

SUPPORTING
REPORT
1

CHONGQING

2
Spatial Transformation Strategy: Increasing Efficiency and Livability by Promoting Compact and Human-Centered Development

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1. Introduction

Chongqing Municipality, located in the southwest of inland China and upstream of the Yangtze River, is one of the largest cities in the world, with an area of 82,400 km² and a population of 33.92 million (Chongqing Municipal Bureau of Statistics and NBS Survey Office in Chongqing 2016).¹ To put it in perspective, the municipality's area is as large as that of Austria and its population is close to that of Canada.

The municipality has a distinct topography with limited developable land. The Yangtze River flows for 679 km through the entire municipality and has its confluence with the Jialing and other rivers. As a city built on mountains surrounded by rivers, Chongqing is known as “a city of mountains and rivers.” While the municipality has a large administrative size, mountainous areas account for 75.8 percent of the municipality and hilly areas for 18.2 percent. Only 6 percent of its land area consists of flat land suitable for development.

Chongqing presents two distinct scales: the municipality is comparable to a country. Chongqing Municipality's land area is 80 percent the size of the Republic of Korea, and its population is 60 percent that of Korea. Central Chongqing's nine districts comprise the core of the municipality and are its economic engine. It also has a vast administrative area of 5,473 km², which is equivalent to the entire Shanghai municipality, 3.7 times the size of Greater London, and seven times the size of New York City. However, only 10 percent of central Chongqing's administrative land is built up; hence it is comparable to other large cities such as New York City, central Tokyo's 23 wards, or Seoul Special City, both in terms of land size and population. In 2014, central Chongqing had a resident population of about 8.2 million, which is comparable to the Big Six global cities: central Tokyo's 23 wards, Seoul Special City, Singapore, London, New York City, and Hong Kong SAR, China.²

This report is based on two analytical streams:

1. An assessment of Chongqing's issues and challenges at municipality and central city scales based on the trends of the past 20 years, benchmarked with other provincial-level municipalities in China and with global cities to derive policy lessons for Chongqing
2. A scenario analysis comparing a Trend scenario and a Compact Growth scenario for central Chongqing.



BOX 1 Key Messages of Chongqing's Spatial Strategy

Chongqing has a high risk of losing its land use efficiency and unique urban form as a city of mountains and rivers. The city can increase its efficiency, livability, and inclusiveness through articulated density, connectivity, mixed-use developments, and high-quality public spaces. A compact urban form increases agglomeration and brings people closer to jobs, while reducing infrastructure costs and environmental impact. Encouraging the development of livable neighborhoods with unique urban fabrics would enhance Chongqing's livability and global appeal.

Current trends and key issues:

- Over the last 20 years, Chongqing Municipality's density has halved. Expansion has fragmented the city and exacerbated inequalities of development and imbalances between districts and neighborhoods.
- Its expansion has been driven by land-financed urbanization and took the form of superblocks. This inefficient land use pattern limits access to transit (reducing access to jobs and social inclusiveness), raises infrastructure costs, and leads to poor walkability and excessive land consumption. It prevents economic agglomeration and has high environmental impacts such as poor air quality and high carbon emissions.
- By 2015, only 807.47 km² remained available for further development. If the past expansion pattern continues, with the growth of 5.8 million people and 4 million jobs in central Chongqing, no more developable land will be left after 2035.

Benchmarking with global cities:

- Central Chongqing's population, job, and GDP densities are considerably lower than those of other global cities, which places the city in a disadvantaged position to reap the agglomeration economies needed to transition towards high-end manufacturing and services.
- The superblock typology dominating the urban form in central Chongqing presents a sharp contrast to the fine-grained urban fabrics of other global cities.

Recommendations:

A modeling comparison of a Trend scenario and a Compact Growth scenario has been undertaken for central Chongqing, and the results are clear—**land use, urban livability, household expenditure, infrastructure costs, and environmental sustainability could be greatly improved with compact growth transformations:**

- About 200 km² of land would be saved in central Chongqing, preserving a valuable asset for future expansion beyond 2035, and increasing economic density, agglomeration and productivity.
- Cumulative expenditure in infrastructure³ to 2035 would be reduced by 30 percent, achieving RMB 34 billion in savings and allowing the redeployment of public expenditure to R&D to improve competitiveness and to the extension of social services such as education and health.
- Chongqing would be more affordable. Household costs for transportation and home energy would be 32 percent lower, achieving annual savings of RMB 5,100 per household, and thus enhancing inclusiveness.
- Central Chongqing would be less car-dependent, with a reduction of congestion and an increase of accessibility to jobs with affordable transportation. The mode share of walking and public transport would increase by 9 percentage points in the compact growth scenario compared with the trend scenario.
- Air quality, which is currently above critical thresholds and threatens human health, would be significantly improved. CO₂ and air pollutant emissions from auto travel could fall by 39 percent.

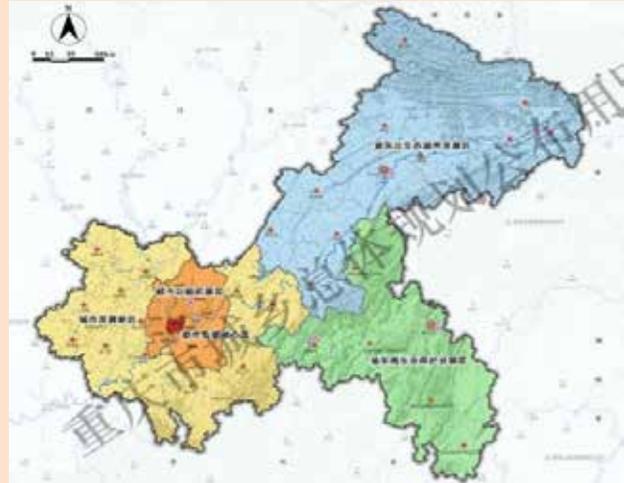
Thus, Chongqing should aim for **three spatial transformations**: compact and land-light growth, transit-oriented development, and new livable neighborhood planning and design taking advantage of the city's unique topography of mountains and rivers.

2. Current Trends and Key Issues

BOX 2 Chongqing Municipality's Sub-Regions

In 2014, Chongqing Municipality had a resident population of 29.9 million (including 17.83 million urban) on an urban built-up area of 2,470 km², resulting in an urban density of 12,129 people/km².

Accounting for 7 percent of Chongqing Municipality's territory, central Chongqing (in red and orange) accommodated 41 percent of Chongqing Municipality's urban population and produced 47 percent of Chongqing Municipality's urban GDP in 2014. It had a resident population of 8.2 million (including 7.22 million urban dwellers) on 545 km² of built-up urban land, resulting in a density of 13,248 people/km². Chongqing Municipality's population and economic activities are increasingly concentrated in central Chongqing. Its share of Chongqing Municipality's total population grew from 17 percent in 2000 to 27 percent in 2014; its share of GDP grew from 38 percent in 2000 to 44 percent in 2014. Yuzhong district is the densest and wealthiest part of central Chongqing, with a density of 38,200 people/km² and a GDP/capita about three times Chongqing Municipality's average.



Central Chongqing is the heart of the “1-hour economic circle” (in yellow, orange, and red, above) that comprises 18.98 million people (including 13.3 million urban residents).⁴ To the east, the municipality extends into the huge northeastern (blue) and southeastern (green) areas. Altogether, these two areas cover 53,700 km² (two-thirds of the municipality) and comprise 5.2 million people (17 percent of the municipality's total population).

Source: Information extracted from Chongqing Municipality Master Plan: 2007 to 2020.

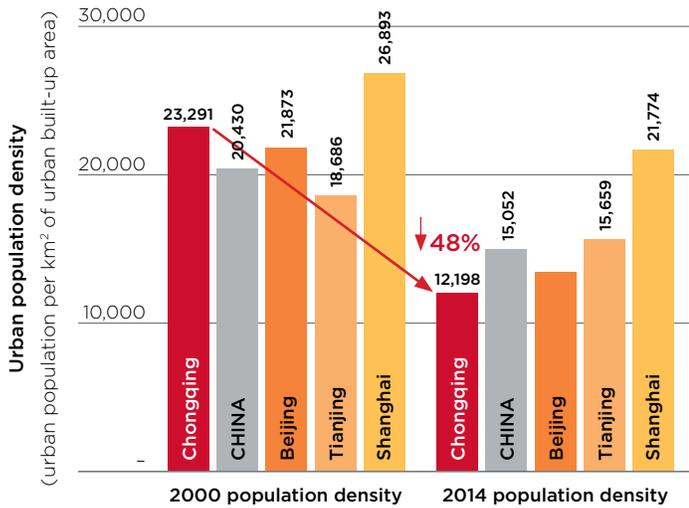
The analysis of trends and key issues includes two levels—the municipality level, which covers 82,400 km², and central Chongqing, which covers 5,473 km² across nine districts. Data and benchmarks will be used at one or both scales as most relevant. As shown in box 2, population and economic activity have agglomerated over the last 15 years in central Chongqing, achieving a higher GDP per capita. This explains the choice of focusing more on central Chongqing's spatial transformation strategies while putting them in perspective within the larger scale of the municipality.

