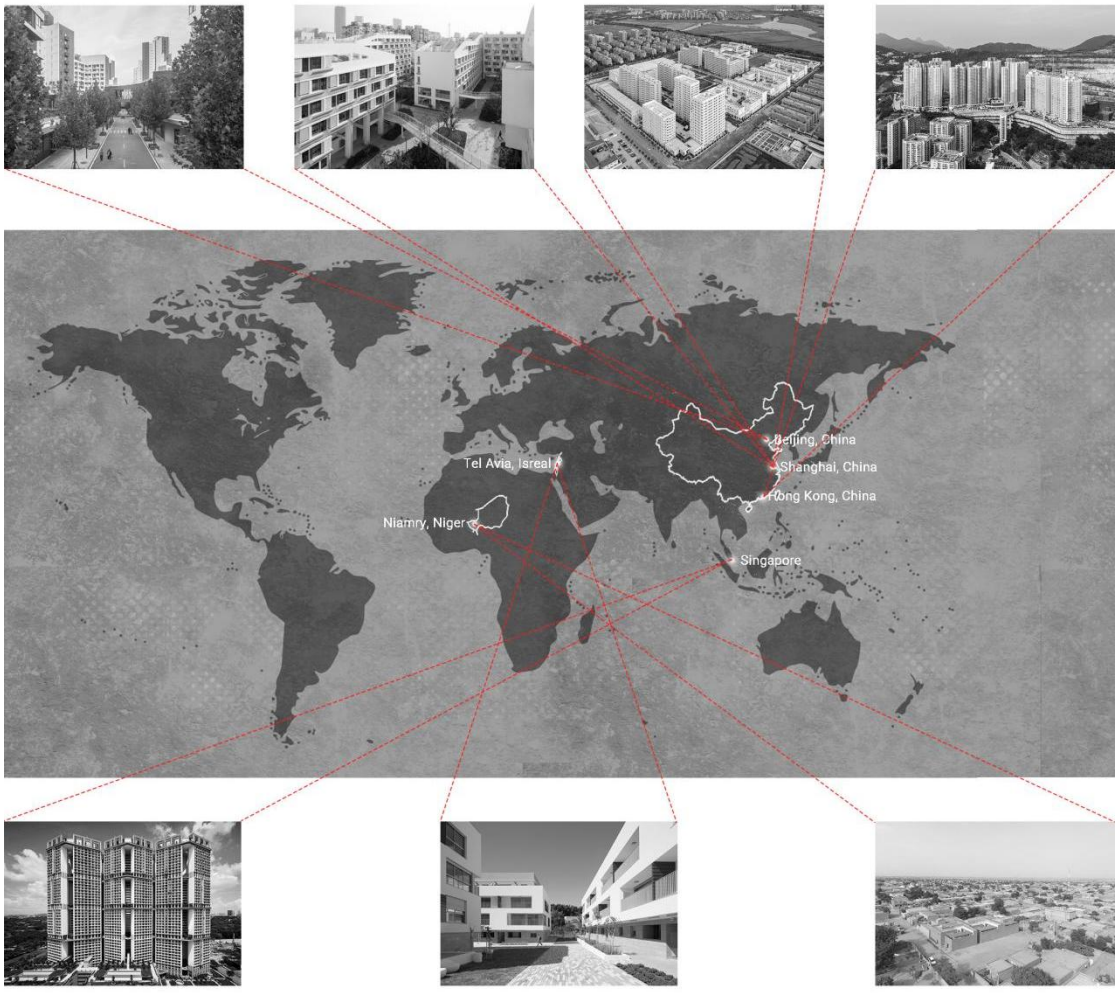



Figure 48: Case studies
(made by author )

### 3.1.1 Baiziwan social housing (Beijing,China)

Figure 49: Open blocks
(source: https://www.gooood.cn/baiziwan-social-housing-by-mad.htm )

**Urban configurations**

China's capital city, Beijing, has multiple ring roads, which include eight ring roads. Baiziwan social housing project is situated on Beijing's 4th ring road (四环路）[9], the urban outskirts. In recent years, the densification process occurred in Beijing, facing a severe housing shortage for low and middle-income groups.

**Architecture**

This project covers an area of 93,900 square meters, with a total construction area of 473,300 square meters. It consisted of 12 residential buildings ranging from 6 to 27 floors and was to realize 4,000 flats and supporting functions. Moreover, it breaks the traditional community model and welcomes urban residents as an open vertical living community. In this design, the setback design of the top floor makes the building complex form a shape with scattered heights.

[9] The 4th Ring Road (四环路) is a controlled-access expressway ring road in Beijing, China which runs around the city, with a radius of approximately 8 kilometers from city centre.

Figure 50: Satellite Mapping of Baiziwan social housing project
(made by author, source: Google earth)

**Location:** Beijing, China

**Completion:** 2019

**Architect:** MAD

**Number of dwellings:** 4000

**Other provision:** Vertical community

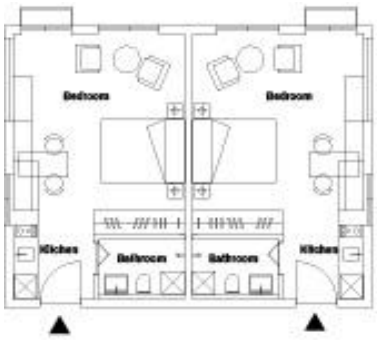
**Density:** 84.5 dwellings per hectares, high-density

**Forms of tenure:** Apartment; Social housing

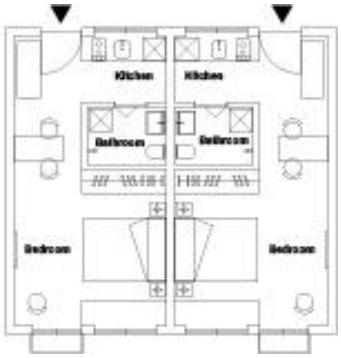
**Green features:** Floating garden, 47% greening

**Industrialization:** Prefabricated construction

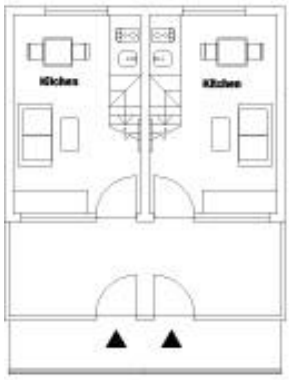
**Key targets/issues:** Solve a series of specific problems related to residence in the current rapid development of Chinese cities



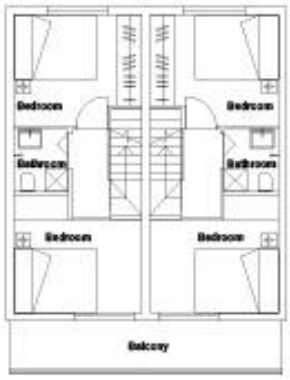

Unit A (27.2m$^2$)



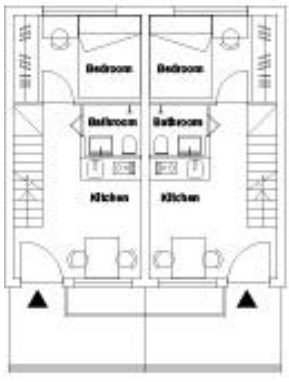

Unit B (26.6m$^2$)




Unit C - 1st floor
(15.35m$^2$)




Unit C - 2nd floor
(23m$^2$)

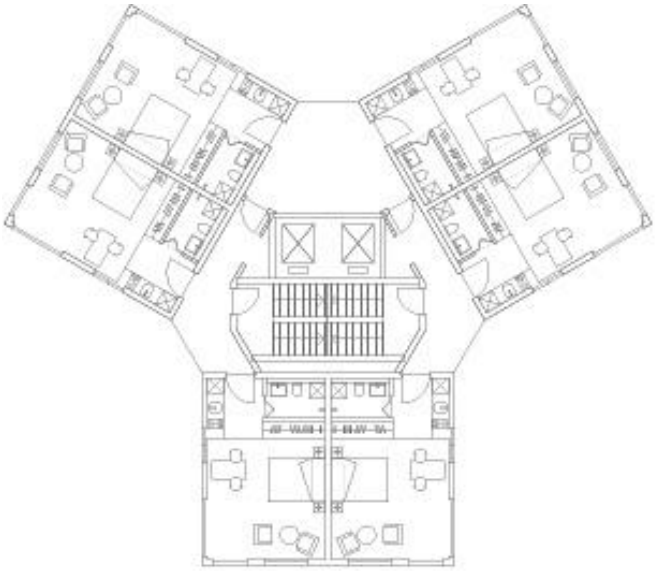



Unit D - 1st floor
(20.5m$^2$)

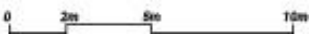

Unit D - 2nd floor
(20.5m$^2$)

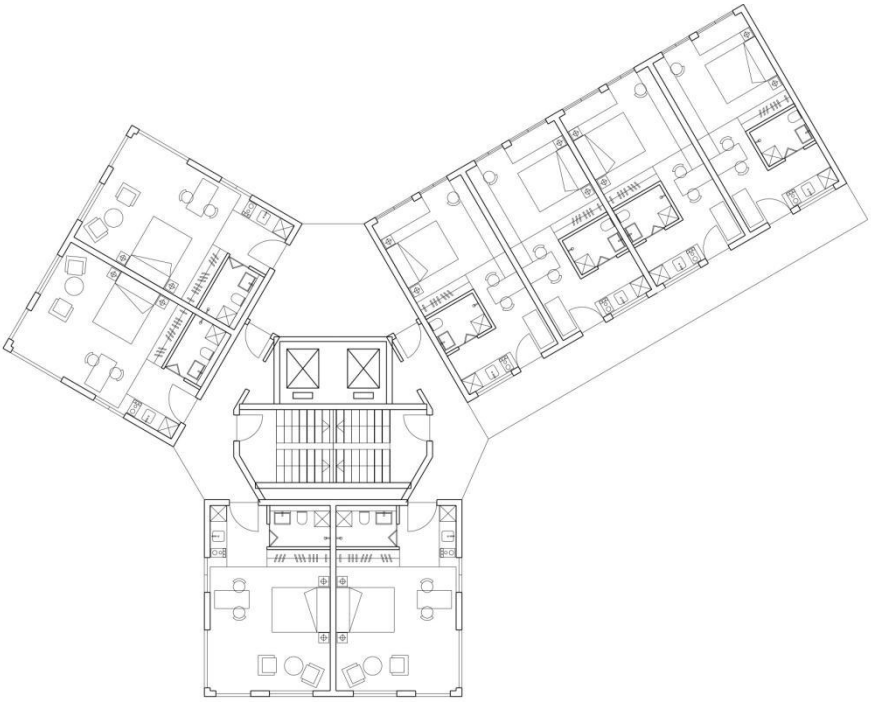

Figure 51: Unit style
(made by author)

Baiziwan public rental housing mainly has four types of ultra-low energy consumption prefabricated units with three areas of 40 square meters, 50 square meters, and 60 square meters.



Building #1 - plan 1



Building #1 - plan 2

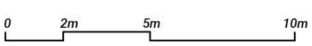
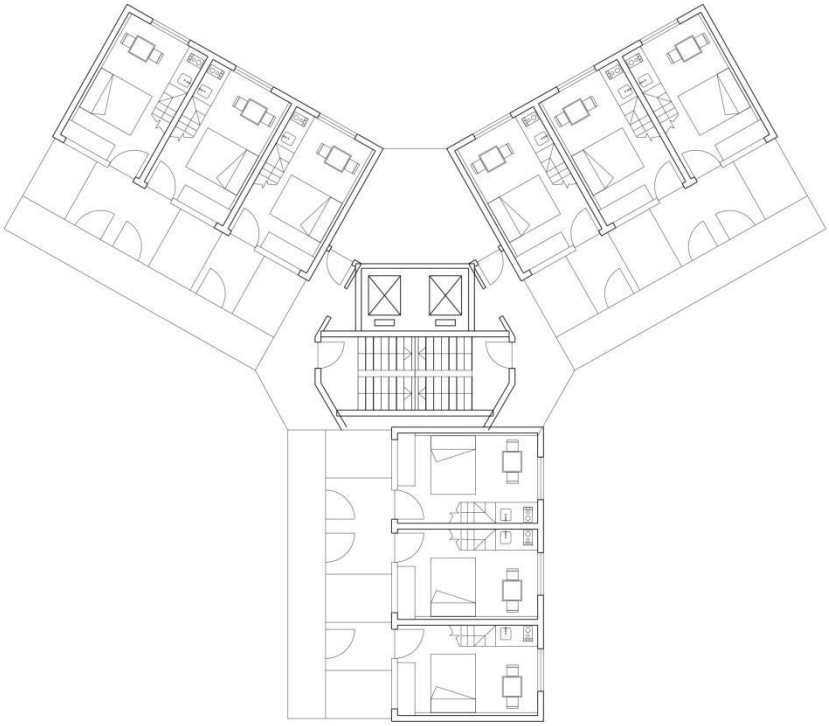
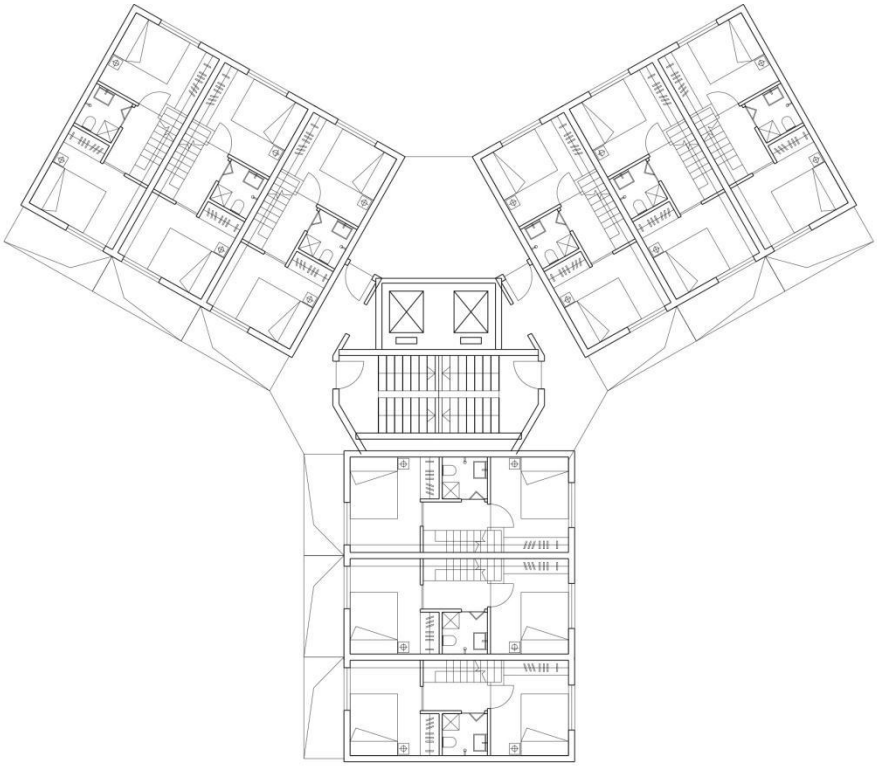



Figure 52: Floor plan
(made by author)

The building plan is Y-shaped, and the setback design of the top floor makes the building complex form a "mountain" shape with scattered heights. The connection between the buildings forms a group of semi-enclosed spaces.



Building #2- plan 1

Building #2 - plan 2

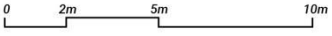



Figure 53: Floor plan
(made by author)

### 3.1.2 Longnan Garden Social Housing Estate (Shanghai,China)

Figure 54: Longnan Garden social housing project
(source:
https://www.archdaily.com/874649/longnan-garden-social-housing-estate-atelier-gom?ad_source=search&ad_medium=search_result_all )

**Urban configurations**

This project locates in Xuhui District, Shanghai. Xuhui District is a core urban district of Shanghai. It has 54.93 km2 and a population of 1,113,078 as of 2020, according to the Seventh National Population Census of the People's Republic of China.

**Architecture**

This project covers an area of 48,112 square meters, with a total construction area of 146,106 square meters. It consisted of 8 residential buildings ranging from 7 to 17 floors and was to realize 2,021 flats and supporting functions. Moreover, On the north side, there is generous pilotis space of two floors and community rooms, and every one or two floors of the North corridor will have a projecting public terrace to welcome some East-West sunlight. In the context of small apartments, these public spaces are a balanced and efficient strategy for social housing.

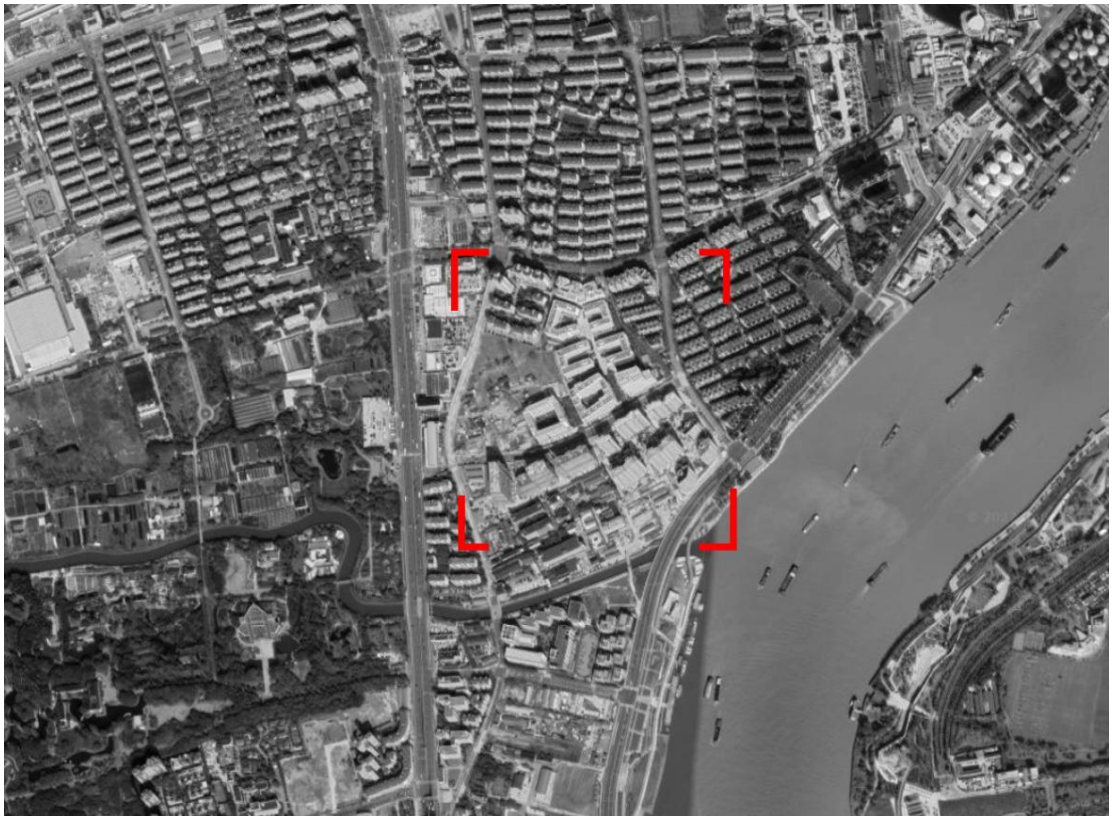


Figure 55: Satellite Mapping of Longnan Garden social housing project
(made by author, source: Google earth)

**Location:** Shanghai, China

**Completion:** 2017

**Architect:** Atelier GOM

**Site Area:** 48,112 sqm

**Construction Area:** 146,106 sqm

**Total number of households:** 2021

**Other provision:** Commercial building

**Apartment area range:** 35-60m²

**Forms of tenure:** Social housing estate; five are sets of small apartment unit; two are sets of single dormitory; one for independent commercial building

**Density:** High-density

**Industrialization:** Prefabricated construction

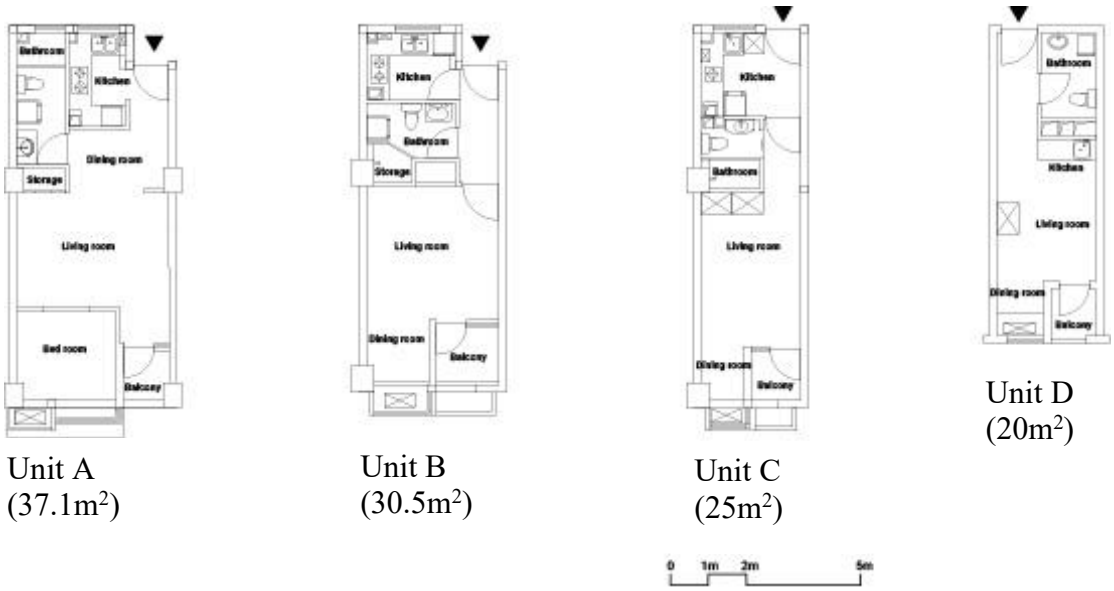



Figure 56: Unit style
(made by author)

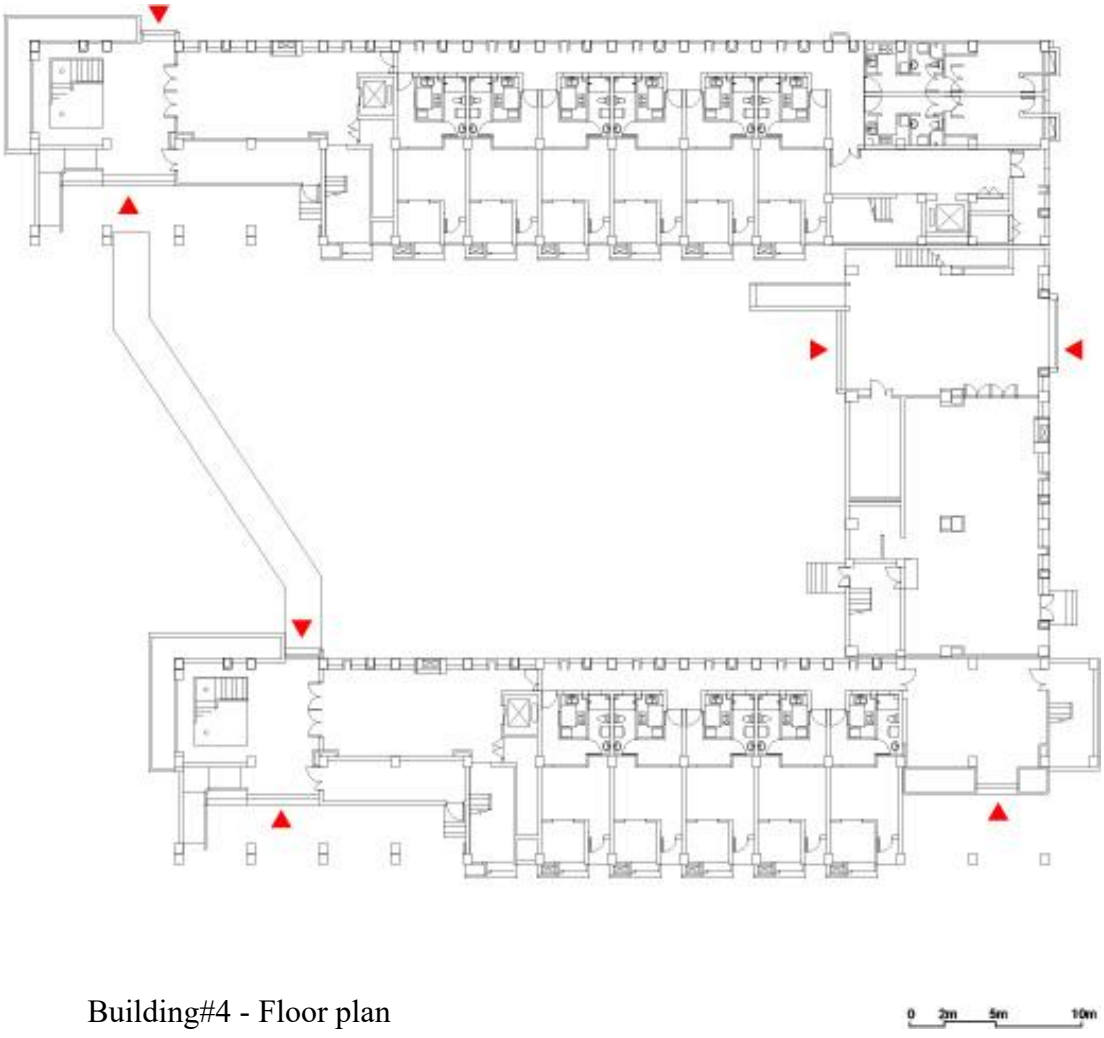
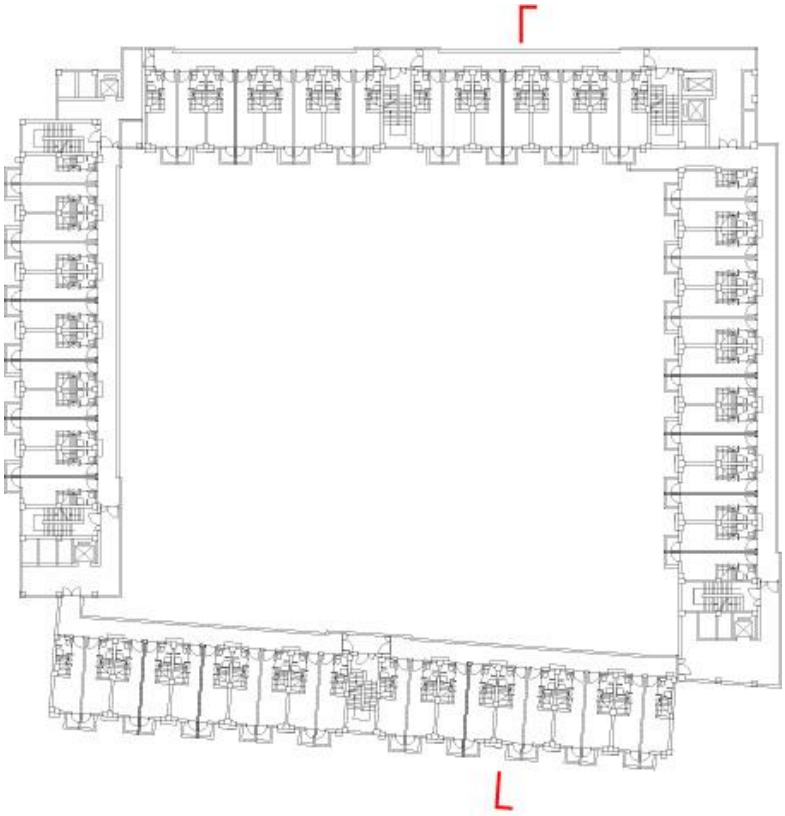
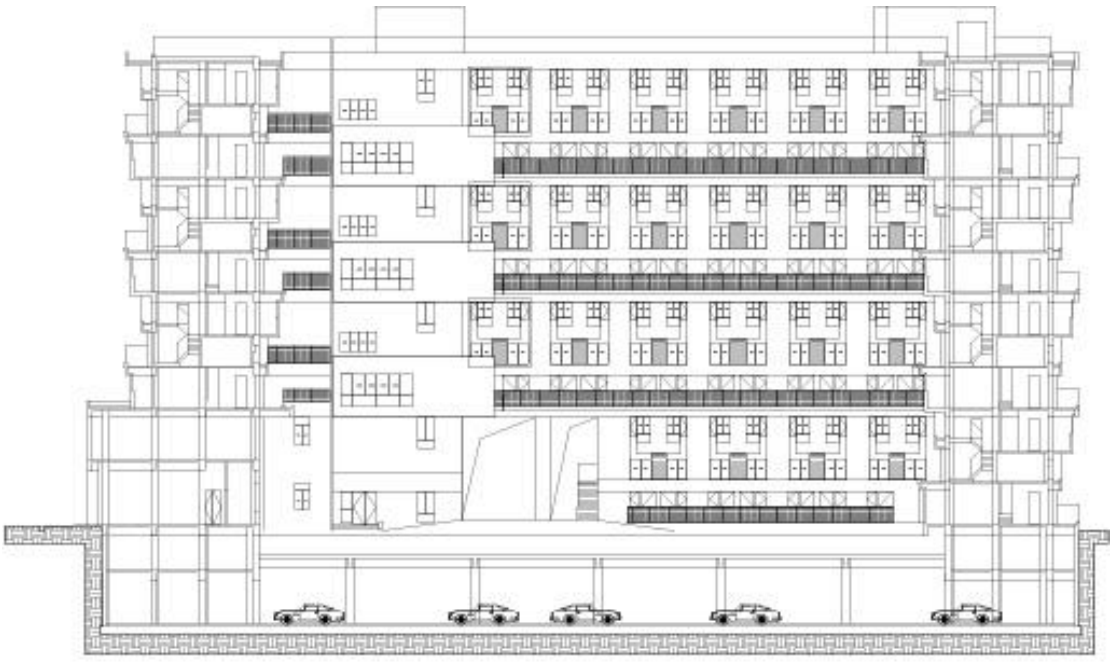