Municipal-Level Trends

For the past 20 years, Chongqing Municipality has expanded in a low-density pattern. Chongqing

Municipality's urban land consumption has grown twice faster than its urban population. The municipality's population density has almost halved, dropping from 22,820 people/km² in 1997 to 12,013 people/km² in 2015, and is now significantly lower than that of other provincial-level municipalities (figure 1). Economic agglomeration is also significantly lower in Chongqing than in other provincial-level cities.⁵ Chongqing's economic density is only 28 percent that of Shanghai, 41 percent that of Tianjin, and 44 percent that of Beijing (figure 2). To catch up with other provincial-level municipalities, Chongqing needs to climb the manufacturing value chains to increase its GDP per capita and to grow in a more compact form to foster agglomeration and associated productivity gains.

FIGURE 1 Chongqing's Urban Population Density Compared to Other Provincial-Level Cities, 2000 vs. 2014



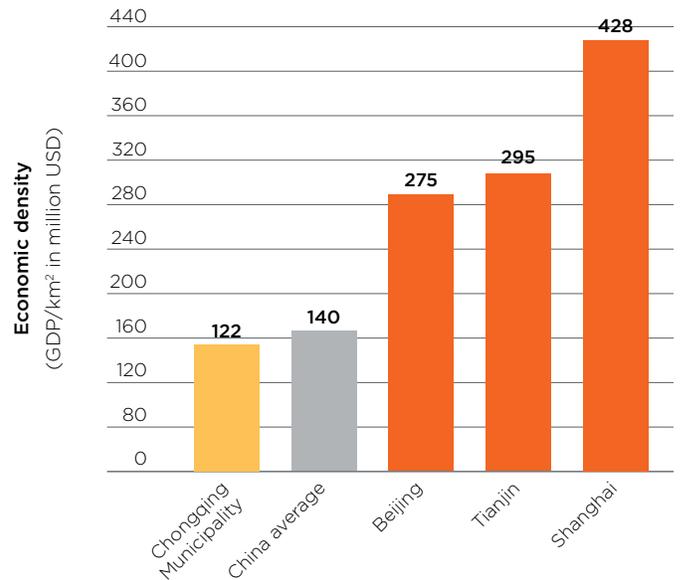
Source: National Bureau of Statistics of China 2000; National Bureau of Statistics of China 2014.

Chongqing's strategic land reserve is fast being depleted. Chongqing has a limited developable land supply due to its mountainous topography. Despite its vast territory of 82,400 km², only 2,336.47 km² is available and planned for development. In 2015, only 807.47 km² remained available for future development, including industrial land use (Chongqing Municipal Bureau of Statistics and NBS Survey Office in Chongqing 2016). In the past two decades, Chongqing Municipality's built-up area has grown twice faster than the growth of the urban population (figure 3).⁶ The city has used more land to accommodate each new urban resident (136 m²) than the Chinese average (94 m²) and other Chinese cities (Beijing: 114 m²; Tianjin: 78 m²; and Shanghai: 65 m²) (figure 4).

Chongqing's high land consumption has three major implications: emerging land shortfall; declining population density; and reduced economic density. If the excessive conversion rate of 136 m² of land per new urban inhabitant since 2000 continues, Chongqing will use all its developable land to accommodate the projected 5.8 million new urban dwellers in central Chongqing by 2030, leaving no room for industrial uses and for further urbanization.

Another important issue at the municipality level is related to spatial inequity. Chongqing Municipality's size and scale are comparable to those of a country,

FIGURE 2 Chongqing Municipality's Economic Density Compared to China's Average and to Other Provincial-Level Cities (2017)



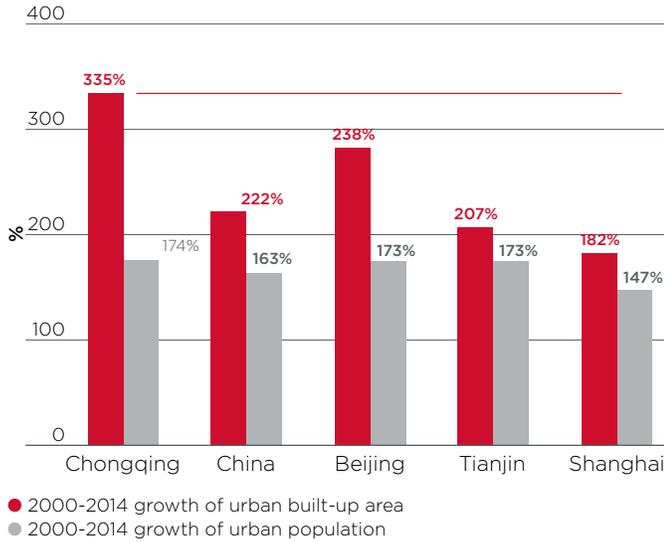
Source: Produced by the Urban Morphology and Complex Systems Institute for this report, based on National Bureau of Statistics of China 2017.

and it has huge inequalities across its districts. Though it is beyond the scope of the analysis of this report, it is important to note that urbanization and economic growth have not alleviated the significant inequalities in income, education, and health between rural and urban populations and between districts. Twelve million rural inhabitants, living mostly in rural outlying districts, have an income that is on average 2.7 times lower than the 18 million urban dwellers, with ongoing geographical biases in education and health access between districts in spite of huge investment and significant progress. These challenges are particularly acute as there is a net migration outflow. The municipality must attract more migrants to maintain its human capital and compensate for its aging population. To become a global city that creates opportunities for all, Chongqing needs to address the looming inequalities, especially between different districts.

Central Chongqing

Central Chongqing's nine districts are increasingly fragmented. The expansion of the city center has fragmented its urban form (figure 5). Huge infrastructure investment has allowed the creation of pockets of urbanization across mountain ridges. The superblock form of expansion has left empty land in between urbanized land. Fragmentation matters for a

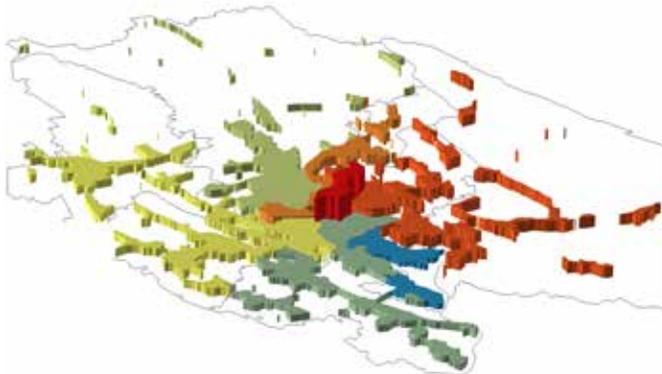
FIGURE 3 Urban Land Growth vs. Urban Population Growth in Chinese Cities, 2000–2014



Source: National Bureau of Statistics of China 2000; National Bureau of Statistics of China 2014.

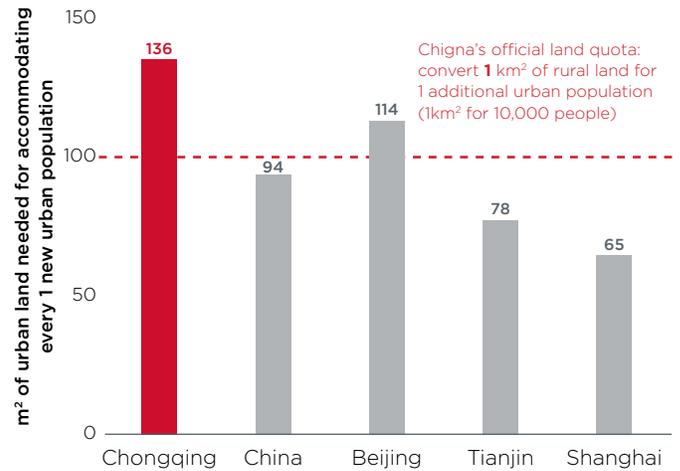
number of reasons. The more fragmented the built-up area, the greater the distance between locations in the city, and the more open space is disturbed by the city. When expanding, cities capture vast amounts of open land that is either surrounded by built-up land or located at its fringe. The built-up area combined with captured and fringe open land is what is called urban extent, which is by far much larger than the built-up area. An index of fragmentation is the degree to which the built-up area saturates the city's urban extent.⁷

FIGURE 5 Density of Population on Built-Up Land Area in Central Chongqing



Source: Produced by the Urban Morphology and Complex Systems Institute for this report, based on satellite analysis and Chongqing Statistical Yearbook 2016.

FIGURE 4 Land Converted to Accommodate 1 Additional Urban Resident, 2000–2014



With a saturation index of 0.67, central Chongqing is more fragmented than Shanghai Municipality, which has a similar population size.⁸ In 1991, Shanghai's urban extent was more than double its urban built-up area. Shanghai has decreased its fragmentation over the years, moving up from a saturation index of 0.49 in 1991 to 0.68 in 2015, thanks to a growth based mostly on infill: 35 percent between 1991 and 2000, to 55 percent between 2000 and 2015 (Angel, et al. 2016). Thus Chongqing should increase the percentage of infill in its urban growth.

Land and economic development are uneven in central Chongqing. Chongqing's core—Yuzhong district⁹—is densely built up, while adjacent districts are built up from 20 to 27 percent and extension districts from 1.4 to 5.4 percent. Population densities in built-up areas vary greatly, from 38,200 people/km² in Yuzhong district to around 12,500 people/km² in other districts (figure 5). Moreover, central Chongqing presents extreme inequalities of economic density and wealth across districts. In 2015, Yuzhong district produced 15 percent of central Chongqing's GDP despite occupying only 3.7 percent of its built-up land area. Yuzhong district creates significantly more wealth than the other districts—with a GDP per capita of RMB 147,000, it is 2.5 times higher than the average for Chongqing Municipality (figure 6). This stands in contrast to Dadukou

district,¹⁰ which was hit by a severe recession that affected its core industry of iron and steel and never recovered. As a result, the two districts have extreme differences in population densities, GDP per capita, and economic density, which are respectively three times, three times, and nine times higher in Yuzhong than in Dadukou. Productivity benefits derived from agglomeration economies tend to exacerbate

these differences. The uncoordinated distribution of economic densities reduces agglomeration economies, productivity, and inclusiveness, as some districts, even within central Chongqing, are lagging. Chongqing's massive disparities between districts highlight the need for policies to address them and to reduce inequalities between different districts.

FIGURE 6 GDP Per Capita in Central Chongqing
(1,000 RMB)

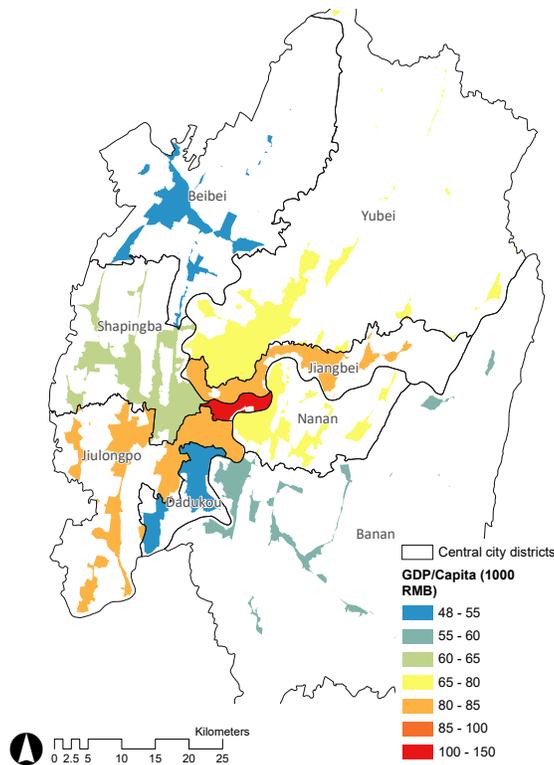
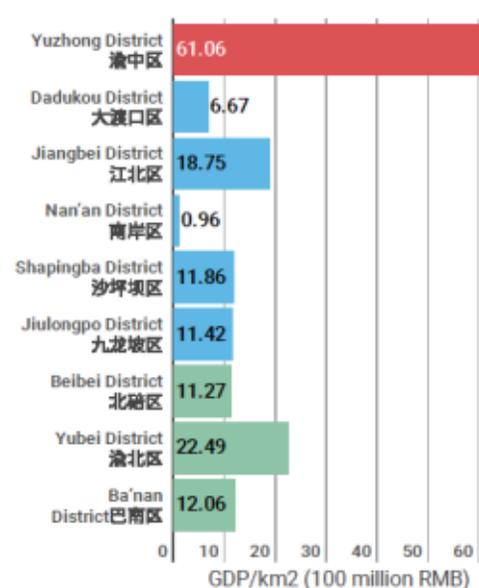
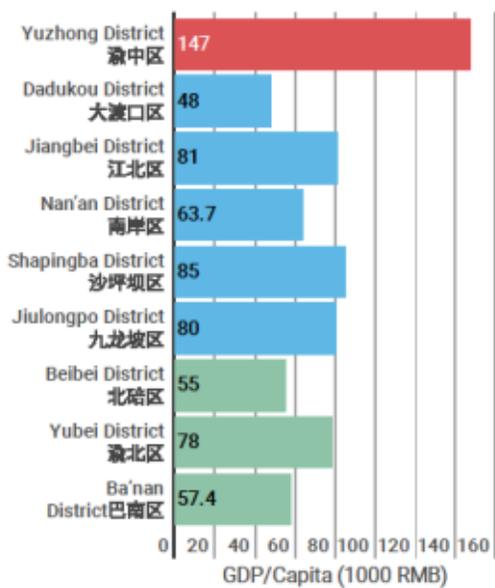
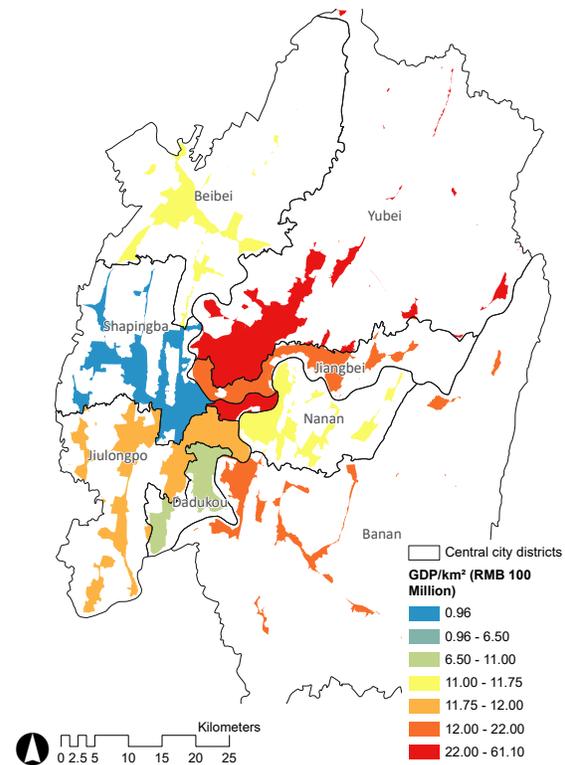


FIGURE 7 Economic Density in Central Chongqing
GDP/km² (100 million RMB)