Figure 57: Floor plan
(made by author)



Building#5 - Floor plan

Figure 58: Floor plan
(made by author)



Building#5 - Section

Figure 59: Section
(made by author)

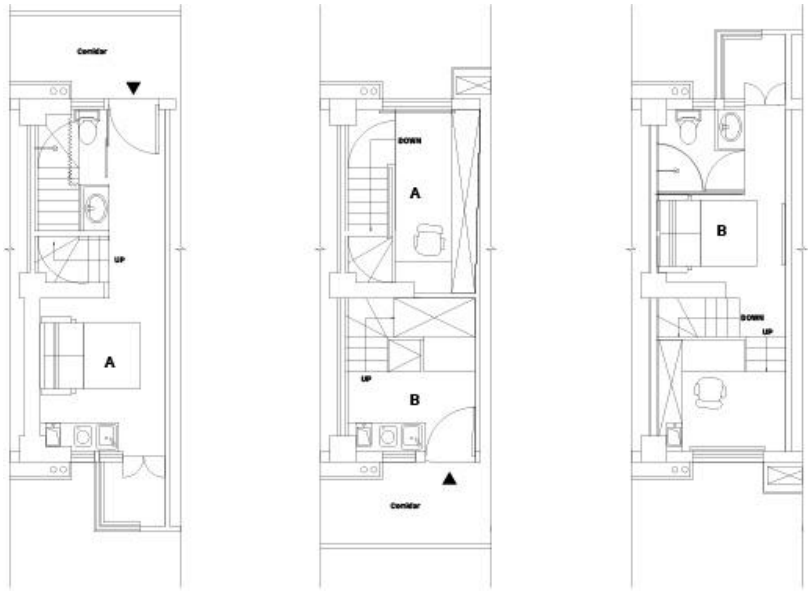



Figure 60: Unit style
(made by author)

Figure 61: Interior space
(source: https://www.archdaily.com/874649/longnan-garden-social-housing-estate-atelier-gom?ad_source=search&ad_medium=search_result_all )

### 3.1.3 Lingang Price-fixed Housing Project (Shanghai,China)

Figure 62: Aerial view of the Lingang price-fixed housing project
(source: https://www.gooood.cn/topic-lingang-price-fixed-housing-project.htm )

**Urban configurations**

This project is located in the Special Area of China (Shanghai) Pilot Free Trade Zone and is a price-fixed housing (Chinese:双限房)[10] project. Special Area of China (Shanghai) Pilot Free Trade Zone was launched by the Chinese government in 2018, and its total area is 873 square kilometers.

**Architecture**

This project covers an area of 89,313 square meters, with a total construction area of 140,351 square meters. It consisted of 12 residential buildings ranging from 4 to 17 floors and was to realize 1,683 flats and support functions. The Price-fixed Housing project in Lin Gang was designed for people who work for the companies registered in the district and to improve the investment environment of Lin Gang New City. The cause of traditional determinant residences is the strict regulations on sunshine and orientation in the code.

[10] Price-fixed Housing was launched by the Chinese government of which the price and trade are both limited. It is a kind of middle-low price housing conditionally provided to general public. The difference between Price-fixed Housing and public rental housing is that the former is merchantable.

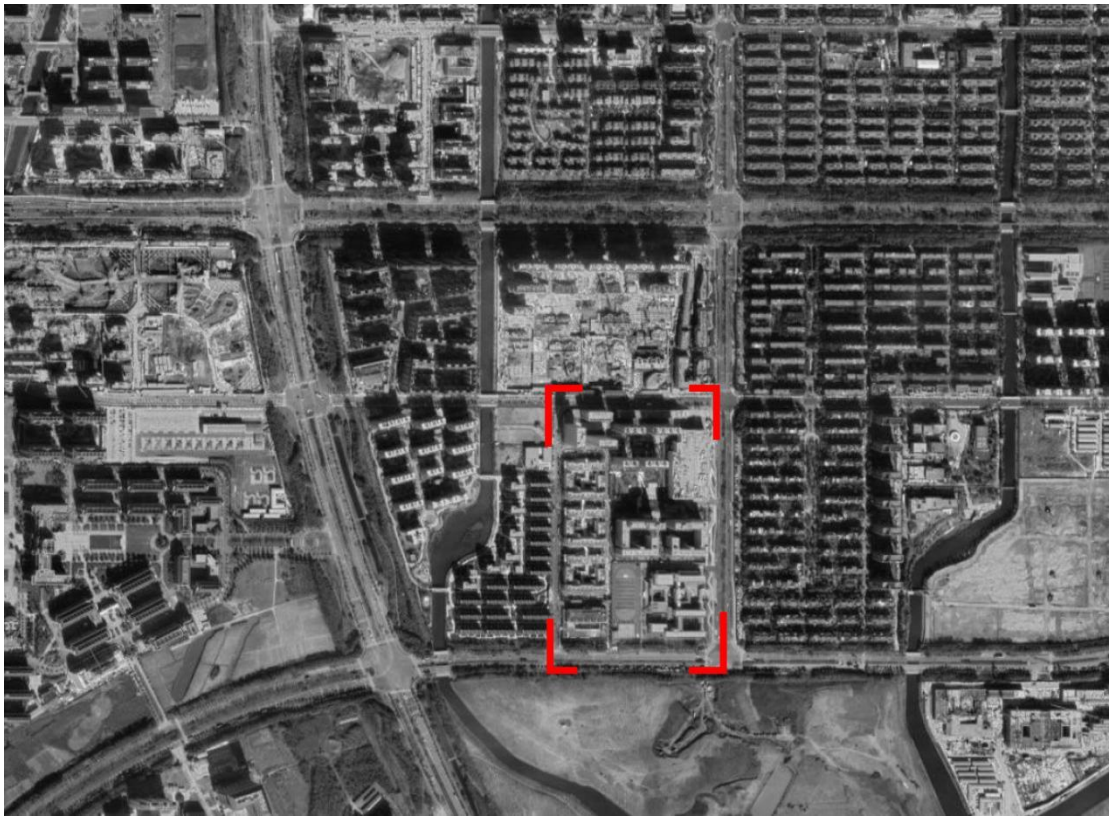


Figure 63: Satellite Mapping of Lingang price-fixed housing project
(made by author, source: Google earth)

**Location:** Shanghai, China

**Completion:** 2020

**Architect:** Atelier GOM

**Site Area:** 89,313 sqm

**Construction Area:** 140,351 sqm

**Other provision:** Commercial building

**Apartment area range:** 35-60m²

**Forms of tenure:** Social housing estate; "enclosing" layout with a large courtyard in the center

**Density:** High-density

**Industrialization:** Prefabricated construction

**Key targets/issues:** Improve the investment environment of Lin Gan


Figure 64: Unit style
(made by author)

The designer defined the house types according to different types of residents. Lin Gang Price-fixed Housing is a large-scale project, and the targeted company staff are of various ages. Therefore, the designer aims to provide diverse products from small-scale rental units, middle-scale units with two bedrooms, large-scale units with three bedrooms, and duplex units.


Figure 65: #1,#2,#3 Building Floor plan
(source: https://www.gooood.cn/topic-lingang-price-fixed-housing-project.htm )

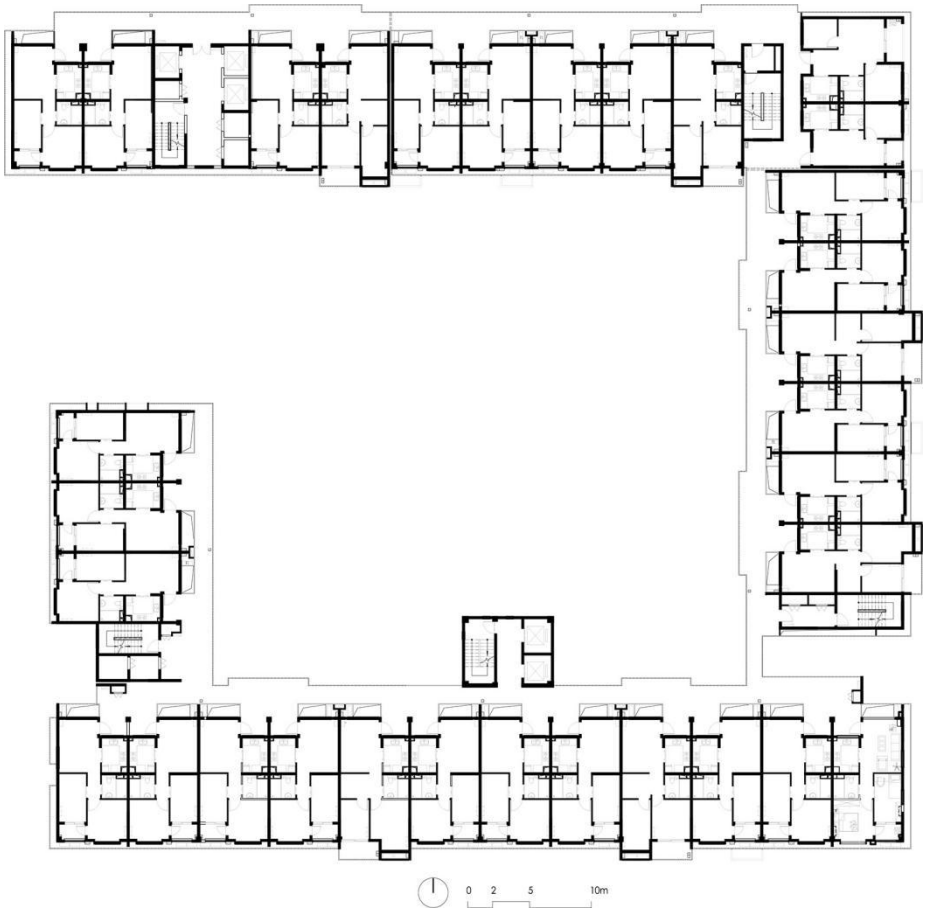



Figure 66: #8,#9 Building Floor plan
(source: https://www.gooood.cn/topic-lingang-price-fixed-housing-project.htm )