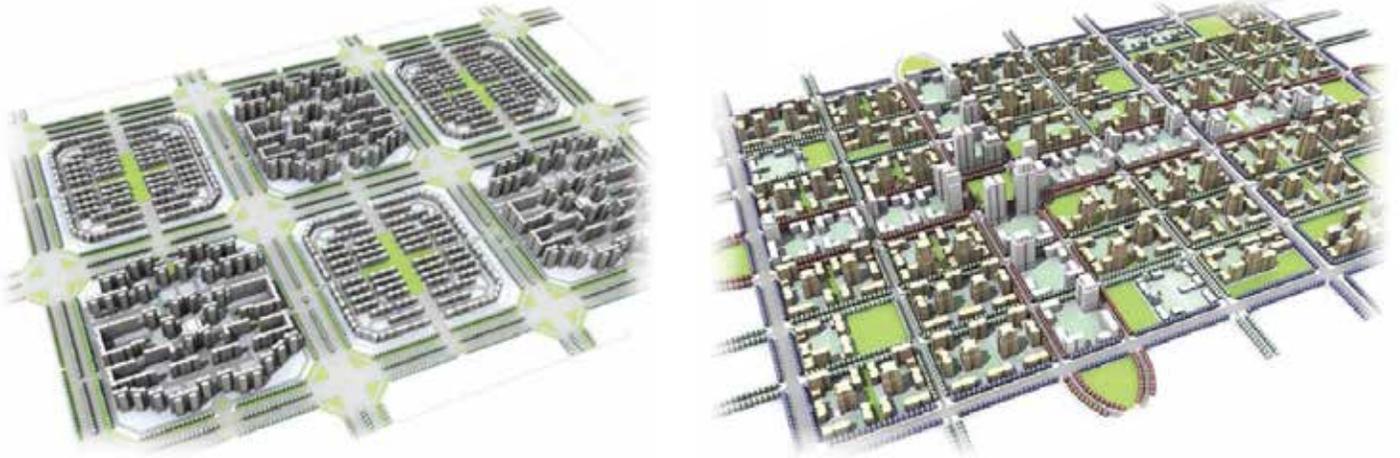


Source: Produced by the Urban Morphology and Complex Systems Institute for this report, based on satellite analysis and Chongqing Statistical Yearbook 2016.

Central Chongqing has expanded with a superblock pattern, which is an inefficient urban form that limits access to transit and jobs and affects social inclusiveness. Characterized by single-use zoning that separates residential and commercial areas, and by large blocks served by wide arterial streets, superblocks are designed to prioritize cars over

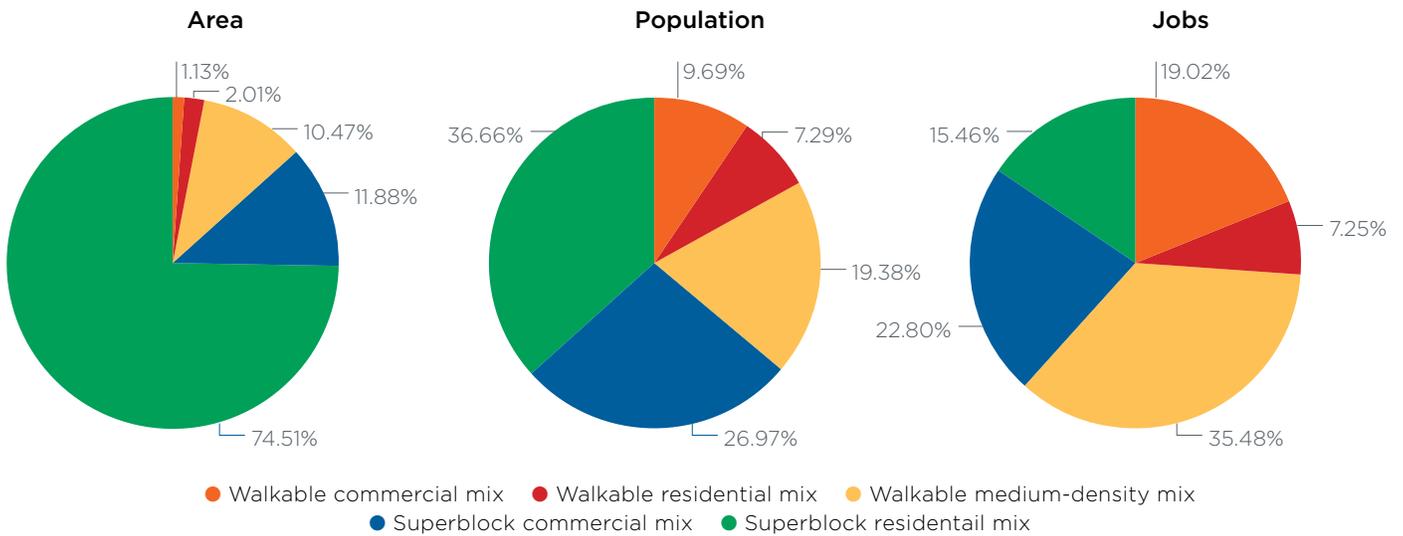
pedestrians (figure 8). This type of urban form has led to Chongqing’s growing fragmentation, vast expansion, and decreasing densities. Today, residential superblocks cover three-quarters of central Chongqing, despite housing only 36 percent of its population and providing only 15 percent of its jobs (figure 9).

FIGURE 8 Illustrative Diagrams Depicting the Urban Form of Superblocks (Left) and Walkable Development (Right)



Source: Produced by Calthorpe Associates for *Chongqing 2035: Urban Growth Scenario*.
 Note: The diagrams are at the same scale.

FIGURE 9 Share of Chongqing’s Urban Built-Up Area, Population, and Jobs in Different Urban Types



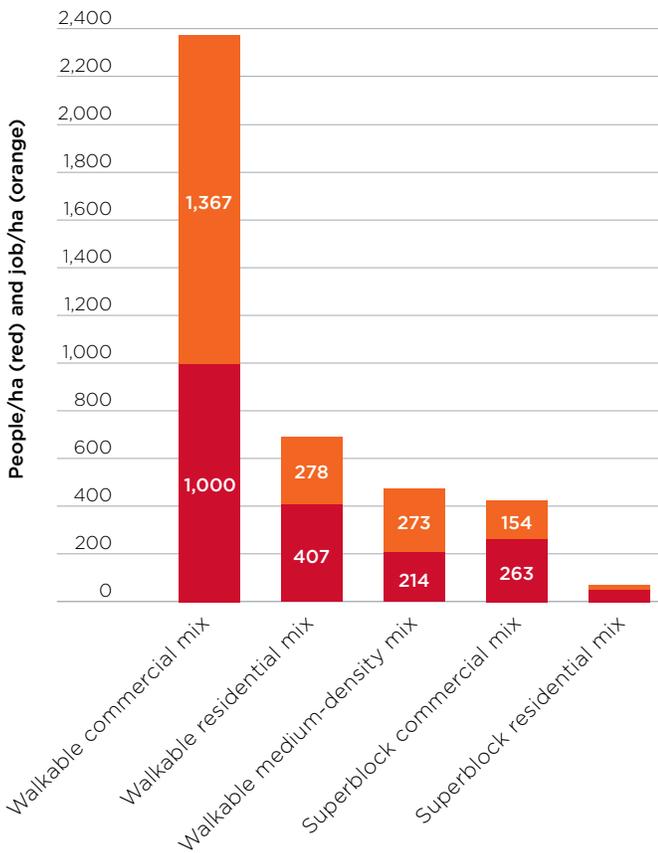
Source: Produced by the Urban Morphology and Complex Systems Institute for this report, based on the assessment made for *Chongqing 2035: Urban Growth Scenario*.

Compared to all other urban fabric types, superblocks are less efficient in terms of land consumption per inhabitant and per job. On average, human density, specifically for people and jobs, is more than six times higher in Chongqing’s walkable residential and commercial core neighborhoods than in its superblocks (figure 10). The lowest densities are found in residential superblocks, with only 5,700 people/km² and 1,660 jobs/km², which are well below central Chongqing’s average and about three times below the thresholds of efficient densities recommended by international organizations. Chongqing has an imbalance of densities, with very high densities—in particular for jobs—in its core walkable commercial mixed-use areas, and very low densities in its extension superblocks. As a result, 80 percent of central Chongqing’s residents are located in car-dependent areas with little or no pedestrian access to public transit—a figure well below global city benchmarks.¹¹ The job/resident ratio is unbalanced: there is a high concentration of

jobs in walkable commercial mix areas, which offer 1.36 jobs per resident but represent only 1.13 percent of the built-up land area and 9.69 percent of the population, while residential superblocks offer only 0.29 jobs per resident and include 36 percent of the population (figure 11). This has increased travel time between low-density residential areas and economic centers, thus contributing to traffic congestion. Policies should limit these imbalances so that central Chongqing can have a more balanced distribution of densities and activities across its urban forms.