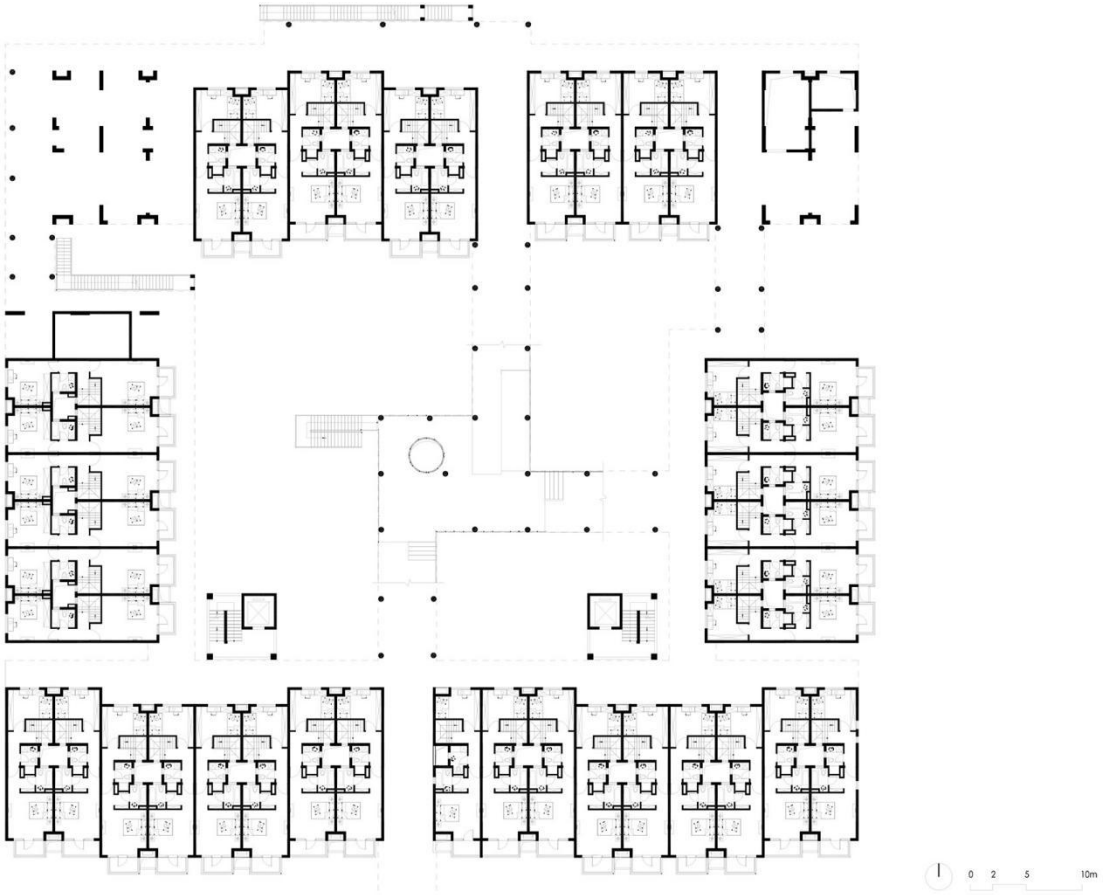



Figure 67: #10,#11,#12 Building Floor plan
(source: https://www.gooood.cn/topic-lingang-price-fixed-housing-project.htm )

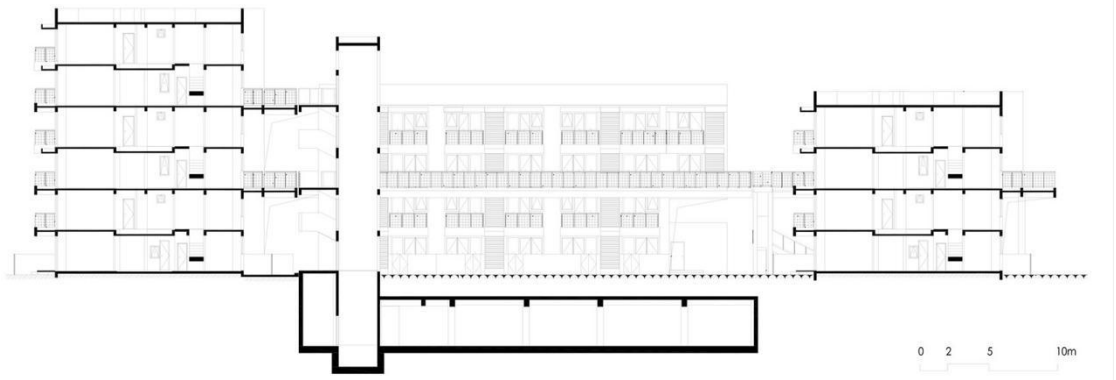



Figure 68: Section
(source: https://www.gooood.cn/topic-lingang-price-fixed-housing-project.htm )

### 3.1.4 Sau Mau Ping Estate (Hong Kong, China)

Figure 69: Aerial view of Sau Mau Ping Estate
(source: https://en.wikipedia.org/wiki/Public_housing_in_Hong_Kong )

**Urban configurations**

This project are public housing estates in Kwun Tong District. Kwun Tong is one of the 18 districts of Hong Kong[11]. It is located in Kowloon，and it is the most densely populated district in Hong Kong. Public housing estates and factory buildings have traditionally dominated Kwun Tong District. However, with the economic transformation, the Kwun Tong Industrial Zone has developed into a Kwun Tong Business District. Various factory buildings have been vacant or converted for other purposes, and there are also many public housing estates. It has been rebuilt as a new building or commercial building.

**Architecture**

It consisted of 19 residential buildings ranging from 19 to 40 floors and was to realize 12,500 flats and supporting functions. Moreover, its complex spatial configuration directly responds to its dense urban context. The cause of high-density and high-rise residences is based on maximizing real estate interests.

[11] Hong Kong in administration consists of 18 districts in 3 different regions. The 3 regions are: Hong Kong Island (HK), Kowloon (KLN), and the New Territories (NT). The New Territories has the most districts (9), followed by Kowloon (5) and lastly Hong Kong Island (4).

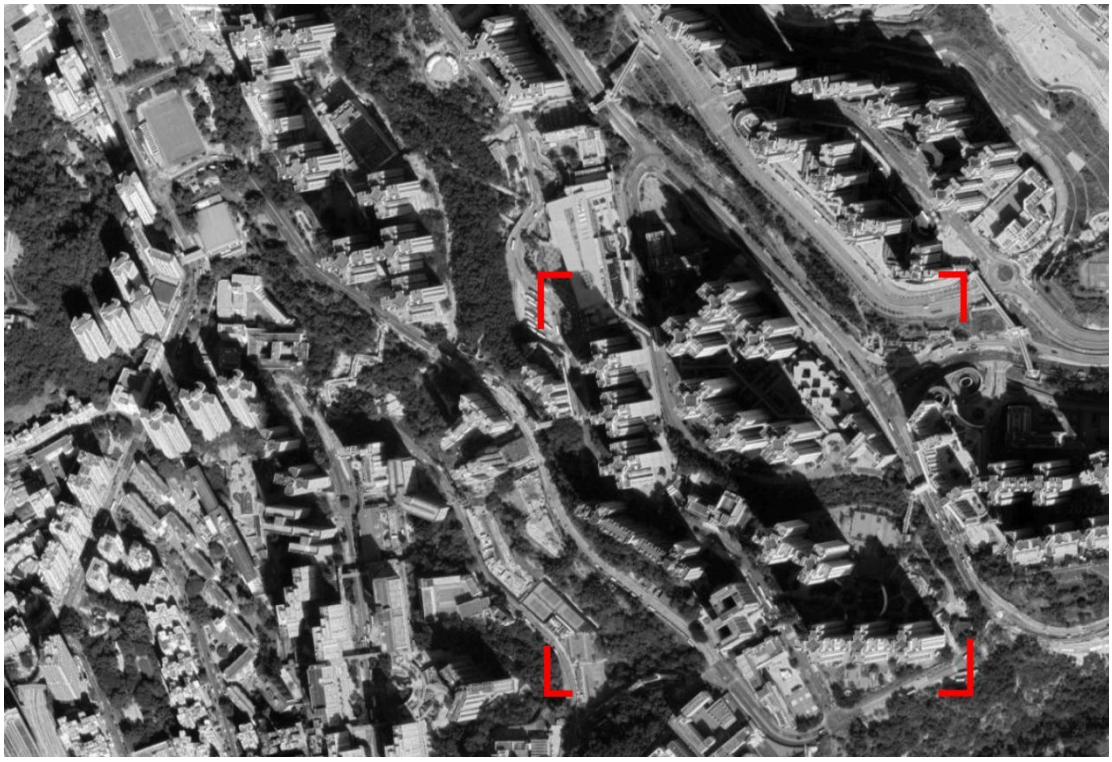


Figure 70: Satellite Mapping of On Tai Estate
(made by author, source: Google earth)

**Location:** Hong Kong, China

**Completion:** 1984, 1993, 1996, 2001, 2019

**Total number of households:** 34,600

**Other provision:** Commercial building

**Apartment area range:** 10.6-52.2m²

**Forms of tenure:** Public rental housing estate; eighteen high-rise apartment units

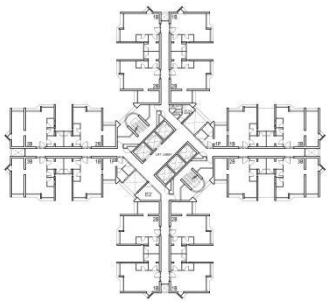
**Density:** High-density

**Key targets/issues:** Reserving more residential housing for people on lower incomes and potentially reducing shortage

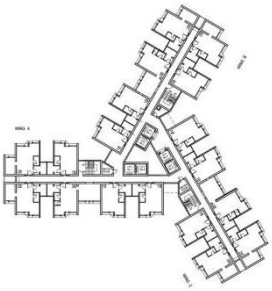
| | Name | Building Type | Number of Floors | Year of completion |
|---|---|---|---|---|
| 1 | Sau Ming House | Twin Tower | 24 | 1985 |
| 2 | Sau Fu House | Harmony3 | 27 | 1993 |
| 3 | Sau On House | Harmony3 | 38 | 1993 |
| 4 | Sau Lok House | Harmony2 | 38 | 1996 |
| 5 | Sau Hong House | Harmony2 | 38 | 1996 |
| 6 | Sau King House | Harmony1 | 41 | 2001 |
| 7 | Sau Ching House | Harmony1 | 41 | 2001 |
| 8 | Sau Chi House | Harmony1 | 41 | 2001 |
| 9 | Sau Nga House | Harmony1 | 41 | 2001 |
| 10 | Sau Yue House | Harmony1 | 41 | 2001 |
| 11 | Sau Wah House | Harmony1 | 41 | 2001 |
| 12 | Sau Wai House | Harmony1 | 41 | 2001 |
| 13 | Sau Wo House | Harmony1 | 41 | 2001 |
| 14 | Sau Yee House | Harmony1 | 41 | 2001 |
| 15 | Sau Yin House | Harmony1 | 41 | 2001 |
| 16 | Sau Yat House | Harmony1 (with Harmony3 Appendix) | 41 | 2001 |
| 17 | Sau Fai House | Single Aspect Building | 21 | 2001 |
| 18 | Sau Yun House | Non-Standard | 18 | 2019 |

Table 3-1 Residential buildings of Sau Mau Ping Estates
(source: Wikipedia)

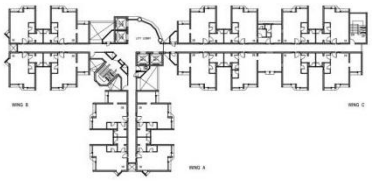
After World War II, the population of Hong Kong overgrew. Therefore, the Hong Kong government decided to build some resettlement areas. Sau Mau Ping Estate (Chinese: 秀茂坪邨) is one of the earliest public housing estates in Kwun Tong District, New Kowloon, Hong Kong. This table illustrates the history of the development of Sau Mau Ping Estates. The old buildings and re-buildings have a temporal interval of 35 years. Moreover, building forms used to be single, simple, and repetitive, but the latest construction built in 2019 used a composite design. In order to raise the construction efficiency, most public housing has standardized footprints, and components are prefabricated; cruciform is one of the most common forms.



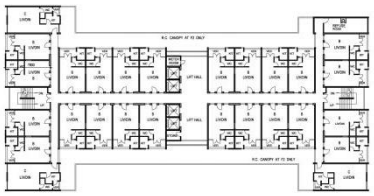
Harmony 1



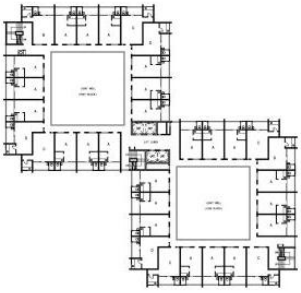
Harmony 2



Harmony 3



Single Aspect Building



Twin Tower

Figure 71: Analysis of Standard Block Typical Floor Plans
(source: Hong Kong Housing Authority )

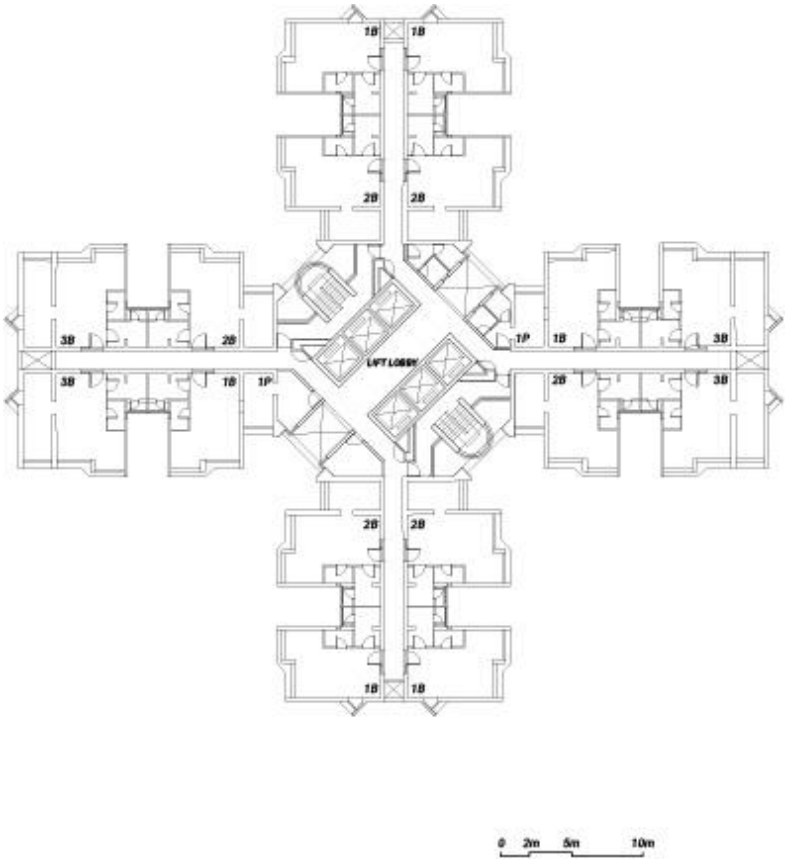



Figure 72: Floor plan style - Harmony1
(made by author，source: Hong Kong Housing Authority )

Table 3-1 above illustrate that Harmony1 accounts for the most significant proportion of 18 buildings in Sau Mao Ping Estates. Therefore, this type of house deserves our in-depth study. Harmony1, also called Cruciform blocks, is commonly found in Hong Kong public housing estates. Cruciform floor plans are a product of plot ratio and site coverage control. It is an established strategy to better integrate into the supply and fully leverage their land resource. Harmony1 uses a unified design for each unit's kitchen and toilet areas, and the dimensions of the dining room and the first room are also unified. That is to say, the design of each family unit is based on one bedroom. The design of the unit and the living room also unifies the lengthy and comprehensive design.