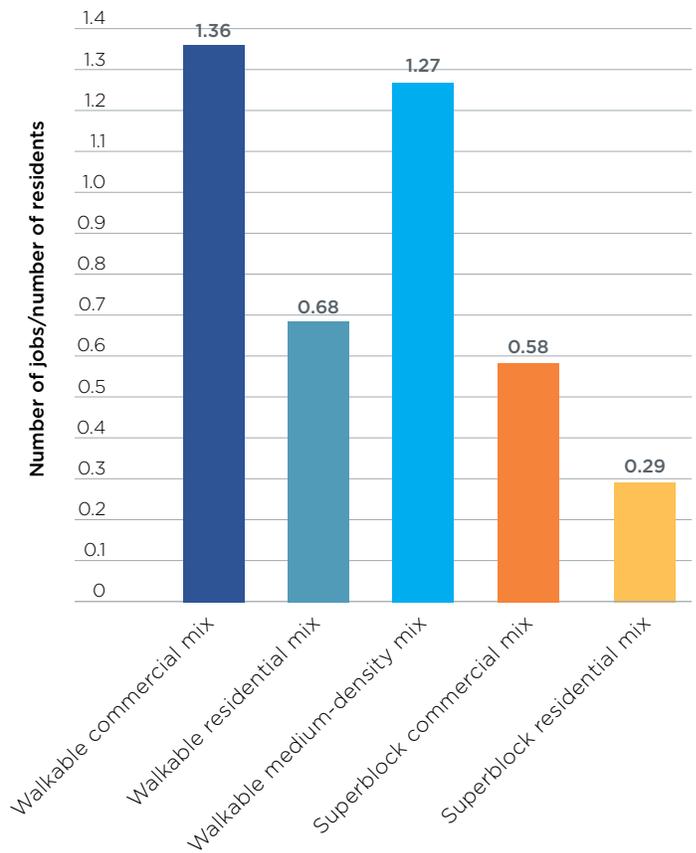
Moreover, superblocks are much less connected and less walkable than other urban forms in Chongqing, are inefficient in terms of economic density, and have higher infrastructure costs (figure 12). More street intersections in an urban area allow for many points where vehicles, cyclists, and pedestrians can move in different directions across the blocks, thus reducing connection distances and increasing urban interaction. Conversely, a coarse

FIGURE 10 People and Job Densities in Chongqing by Urban Form Type



● Population density (people/ha) ● Jobs density (jobs/ha)

FIGURE 11 Job/Resident Ratio in Chongqing by Urban Form Type

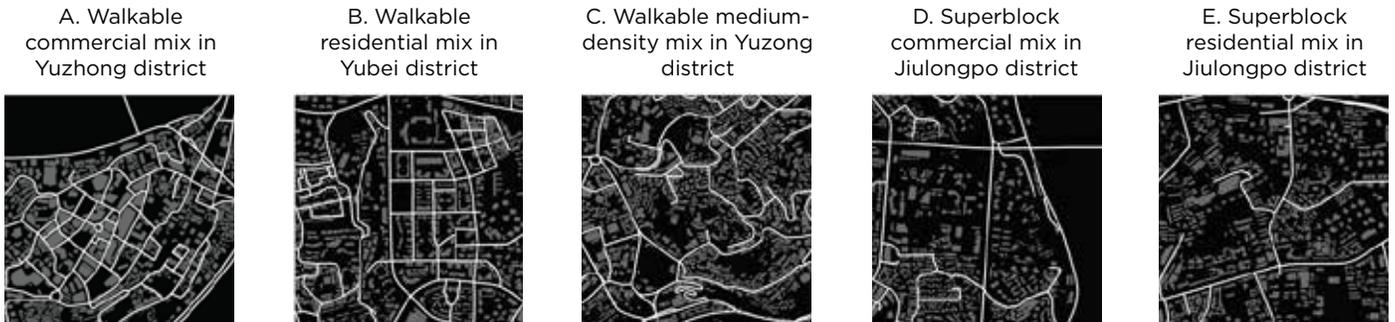


Source: Produced by the Urban Morphology and Complex Systems Institute for this report, based on the assessment made for *Chongqing 2035: Urban Growth Scenario*.

urban fabric is pedestrian-unfriendly and car-oriented. The density of intersections in Chongqing's superblocks drops below 10 and the length of streets falls to 5 km per km² when counting only those with public access. The average distance between intersections reaches 400 m in superblocks (figure 13).¹² Moreover, economic density is significantly lower—by about 16 times—in residential superblocks

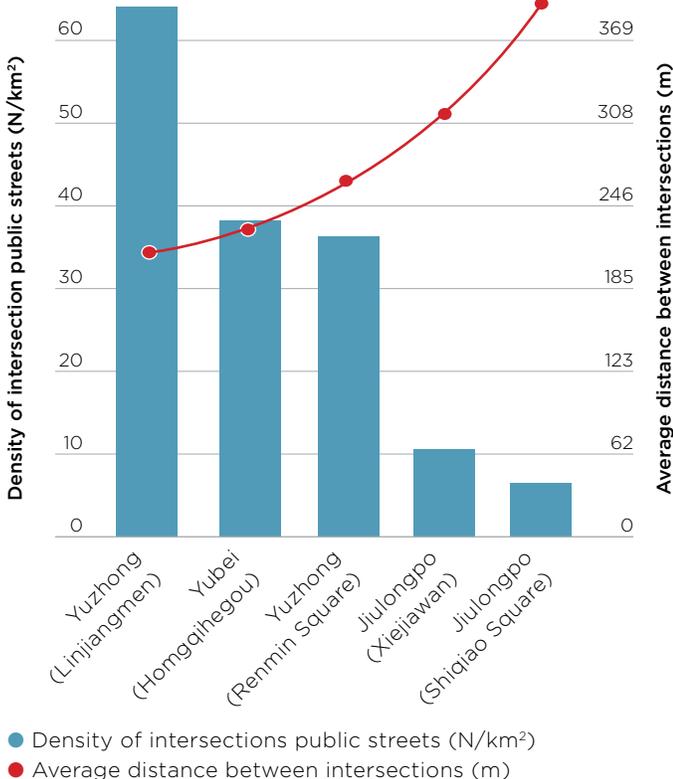
than in Chongqing's mixed-use walkable areas, and the cost of street infrastructure per unit of GDP can be 11 times as much (figure 14). To increase economic agglomeration and walkability while reducing infrastructure costs, Chongqing must transform its urban form to promote walkability and mixed use by retrofitting existing superblocks and planning future expansions with smaller blocks and diverse uses.

FIGURE 12 Chongqing's Urban Forms



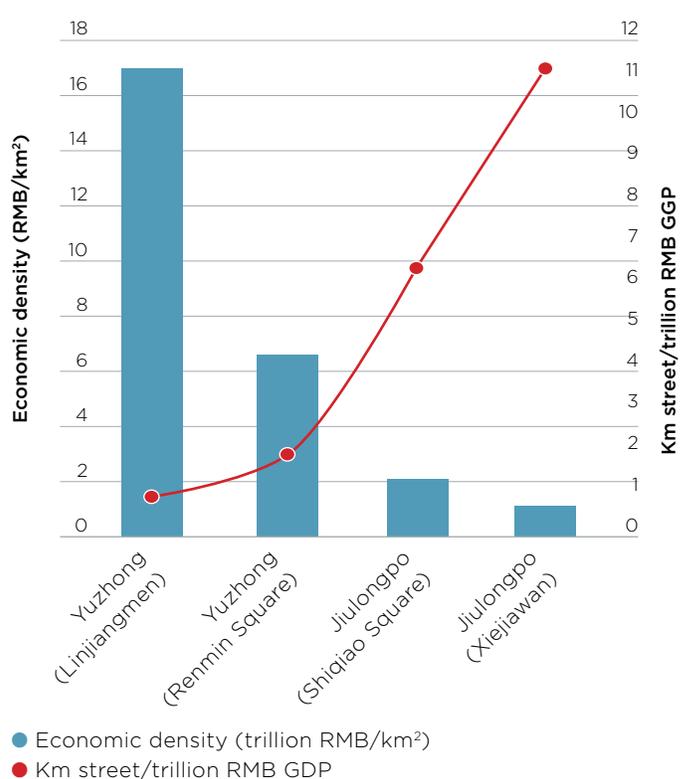
Source: Produced by China Sustainable Transportation Center (CSTC) for this report.

FIGURE 13 Density of Intersections and Average Distance between Intersections in Chongqing's Five Urban Form Types



Source: Produced by the Urban Morphology and Complex Systems Institute for this report.