### 3.1.5 Skyville at Dawson (Singapore)

Figure 73: Affordable housing project in Singapore
(source: https://www.gooood.cn/skyville-at-dawson-singapore-by-woha.htm )

**Urban configurations**

This project locates in District three of Singapore. Singapore is divided into three regions: Core Central Region (CCR), Rest of Central Region (RCR), and Outside Central Region (OCR). District three belongs Rest of Central Region; it is defined as the non-core central region. With the investment and growth in transportation, this region is becoming increasingly popular as a rental option for people due to its affordability and relative proximity to Singapore's CBD. Moreover, Singapore is a sovereign island country with the third highest population density in the world.

**Architecture**

This project covers an area of 29,392 square meters, with a total construction area of 113,959 square meters. It consisted of 3 residential buildings with 47 floors and was to realize 960 flats and supporting functions. The block comprises three villages, stacked four high, for 12 villages. In addition, its complex spatial configuration directly responds to its dense urban context. The specificity of this design is highly repetitive, modular, and fully precast. Three themes are emphasized in the design: community, variety, and sustainability.

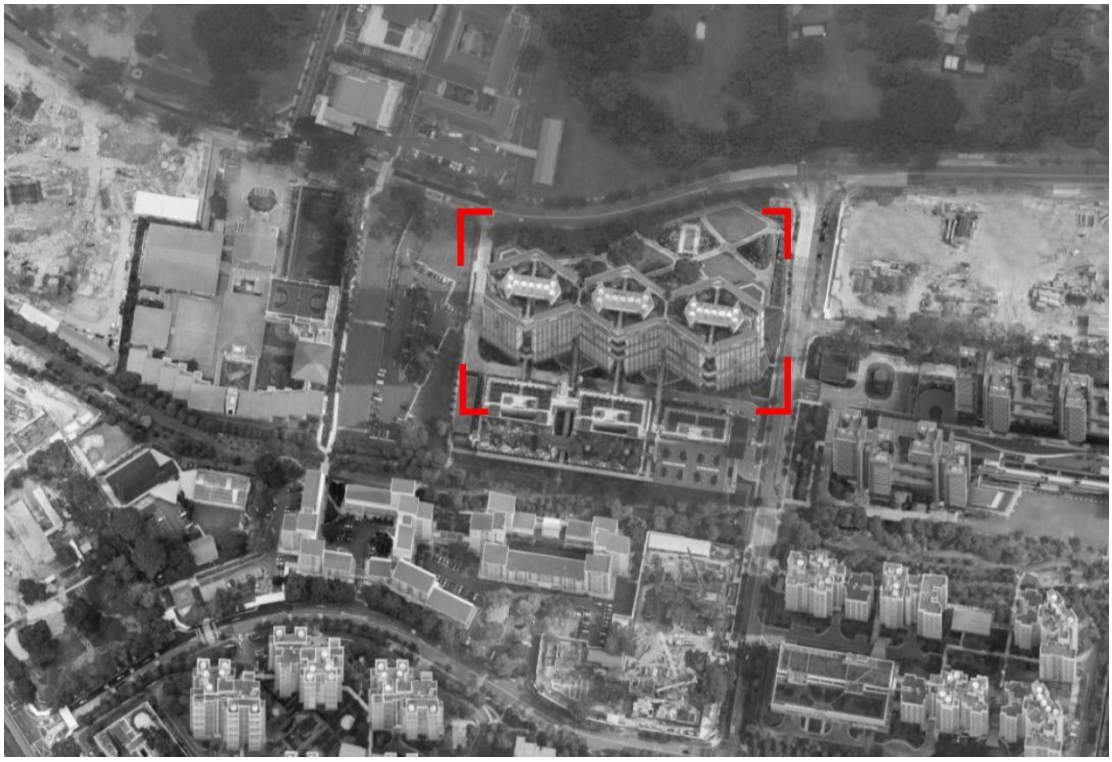


Figure 74: Satellite Mapping of Skyville at Dawson
(made by author, source: Google earth)

**Location:** Singapore

**Completion:** 2015

**Architect:** WOHA

**Site Area:** 29,392 sqm

**Construction Area:** 113,959sqm

**Other provision:** A variety of community space

**Forms of tenure:** Affordable housing estate; The block is composed of 3 villages, stacked 4 high, for a total of 12 villages.

**Density:** High-density

**Key targets/issues:** Variety and sustainability

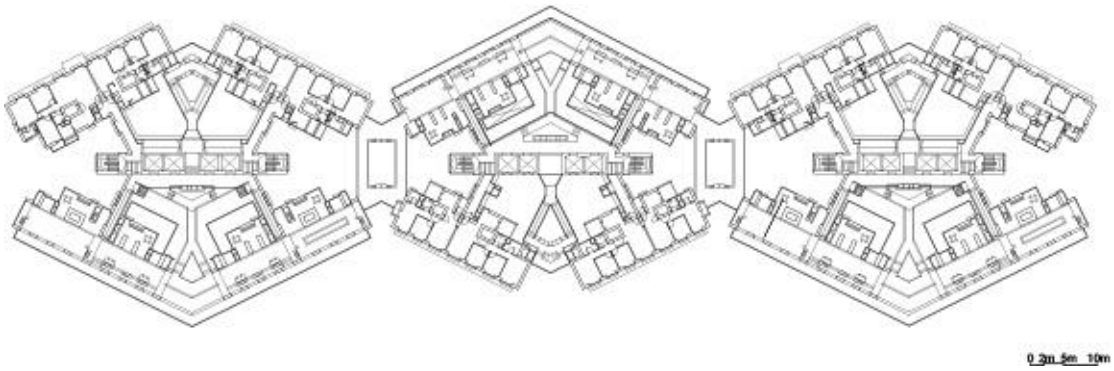


Figure 75: 14th Floor plan
(made by author )

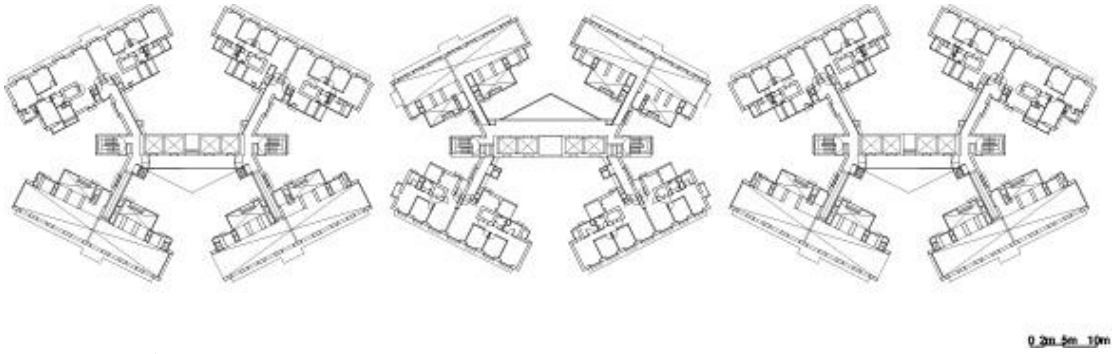


Figure 76: 15th Floor plan
(made by author )

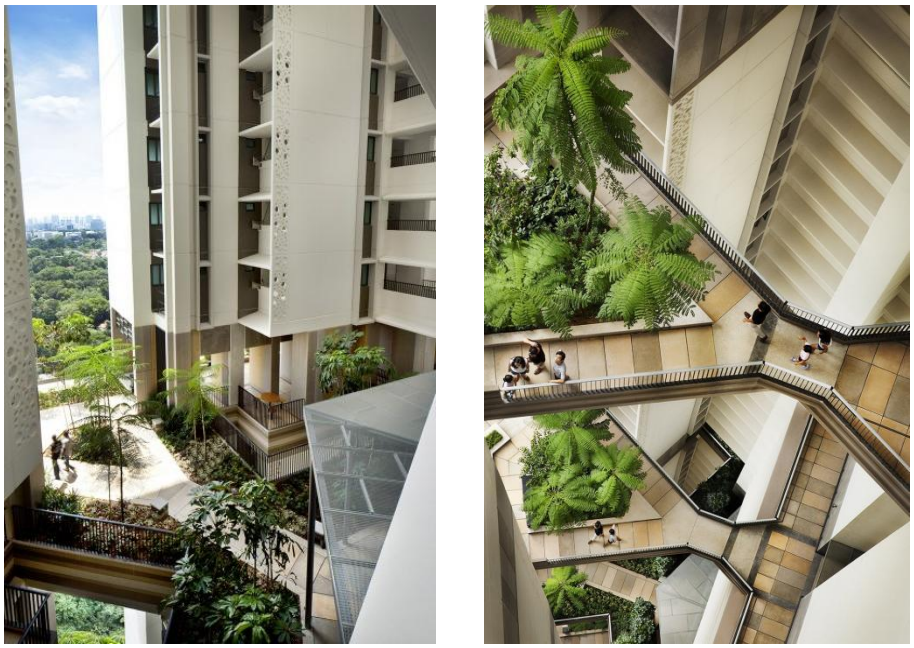


Figure 77: The sheltered community garden terrace
(source: https://www.gooood.cn/skyville-at-dawson-singapore-by-woha.htm )

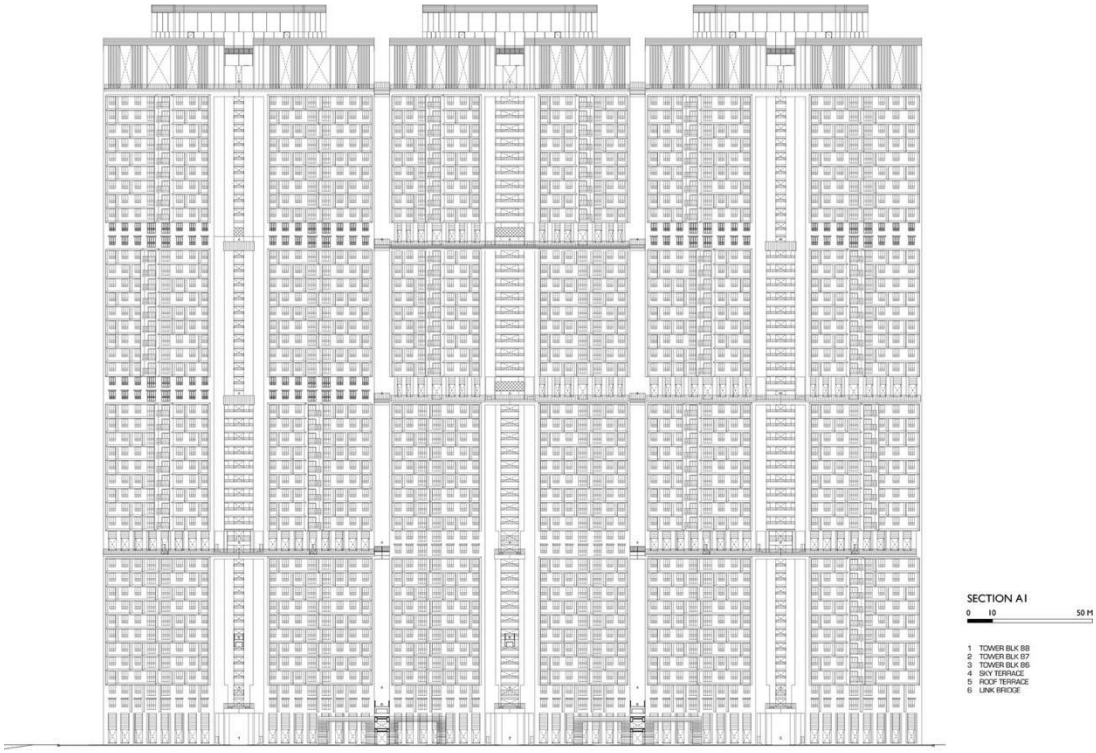



Figure 78: Section A1
(source: https://www.gooood.cn/skyville-at-dawson-singapore-by-woha.htm )

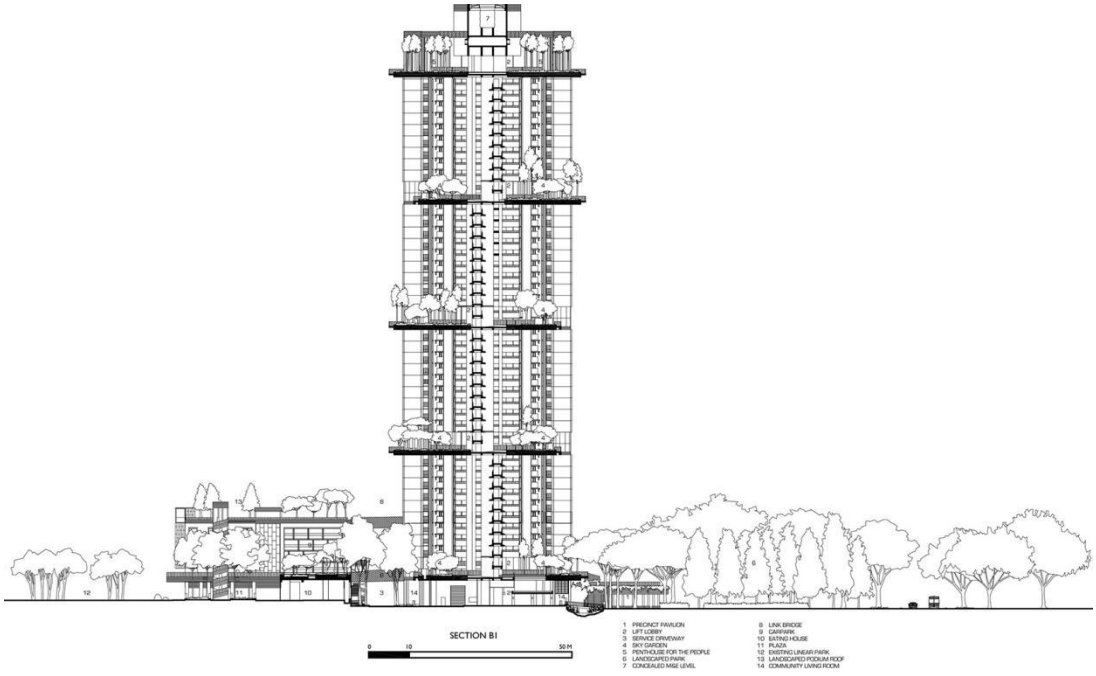



Figure 79: Section B1
(source: https://www.gooood.cn/skyville-at-dawson-singapore-by-woha.htm )

### 3.1.6 Ganei Shapira Affordable Housing (Israel)

Figure 80: The communal space in the middle
(source: https://www.archdaily.com/534569/ganei-shapira-affordable-housing-orit-muhlbauer-eyal-architects?ad_source=search&ad_medium=projects_tab )

**Urban configurations**

This project locates in the Shapira neighborhood, Tel Aviv. Tel Aviv is the economic and technological center of the country. It has a land area of 51.8 square kilometers and a population of 460,613.

**Architecture**

This project covers an area of 4,046 square meters. It consisted of 3 residential buildings and was to realize 69 apartments and supporting functions. Moreover, the open communal spaces and the neighborhood's green spaces were emphasized in this project. The Shapira housing project draws on the traditional Israeli 'Shikun' house design. However, unlike the old neighborhoods, this project was done with high building standards.

Figure 81: Satellite Mapping of Ganei Shapira Affordable Housing
(made by author, source: Google earth)

**Location:** Tel Aviv, Israel

**Completion:** 2014

**Architect:** Hila Berger, Shay Naim

**Constructor**: Shalom and Natan

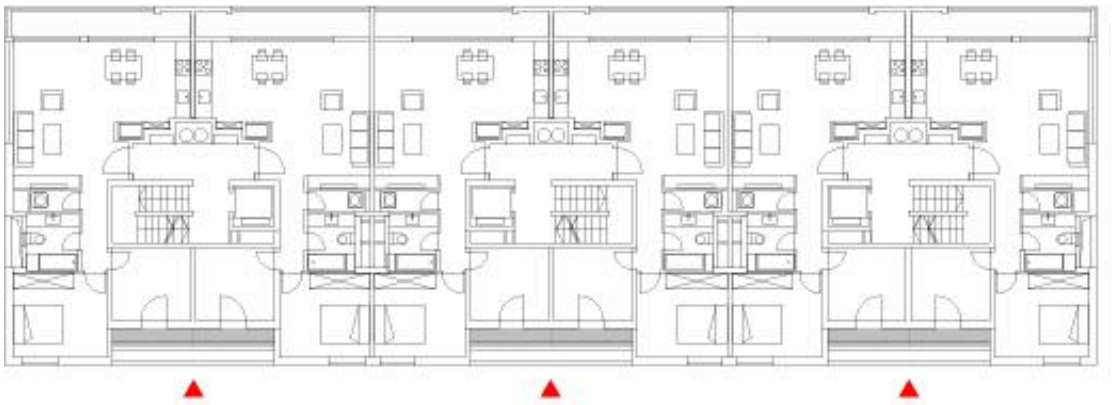
**Site Area:** 4,046 sqm

**Apartment area range:** 80-120m$^2$

**Forms of tenure:** Affordable housing estate

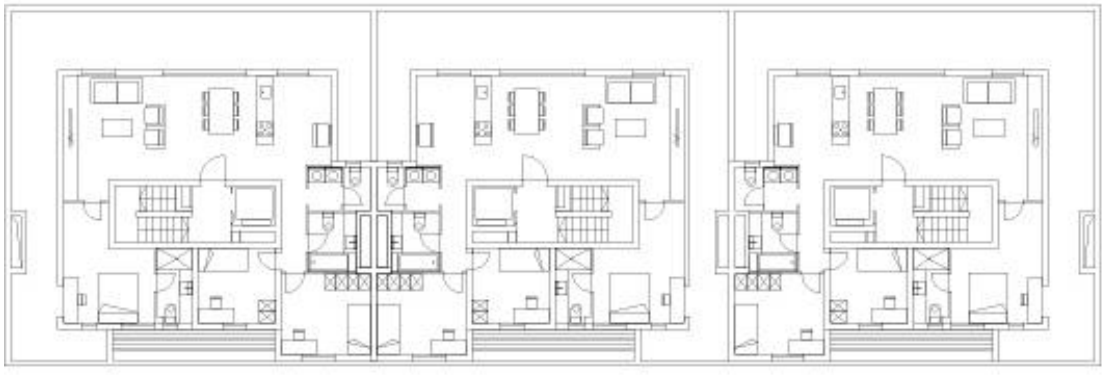
**Density:** Not relevant

**Key targets/issues:** Provide an appropriate, innovative and much-needed response to the housing crisis in Israel.




Building#1


Building#2




Building#3

Figure 82: Floor plans
(made by author )

### 3.1.7 Niamey 2000 (Niger)

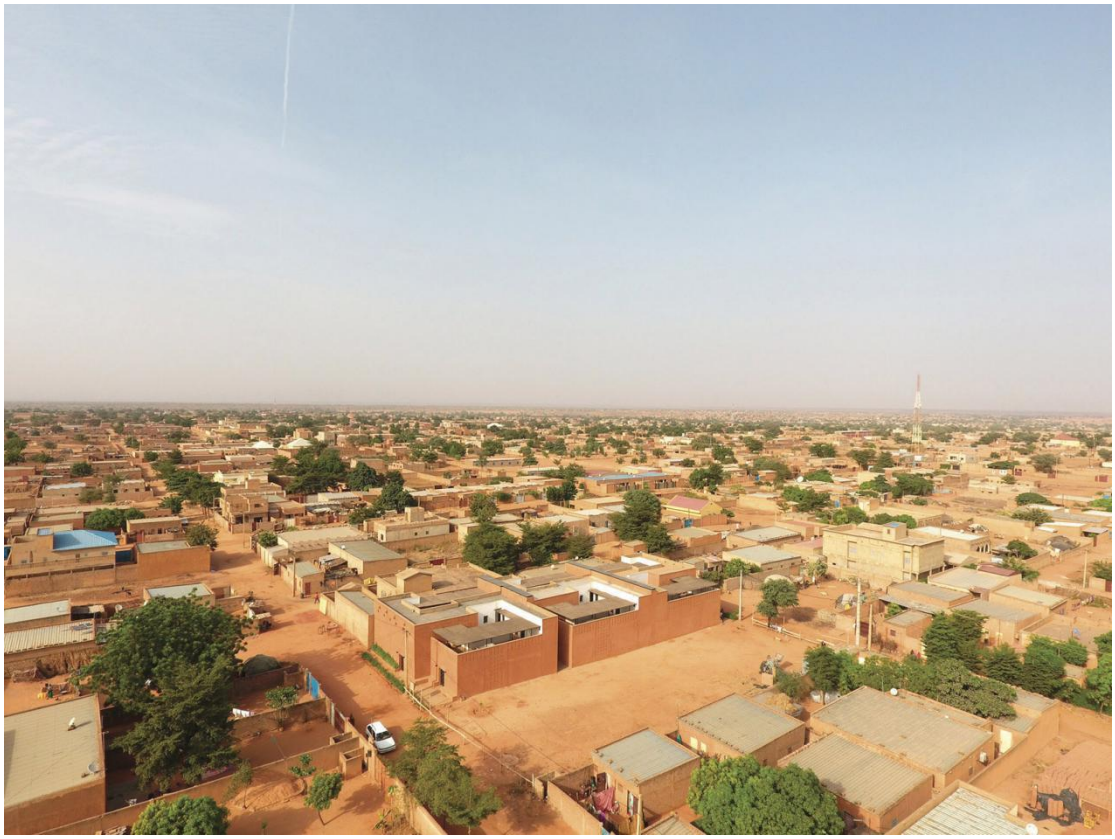


Figure 83: Aerial view of Niamey 2000
(source: https://www.gooood.cn/niamey-2000-united4design.htm )

**Urban configurations**

This project is located in Niamey, home to over one million inhabitants. Recently, the city's expansion and increasing commute times have made it more critical to increase housing density in Niamey.

**Architecture**

This project covers an area of 9,600 sqft, with a total construction area of 18,000 sqft. Niamey 2000 takes its inspiration from dense urban centers in history. The cities' organic configurations of intricately intertwined homes were often two or three stories in height. On the other hand, not as in many other places, this project uses local materials to replace concrete. This design proposes six single-family units in the same area as a conventional, single-family compound lot. Reducing the building footprint increases the maximum number of dwellings on a typical plot.

Figure 84: Satellite Mapping of Niamey 2000
(made by author, source: Google earth)

**Location:** Niamey, Niger

**Completion:** 2016

**Architect:** United4design

**Constructor**: Entreprise Salou Alpha & Fils

**Site Area:** 9,600 sqft

**Construction Area:** 18,000 sqft

**Other provision:** None

**Forms of tenure:** Six single-family units on the same area as a conventional, single-family compound lot

**Density:** Low-density

**Material:** Local resource; Compressed earth block

**Key targets/issues:** Proposes a new model for urban housing

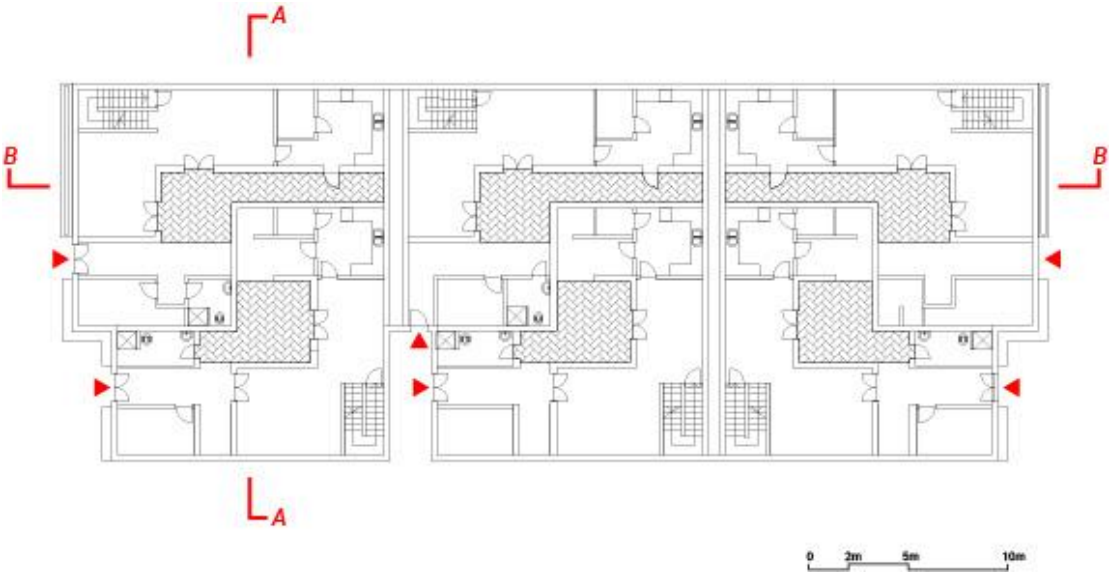



Figure 85: First-floor plan
(made by author )

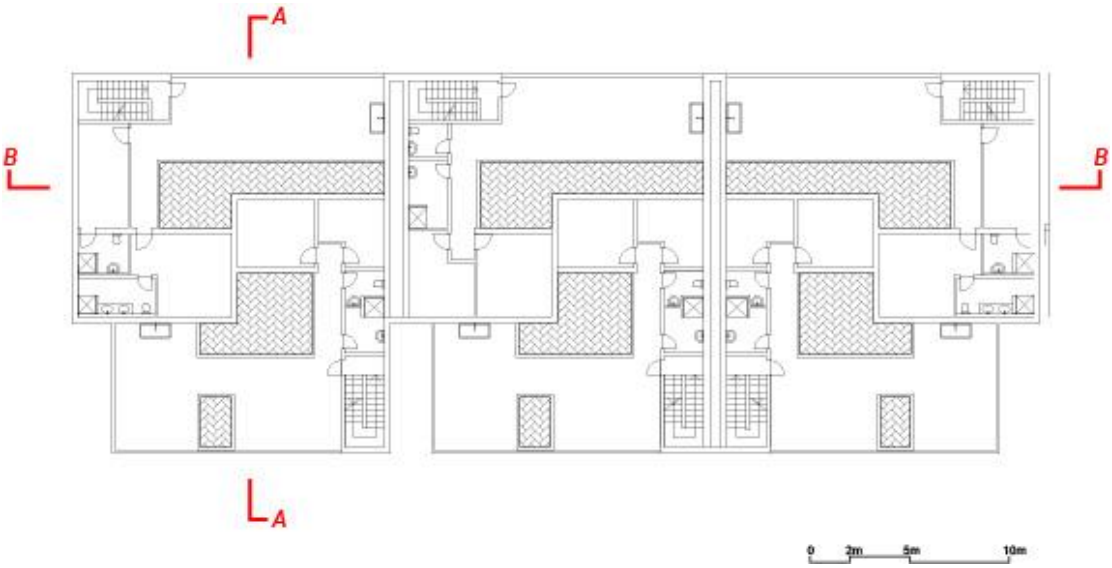



Figure 86: Second-floor plan
(made by author )