FIGURE 14 Economic Density and Length of Streets Per Unit of GDP in Chongqing's Five Urban Form Types



Source: Based on information provided by China Sustainable Transportation Center (CSTC) and Chongqing Municipal Bureau of Statistics and NBS Survey Office in Chongqing 2016.

Chongqing's superblock-based expansion also has major environmental impacts and contributes to poor air quality with high carbon emissions.

Superblock expansion entails significant impacts on the energy embodied in infrastructure, energy use, and CO₂ emissions.¹³ Comparative studies in Jinan have demonstrated that households living in superblocks use twice the amount of energy for transportation and for the built environment as those living in any other Chinese urban form (Massachusetts Institute of Technology and Tsinghua University 2010). Superblock expansion has contributed to the high material intensity of Chongqing's economy and its high emissions. Construction projects account for three-quarters of capital growth, while one-third of capital investment has been invested in transportation infrastructure made necessary by the municipality's fragmented form. As a result, cement and steel production, which are more energy consuming and

emissions intense, have grown at the same pace as output value of construction. For example, aluminum production has grown twice faster than GDP. The urbanization patterns dominated by superblocks—associated with an economy based on heavy industry and an energy mix that comprises 75 percent coal and fossil fuels—mean that Chongqing Municipality's CO₂ emissions per unit of GDP are twice higher than those of Shanghai and Beijing. Air quality has deteriorated, with the average concentration of fine particulate matter well above WHO critical thresholds according to data from Chongqing, Beijing, and Shanghai Statistical Yearbooks for 2016. To reduce its high material, energy, and emissions footprint, and improve its air quality, Chongqing needs a more compact urban form based on smaller mixed-use blocks.

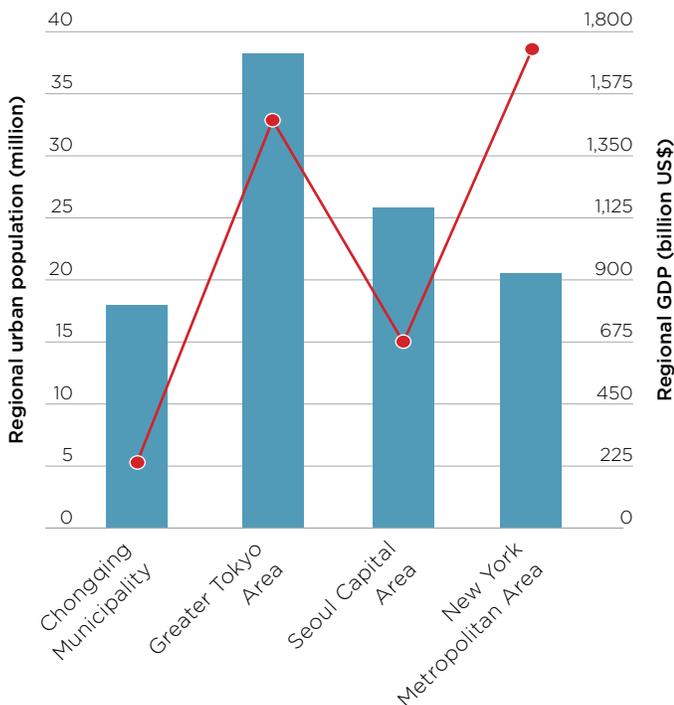
3. Benchmarking and Lessons from Global Cities

Municipality Level

Due to its sheer size and large rural population of 12 million, it is difficult to benchmark Chongqing Municipality against any other city. Moreover, its urban population of 17.83 million people is divided into central Chongqing, which has 7.22 million residents, and a number of smaller towns comprising 10.61 million people scattered across a vast territory. These small towns present, however, a built-up area and population size that can give a sense of scale compared to huge metropolitan regions. Chongqing Municipality's urban population is half that of the Greater Tokyo Area,¹⁴ two-thirds that of the Seoul Capital Area,¹⁵ and 90 percent that of the New York metropolitan area (figure 15).¹⁶

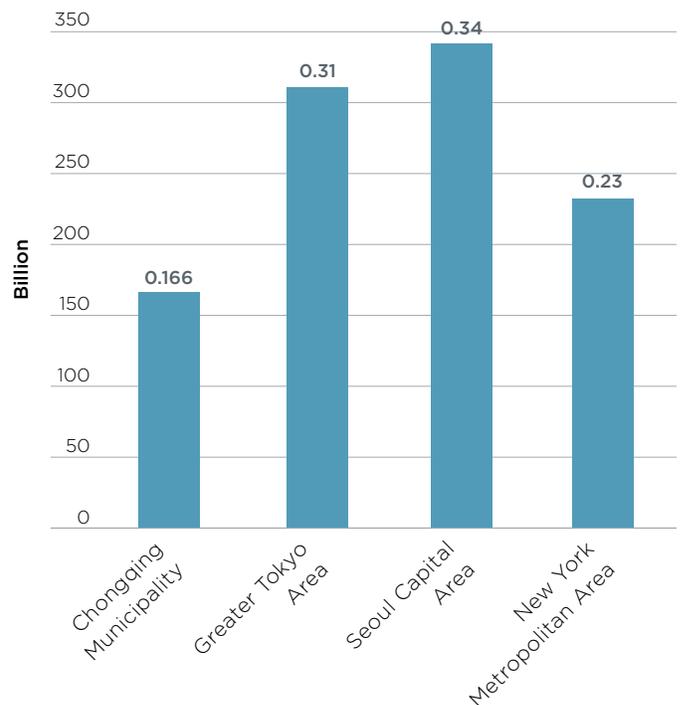
Comparing Chongqing Municipality to large metropolitan regions suggests that Chongqing needs to increase its spatial and economic integration beyond the central city boundaries by developing connectivity between central Chongqing and the 10 million people in other districts. Although comparing fully integrated functional urban regions such as the ones above is of limited value, some lessons can be derived from density indicators. The average urban population density of Chongqing at municipality scale is similar to that of the Seoul Capital Area at 11,880 people/km² in the built-up area and significantly higher than that of the Greater Tokyo Area at 8,062 people/km² (figure 16) (Angel, et al. 2016). However, Chongqing's economic agglomeration is much lower, and the insufficient

FIGURE 15 Chongqing Municipality's Urban Population Compared to Those of Large Metropolitan Regions



● Regional urban population (million)
● Regional GDP (billion US\$)

FIGURE 16 Chongqing Municipality's Economic Density Compared to Other Large Metropolitan Regions



● Regional GDP density (billion US\$/km² of built-up land)

Source: Produced by the Urban Morphology and Complex Systems Institute for this report, based on Chongqing Municipal Bureau of Statistics and NBS Survey Office in Chongqing 2016; New York, Seoul, and Tokyo departments of statistics for GDP; and Angel, et al. 2016.

agglomeration is exacerbated by the lack of connectivity between urban settlements outside the central city. Lessons from this benchmark are that the huge economies of global cities are supported by large fully integrated economic urban regions that constitute commuting zones and very large markets. These functional urban regions are economic giants. The Seoul Capital Area has half of Korea's population. The GDP of Tokyo is larger than Russia, the country with the biggest landmass in the world. In 2016, Russia's nominal GDP was less than 80 percent of Tokyo's, despite having a population four times greater than that of Tokyo.

Central Chongqing Level

With a population of 8.2 million and a built-up area of 545 km², **central Chongqing is comparable to the Big Six global cities in terms of built-up area and population.**

At this scale, international experience suggests that global cities reap agglomeration economies from high densities of people, jobs, and firms,

which are well connected by public transport. Their compact urban form contributes to the decoupling of economic growth from environmental impacts and resource use. Their unique and people-oriented urban fabrics enhance their livability and attractiveness.