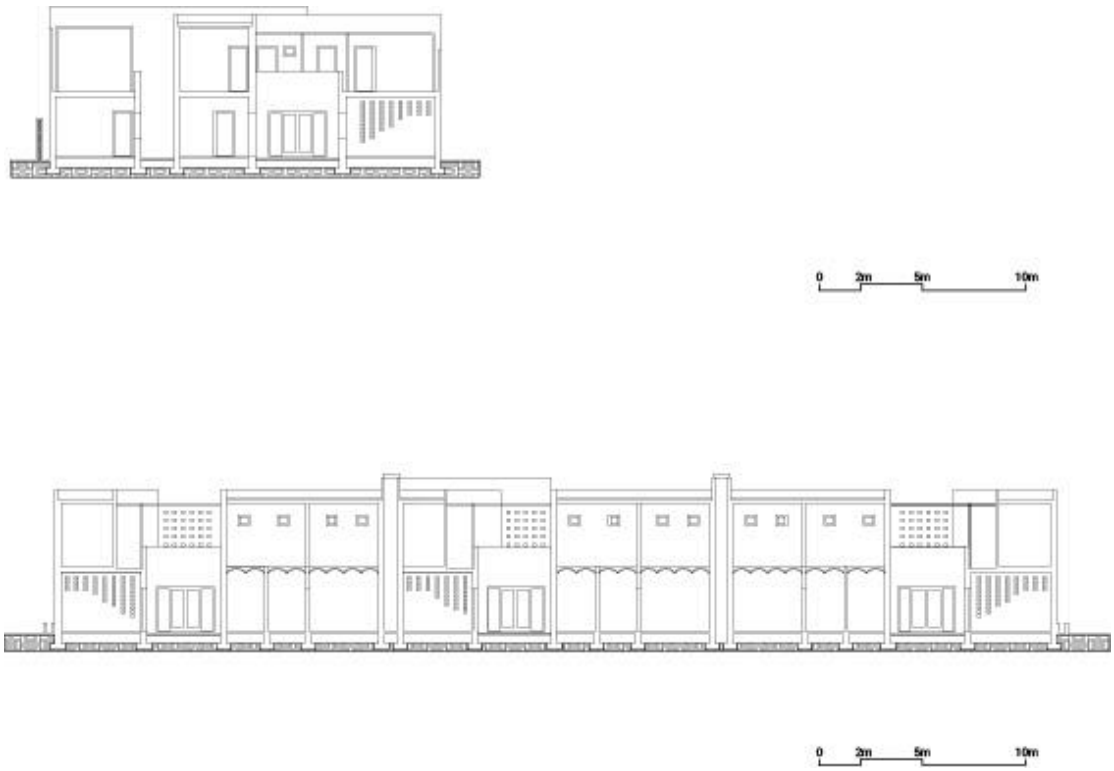


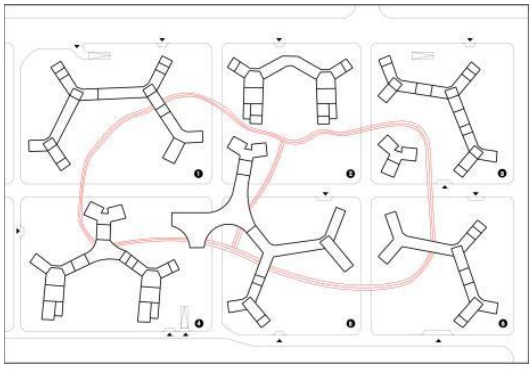

Figure 87: Section A-A & Section B-B
(made by author )

Figure 88: Section A-A & Section B-B
(source: https://www.gooood.cn/niamey-2000-united4design.htm)

### 3.2 Comparison and analysis of the design of urban housing

The difficulties in conducting this research study are apparent. First, although China and the countries along the Belt and Road have many similarities in the same context, their development is entirely out of sync. For example, the suburban determinant residential area in China in the 1980s only emerged in Africa in the 1990s, and the period for comparison is extensive. Secondly, Africa's economic and political development is relatively slow, and it has not been easy to make significant progress in housing development for a long time. The situation is complicated; China has suddenly changed after the reform and opening up. The multi-track coexistence of the export houses leads to various clues, and the content of comparative research is complicated. Third, urban housing development is mainly affected by political and policy changes and is also related to the economy, market, and land use. Finally, a series of sociological issues, such as the relationship with neighboring areas, living habits, climatic conditions, technical level, cultural trends, Etc., make it impossible for us to conduct comparative research within the narrow scope of architecture. In order to solve the above problems, this part will be from the perspectives of architectural design to analyze countries along the Belt and Road, social residential design ideas, and types.ial background of residential development and residential design ideas and types.

#### 3.2.1 Masterplan

| Project - Masterplan | Description |
|---|---|
|  <br>1. Baiziwan social housing (Beijing,China) | Open blocks<br><br>This design opens community walls and introduces city roads. The 12 residential buildings are divided into six clusters, and a large plot is divided into six smaller blocks. The street-facing space on the first floor will be used as a supporting living service. It will introduce a series of rich functions such as convenience stores, coffee shops, restaurants, kindergartens, convenience clinics, bookstores, and elderly care institutions. As a result, community life will be integrated into the city, and the urban scale will be more pleasant. |

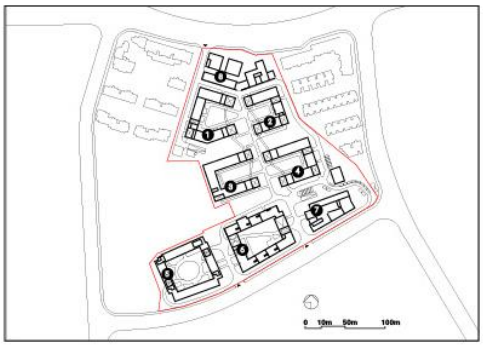
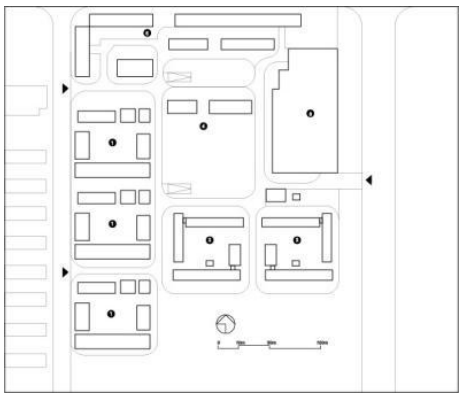
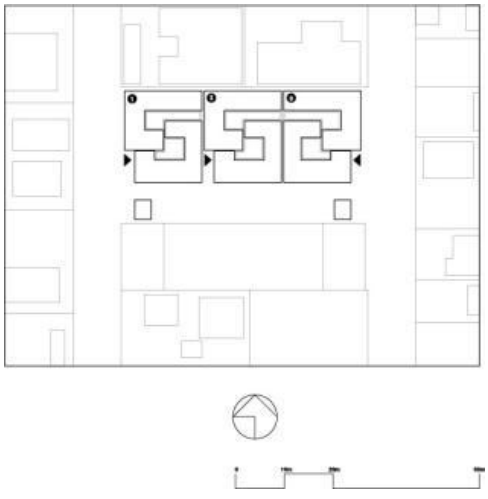
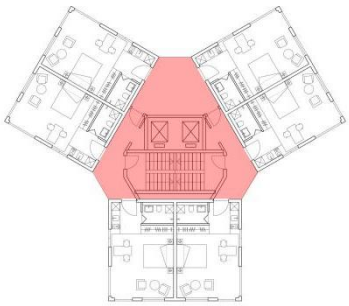
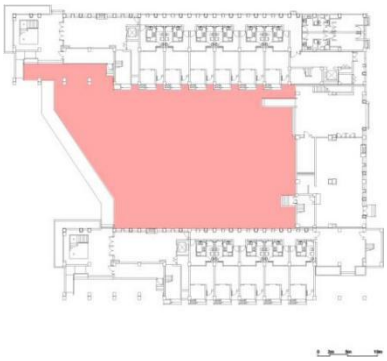
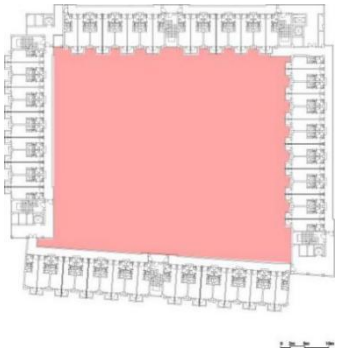
<table>
<tr>
<td>  <br>2. Longnan Garden social housing (Shanghai,China)</td>
<td rowspan="2">Enclosure<br><br>In the master plan, a closed layout is proposed, which is typical of Chinese architecture. The Lingang price-fix project adopts the enclosed courtyard layout of the large central garden, with a large courtyard in the center. In addition to creating a sense of domain and belonging, an enclosed layout can meet people's psychological needs. As the houses are arranged along the surrounding land, the surrounding center becomes a relatively large garden, allowing more families to enjoy the natural landscape. Moreover, the enclosed layout is the ideal way to get good sunlight.</td>
</tr>
<tr>
<td>  <br>3. Lin gang price-fixt housing project (Shanghai,China)</td>
</tr>
<tr>
<td>  <br>4. Niamey 2000 (Niamey, Niger)</td>
<td>Low-density<br><br>In Niamey, conventional urban areas are divided into parcels, each with an average of three dwellings for three families, which is low-density. To combat housing shortage amid rapid urban expansion and seek to increase density while remaining compatible culturally. A new prototype housing development is created, including six family units on two floors with outdoor spaces on the ground and upper floors.</td>
</tr>
</table>

Table 3-2 Comparison of building layout
(made by author)

### 3.2.2 Building form

| Plan | Project |
|---|---|
|  <br>1.Baiziwan social housing(Beijing,China)<br>(Light red section related lift lobby) | Y-shaped<br><br>This type of building form is called Y-shaped, based on a group of vertical traffic. Each household is arranged around the transportation hub, not spliced with other units, and is an independent building. Its characteristic is that it can adapt to the base with a small area and complex terrain. It has little impact on the residents' sunshine, lighting, ventilation, and sight line. |
|  <br>2.Longnan Garden social housing<br>(Shanghai,China)<br>(Light red section related half enclosure courtyard) | Enclosing<br><br>This type of building form proposes half enclosure or all enclosed courtyard space. Chinese traditional residential architecture is almost like this one, which is called Chinese quadrangles. (Chinese: 四合院)[12]. It creates enough social housing public space and a private living environment for resident. |
|  <br>3.Longnan Garden social housing<br>(Shanghai,China)<br>(Light red section related all enclosed courtyard) | |

[12] Chinese quadrangles (Chineses: 四合院) refers to a courtyard surrounded by buildings on all four sides. It is a historical type of residence that was commonly found throughout China.

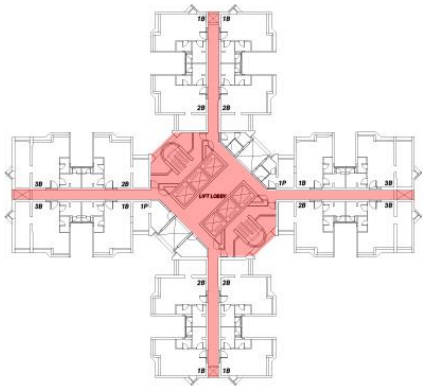
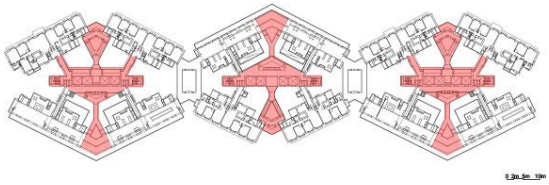
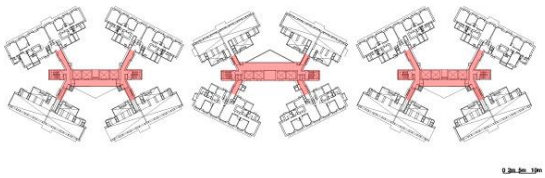
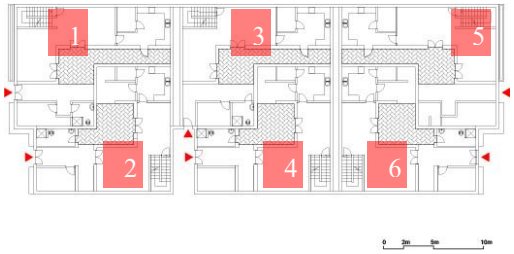
<table>
<tr>
<td>  <br>5. Sau Mau Ping Estate (Hong Kong)<br>(Light red section related long corridors and lift lobby)</td>
<td>Cruciform blocks<br><br>This type of building form is a typical cruciform high-rise residential building plan. Because of the need to provide more flats for low-cost public housing, it is typical to have long corridors to provide passage from the flats to the lift lobby.</td>
</tr>
<tr>
<td>  <br>6. Skyville at Dawson (Singapore)<br>(Light red section related common space)</td>
<td rowspan="2">Flexible layout<br><br>This type of building form has naturally ventilated and lit common and private areas. In addition, all units are cross-ventilated, with the design facing north and south. Living in a tropical climate without air conditioning with this type of design is possible.</td>
</tr>
<tr>
<td>  <br>7. Skyville at Dawson (Singapore)<br>(Light red section related common space)</td>
</tr>
<tr>
<td> 
<br>8. Niamey 2000 (Niamey, Niger)</td>
<td>Intertwined<br><br>This type of building form proposes six single-family units in the same area. It is a traditional organic configuration of intricately intertwined homes in Niamey while maintaining a sense of privacy and intimacy.</td>
</tr>
</table>