Central Chongqing's density of 13,253 people/km² is lower than that of Asian global cities (figure 17). In terms of built-up area, its density is 36 percent that of Hong Kong SAR (37,100 people/km²) and 45 percent that of Seoul Special City (29,100 people/km²). Global cities control their land expansion and have policies to ensure the ongoing protection of land as a valuable asset. For example, London and Seoul have set a growth boundary while policies in Hong Kong, and Singapore have reduced the amount of land expansion for each new inhabitant to 40 m² and 38 m² respectively from 2000 to 2009 (figure 18). In contrast, central Chongqing has provided three times more land for each new inhabitant.¹⁷ Moreover, cities such as London, Brussels, Boston, Tokyo, Hamburg, and Nagoya have become denser as they have grown, and have returned to more concentrated

FIGURE 17 Density of Central Chongqing's Built-Up Area Compared to Asian Global Cities

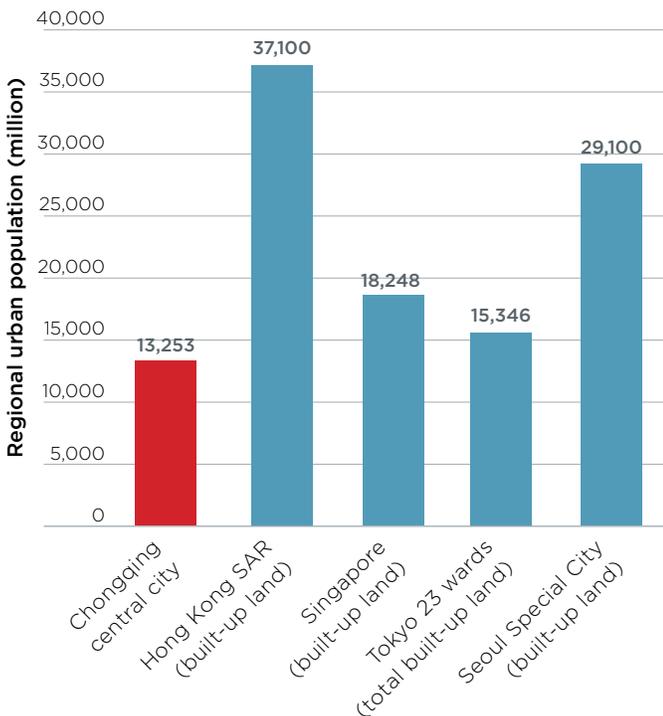
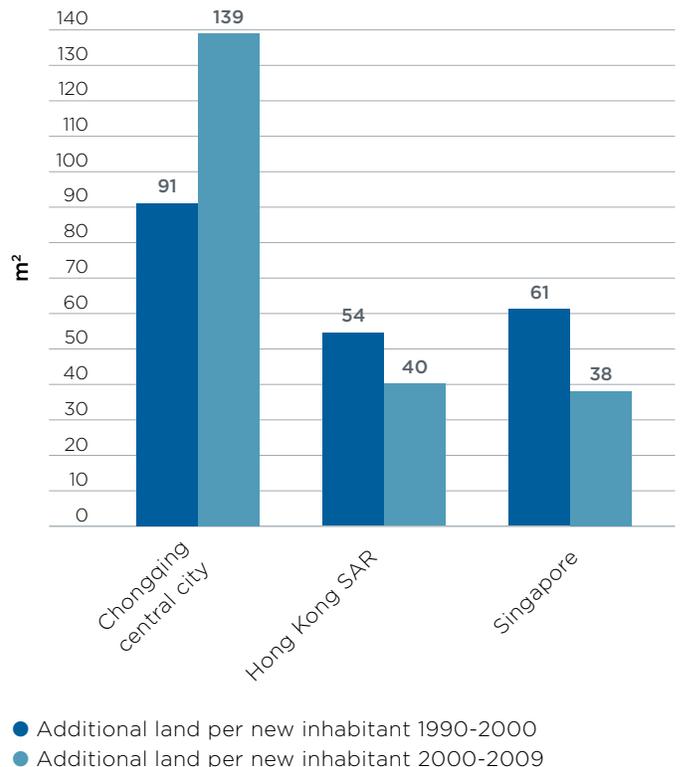
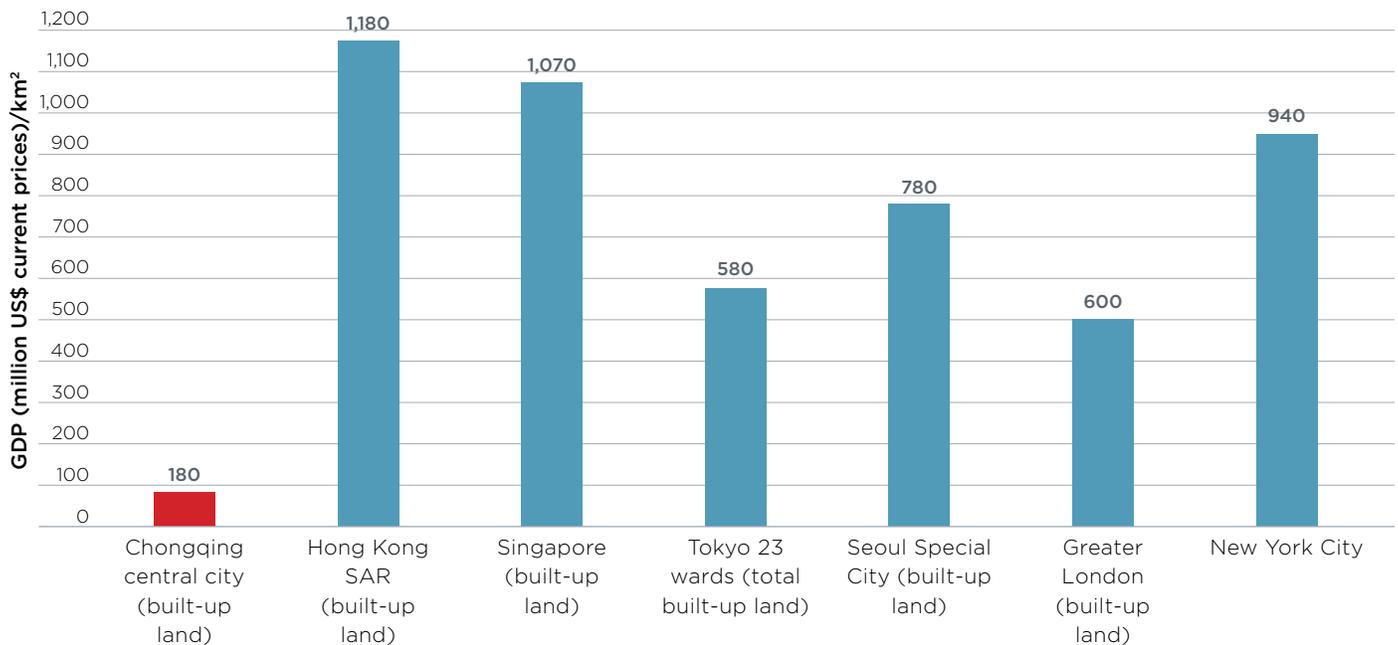


FIGURE 18 Additional Land Required Per Additional Urban Dweller in Central Chongqing Compared to Hong Kong SAR, and Singapore



Source: Produced by the Urban Morphology and Complex Systems Institute for this report, based on Chongqing Municipal Bureau of Statistics and NBS Survey Office in Chongqing 2016 and Angel, et al. 2016.

FIGURE 19 Central Chongqing's Economic Density on the Built-Up Area Compared to Global Cities

Source: Produced by the Urban Morphology and Complex Systems institute for this report, based on Angel, et al. 2016 and Government of Hong Kong Planning Department 2018.

forms (Floater et al. 2013, 2014). Since 2000, London's population growth has been concentrated within a radius of 10 km of its historic city center, closest to the highest peaks of employment density. Between 2004 and 2011, 53 percent of all newly constructed floor area in London was located within 500 m of the nearest rail or Underground station (Rode 2014).

Central Chongqing's low economic density does not currently allow the city to reap the full potential of economic agglomeration, that is created in global cities. Economic density, measured in terms of GDP/km², is about six times lower in central Chongqing than in Hong Kong SAR or Singapore. It is three to five times lower than in global cities such as Tokyo, Seoul, London, or New York (figure 19).

The average employment density in central Chongqing is less than one-third that of Hong Kong SAR. However, Chongqing has areas of high job densities that can contribute to fostering higher productivity. In limited areas such as Linjiangmen in Yuzhong district, employment density peaks at over 130,000 jobs/km². These peaks of high economic activity are similar to those found in global cities. For example, employment density peaks at 150,000 jobs/km² in the 3-km² City of London, and in New York's Midtown, while it peaks at 120,000 jobs/

km² in central Hong Kong SAR. This high density of jobs increases productivity. The City of London, represented by the Square Mile, accounts for only 0.2 percent of the Greater London area, but produces 14 percent of London's GDP and 3 percent of the UK's total GDP, while its productivity is almost three times the national average (Centre for Cities and Cambridge Econometrics 2015). Similarly, higher agglomeration of job density in Yuzhong district fosters higher economic productivity and a GDP per capita three times higher than the average of central Chongqing.