Table 3-3 Comparison of building form
(made by author)

### 3.2.3 Construction

<table>
<tr><th>Project</th><th>Description</th></tr>
<tr><td>  <br>1.Baiziwan social housing<br>(Beijing,China)</td><td rowspan="2">Prefabricated concrete modules<br><br>The structural building units and interiors' prefabricated decoration system are efficient and environmentally friendly because the building modules are made in factories and then transported to the project base for placement to reduce pollution caused by construction on the site. In addition, prefabricated construction can also reduce construction costs and improve the quality of residential construction.</td></tr>
<tr><td>  <br>2. Skyvill<br>(Singapore)</td></tr>
<tr><td>  <br>3. Niamey 2000<br>(Niger)</td><td>Local resource<br><br>In Africa, compressed earth block offers a sustainable approach for integrating earth-based construction with the contemporary demands of the construction industry. This local resources can reduce material transportation costs as well as maximize domestic resource utilization.</td></tr>
</table>

Table 3-4 Comparison of construction
(made by author)

## 3.3 Summary

The increasing concentration of urban populations is an apparent global phenomenon, and developed, and developing countries face housing shortages. The Belt and Road overseas construction of affordable housing projects has helped many countries build more houses to meet the needs of urban low-income people. The unified paradigm of Chinese affordable housing in Angola and other countries is to maximize the needs of the people, but it is not necessarily the most suitable. Excellent housing design varies by country, geography, society, culture, and environmental climate.

This chapter analyzes seven practical projects for local affordable housing in countries along the Belt and Road. According to seven case studies, low-density cities in the New World, such as Niamey in Niger, place too much on resources. In response to housing shortages amid rapid urban expansion, housing seeks to increase density. Conversely, in Hong Kong and Singapore, where land is expensive, high-rise, high-density housing is the optimal solution. However, very high-density housing comes at a heavy price in terms of technical and management complexity and restricts how residents live. At the same time, affordable housing in many countries no longer meets minimum living needs but is constantly exploring the higher quality and more sustainable designs. This study can be used for reference in the future overseas affordable housing practice of the Belt and Road Initiative.

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李振宇. 城市住宅城市[M]. 南京:东南大学出版社. 2020.

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# PART 4_ RE-IMAGINING THE POSSIBILITIES FOR AFFORDABLE HOUSING IN CHINA AND COUNTRIES ALONG THE BRI IN SUSTAINABLE SPATIAL MORPHOLOGY

## 4.1 Cost-effective models for the future

### 4.1.1 Flexibility - Structure model

For example, social housing in today's China. It is primarily a wall structure, and its modulus is fixed （2.7 meters to 2.9 meters high）. "There is nearly no possibility for reconstruction if, in fifteen years, the post-social housing time"(Atelier GOM,2017). On the one hand, social and demographic change requires flexible spatial structures. On the other hand, there is a trend that with each passing day and the rapid development of society, there may be significant changes in the social structure in the future. Therefore, in the long run, it is cost-efficient and sustainable to avoid high degrees of spatial specialization and to design floor plans flexibly by separating the structure from the completion of the interior. Open plan buildings with a multifunctional structure thus have a high stable value, solely on account of their conversion potential. According to the case study - Longnan Garden social housing, the designer of this project developed the sizeable concrete frame (Skeleton), 7.6 meters high, embedded steel structure (Infill), 2.8 meters + 2 meters + 2.8 meters. Instead of China's primarily wall structure with a height of 2.7 meters to 2.9 meters. This new structure can challenge the space variation of housing in the background of social housing standards and give infinite possibilities of functions for the post-social housing time.

Figure 89: Section of skip-floor apartment
(source:
https://www.archdaily.com/874649/longnan-garden-social-housing-estate-atelier-gom?ad_source=search&ad_medium=search_result_all )

### 4.1.2 Construction - Local material

Kilamba housing project ships over two million tonnes of materials directly from China because getting materials of satisfactory quality at local markets is challenging. It increases construction costs significantly and extends the duration. Using local materials can help countries leverage their resource endowment and decrease construction costs. For example, the Niamey 2000 project reintroduces locally derived resources to the construction industry. In addition, Compressed earth block and Interlocking Stabilized Soil brick (ISSB[13]) are used in African construction.

Figure 90: The local material used in the project
(source: https://www.gooood.cn/niamey-2000-united4design.htm )

Figure 91: Interlocking Stabilized Soil Bricks
(source: Design Indaba )

[13] ISSB uses a simple compression machine and easily accessible ingredients. All that's needed is rich, moist soil, some bags of cement, and a pressing machine.

### 4.1.3 Prefabrication - Precast housing components

Prefabrication is not a recent phenomenon. The first bricks were built several thousand years ago and uniformly pre-assembled components, such as for nomadic tents. What is comparatively new, though, is the rationalization of construction processes and the serial production of significant, load-bearing building components, which since the introduction of the assembly line in the automotive industry - are also becoming increasingly widespread in the construction industry. Modernist architects such as Walter Gropius viewed the prefabrication of wall and ceiling elements, as well as complete units of space, as being the future of the building sector - and they were proven right.

Due to the economic recovery and the city's rapid development, the demand for housing proliferated. Moreover, conventional manufacturing cannot meet this kind of growth, so prefabricated items started to gain much ground. Prefabricated components have long since been used as a matter of course in all parts of buildings for all uses, including reinforced steel components of all sizes and shapes, as well as timber walls and ceilings produced in solid or frame construction. In doing so, new digital tools and CNC-controlled machines - mainly in timber construction - allow for economic serial or individual production, as has been common in other areas of the construction industry for years, as in the case of windows, facade elements, and building service components. The advantage of prefabrication lies in its fast and straightforward assembly, reduced work time, and construction period resulting in higher precision in execution. For example, the Baiziwan social housing project reaches more than 80% of the industrial production. The structural building units are all assembled and decorated. All the efficient and environmentally friendly building modules are prepared for factory labor and then transported to the project base for resettlement to reduce the pollution caused by construction on the site. In addition, prefabricated construction can reduce construction costs and improve the quality of residential construction.

Figure 92: Prefabricated modules on site
(source: https://www.gooood.cn/baiziwan-social-housing-by-mad.htm )

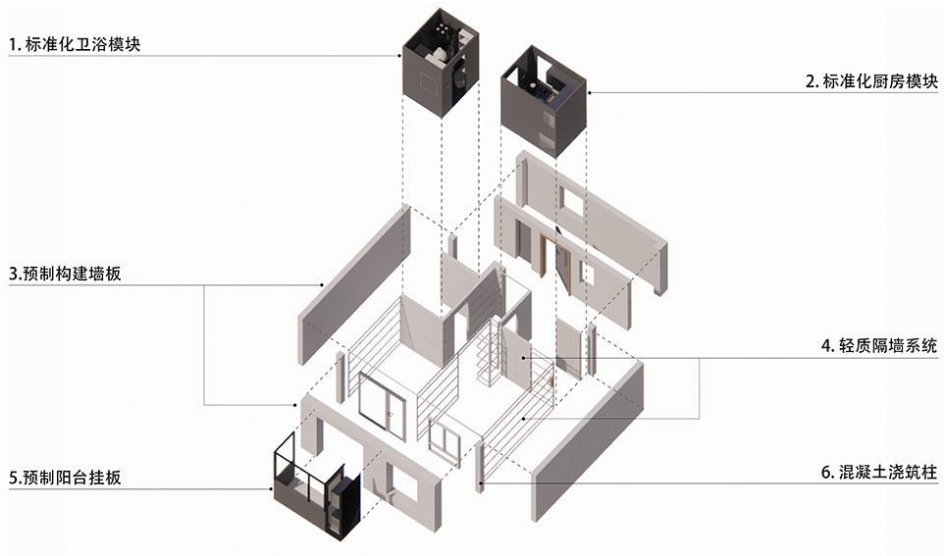

Figure 93: Prefabricated construction exploded diagram
(source: https://www.gooood.cn/baiziwan-social-housing-by-mad.htm )

On the other hand, in light of the already scarce and increasingly expensive housing, it is clear that the demand for new flats will continue to grow in the future. It necessitates developing intelligent residential building strategies, which simultaneously consider urban planning-related, social, ecological, and economic aspects, whether it is about re-densification within existing buildings and neighborhoods or new buildings in urban extension areas. Prefabricated concrete and timber components for supporting structures and building envelopes contribute to allowing residential buildings to be realized efficiently in terms of time, materials, and cost, as well as creating high levels of diversity and high-quality execution. It promises to be the most effective way to provide affordable housing for the steadily growing number of people living in poverty or at risk of poverty.

### 4.1.4 Simplification - Community

Simplifying architecture despite complex demands requires precise proportioning and a high degree of development effort. Repeated details and connection points can support the architectural concept and avoid complicated material use and construction techniques. The community aspect of housing will be much more important, alongside the further integration of technology. Ben van Berkel, a founder of UNStudio, argues that "forms of community living reduce "the spatial needs compared to if everyone privately claims space for their amenities. Indeed, while it takes on many shapes, from co-housing to co-living and any variants, the defining characteristic of community living is shared spatial resources. In recent years, forms of community living have gained traction as a viable answer to issues such as the housing shortage, the rising costs of living, the loneliness epidemic, and the changes within the social fabric."

### 4.1.5 Building form - New models for Collective housing

The term ‘collective housing’ is generally understood as housing that features spaces and facilities for shared use by all residents who also maintain their households. The most considerable potential for savings lies in the design and construction decisions, including cubage and floor plan design. A compact building form can reduce facade areas, which make up 20-30% of the total construction costs, and lower energy and heating costs. The area/volume ratio (A/V) and the useable floor space/gross floor area ratio (UFS/GFA) are definitive measures for cost-efficient buildings. Moreover, floor plan concepts ought to be developed to minimize circulation areas, constituting up to 20% of the floor space in residential buildings. As the New Models for Collective Housing defines, “collective housing features spaces and facilities for common use by all residents who also maintain their households.” These spaces and facilities form a central characteristic of the housing, not simply an added amenity. Today in collective housing, the shared facilities supplement complete, self-sufficient dwelling units so that each household has its kitchen even though there also is a larger, shared kitchen. In the past, shared facilities in collective housing often replaced facilities conventionally placed in individual dwelling units; thus, individual units often lacked private kitchens, but the individuality and separateness of the households were acknowledged, both socially and spatially, in other ways.

Figure 94: Housing as service
(source: https://www.archdaily.com/973379/new-models-for-collective-housing?ad_medium=widget&ad_name=related-article&ad_content=977864 )

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## 4.2 Conclusion

This paper has discussed the factors for urban and urban housing development under the Belt and Road Initiative. The Belt and Road Initiative promotes most countries' economies and accelerates many rural to urban immigrants. In addition, the BRI helps many countries to build infrastructure in the city to accelerate the development of cities. For example, after the civil war, Angola needs to rebuild its cities and develop its economy. With the help of China, many infrastructures were built in Angola's big cities. It promotes local urban development and improves people's living standards. Angola's economy also benefits from trade with China. However, rapid urbanization brings urban housing shortages. Although China has helped Angola and many other countries to build affordable housing to solve this problem, there is still a lack of affordable housing for middle and low-income people in the city. Moreover, these affordable housing still have problems, such as high cost, lack of infrastructure, unsustainable, and ghost cities.

This paper critically examines vast affordable housing built by Chinese companies under the Belt and Road Initiative. Look at this paradigm and pitfalls, searching for lessons to improve what could become a much-needed housing solution for the continent. However, how to solve these problems is the focus of our attention in the future. Several solutions have been proposed to address the housing shortage around the world. Some actual practice affordable housing projects in countries along the BRI met the challenges outlined by urban housing. Through some successful case studies, this paper re-imagines the possibilities for affordable housing in China and countries along the BRI in sustainable methodology. A cost-effective, affordable housing model is an excellent way to meet the challenge of urban dwellings. Solving the severe housing shortage is currently an important problem for people all over the world. Providing affordable housing for everyone would be a long and challenging journey that took a lot of hard work and practice. Global cross-border investment declined somewhat in 2020 due to the Covid-19 epidemic, but Belt and Road Initiative investment cooperation progressed. The mutually beneficial trade volume between China and the countries along the route increased by 0.7% yearly, which is very positive. Indeed, if we want a sustainable city compatible with all the other larger countries, we must achieve excellence. Research into affordable housing has a long history. We all know the new affordable housing will be characterless and monotonous. However, a perfect affordable housing system has played a crucial role in various countries' economic development and social stability.

Overall, in the one year of research for this dissertation, The objective was to understand the circumstances and socioeconomic activity under the Belt and Road Initiative that shaped countries' urban growth. Furthermore, it aimed to use the information gathered from relevant books, literary reviews, and practical projects to re-image the design of a prototype for sustainable urban development and affordable housing in the future. A limitation of this study is that the Belt and Road Initiative is a massive project; it covers more than 140 countries, from the European to the African continent. Moreover, due to the different geographical environments and cultural traditions, affordable housing designs are varied.

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# LIST OF FIGURES

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