Central Chongqing's employment opportunities are less accessible by public transit than in global cities. Global cities maximize public transport access, which enables people to easily reach other people, goods, and ideas. For example, the dense provision of subway infrastructure in New York City has created a highly efficient urban form with an integrated labor market: 1.35 million jobs can be reached with a 30-minute transit commute including walking time, and employers also have access to a labor market comprising 700,000 workers within a 30-minute transit commute (Salat and Ollivier 2017). This accessibility peaks in Manhattan neighborhoods, where people can reach more than 4 million jobs in a 1-hour transit window (Kaufman, et al. 2015). This is

made possible because half of New York’s population and two-thirds of its jobs are within walking distance of a subway station. London’s accessibility is similar, and that of Hong Kong SAR is even higher, with three-quarters of the population and 84 percent of jobs located within walking distance of mass transit (Rode et al. 2013). In contrast, only 20 percent of the resident population and one-third of jobs are within walking distance of an urban rail or transit station in Chongqing (figure 20).¹⁸

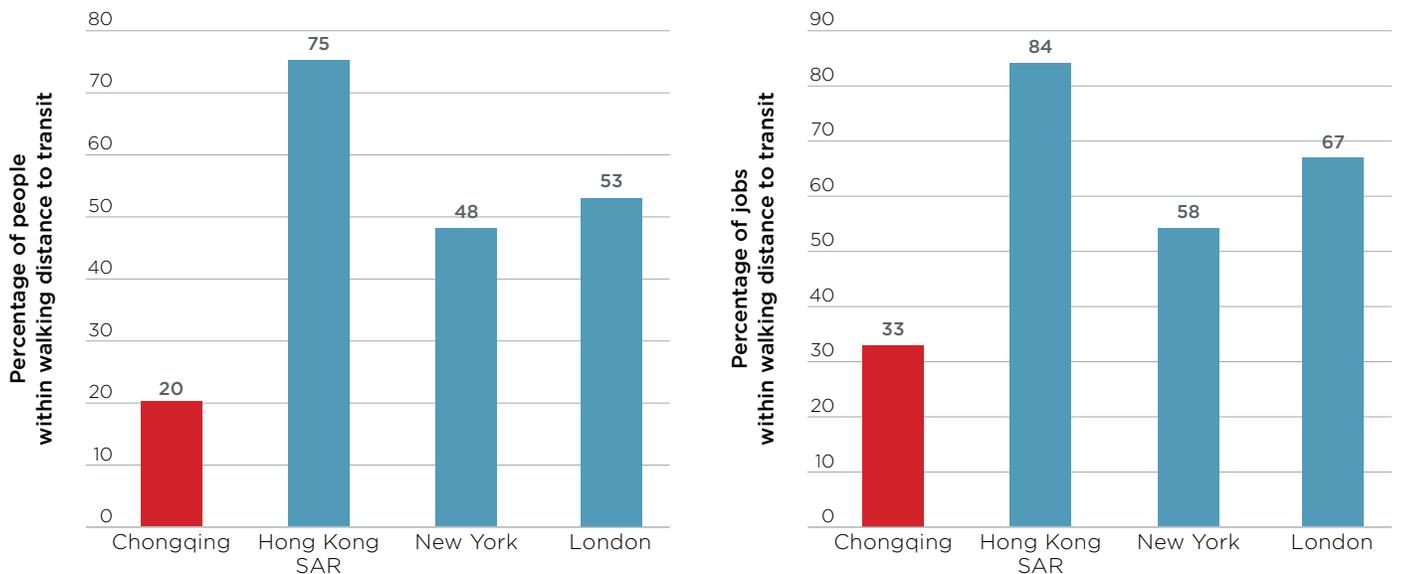
Central Chongqing’s superblock patterns present a sharp contrast to the fine-grained urban form of global cities. Global cities have highly livable urban environments with mixed-use development, vibrant and people-centered streets, and a fine-grained urban fabric. This report benchmarks Chongqing’s dominant urban form—residential and commercial superblocks—to typical urban fabrics in global cities at the same scale of 1 square mile. The average block size in Tokyo Nihonbashi (0.26 ha) is over 20 times smaller than in Chongqing Jiulongpo (5.7 ha). The urban fabric of global cities is made of small blocks: 0.57 ha in Paris Louvre, 0.7 ha in the City of London, 0.65 ha in Lower Manhattan, 0.34 ha in central Hong Kong SAR, 0.9 ha in Singapore, and 0.36 ha in Seoul. Urban environments in global cities are highly connected by dense street patterns: there are 456 street intersections/km² in central Hong Kong SAR, 386 in Tokyo Nihonbashi, 333 in Seoul, 242 in Paris, and 188 in London (figure 21). This helps to create

pedestrian-friendly and walkable environments.

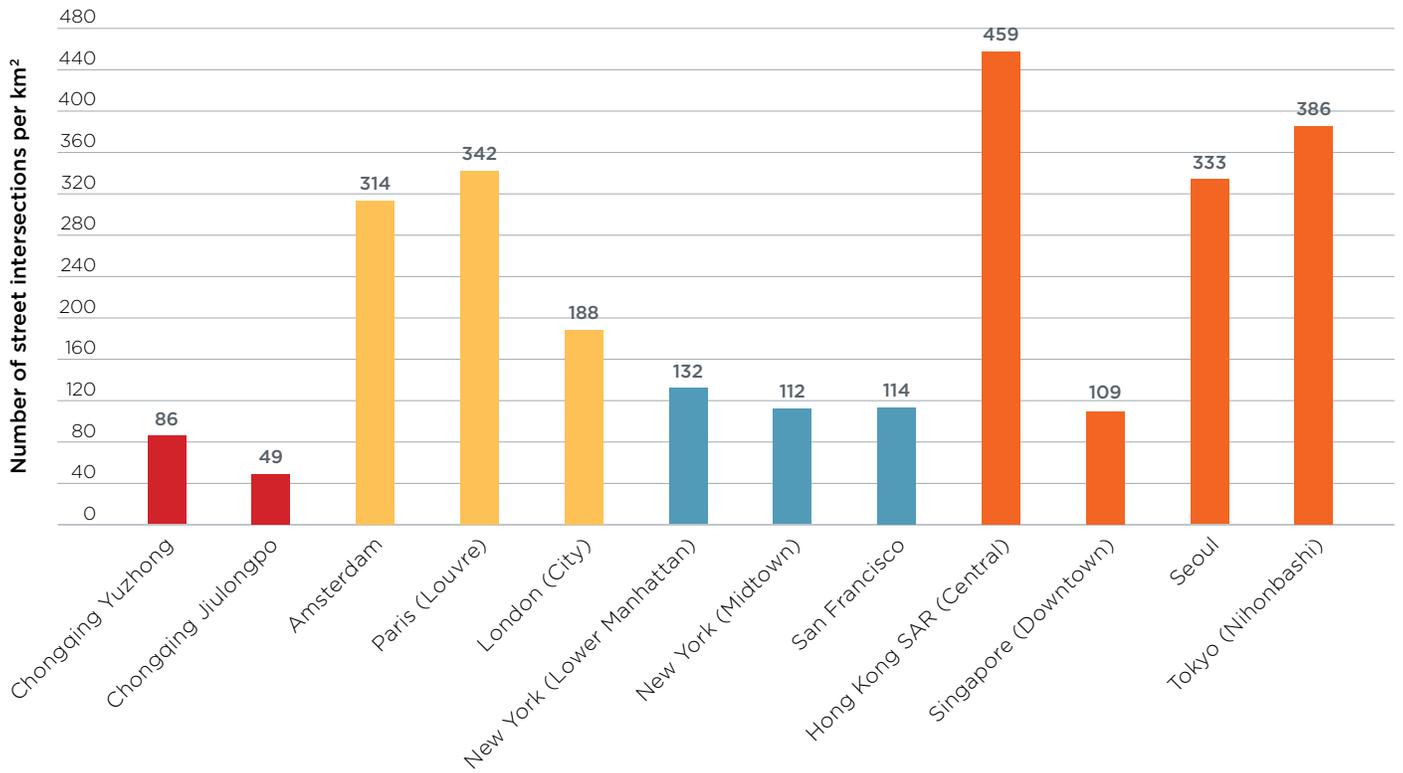
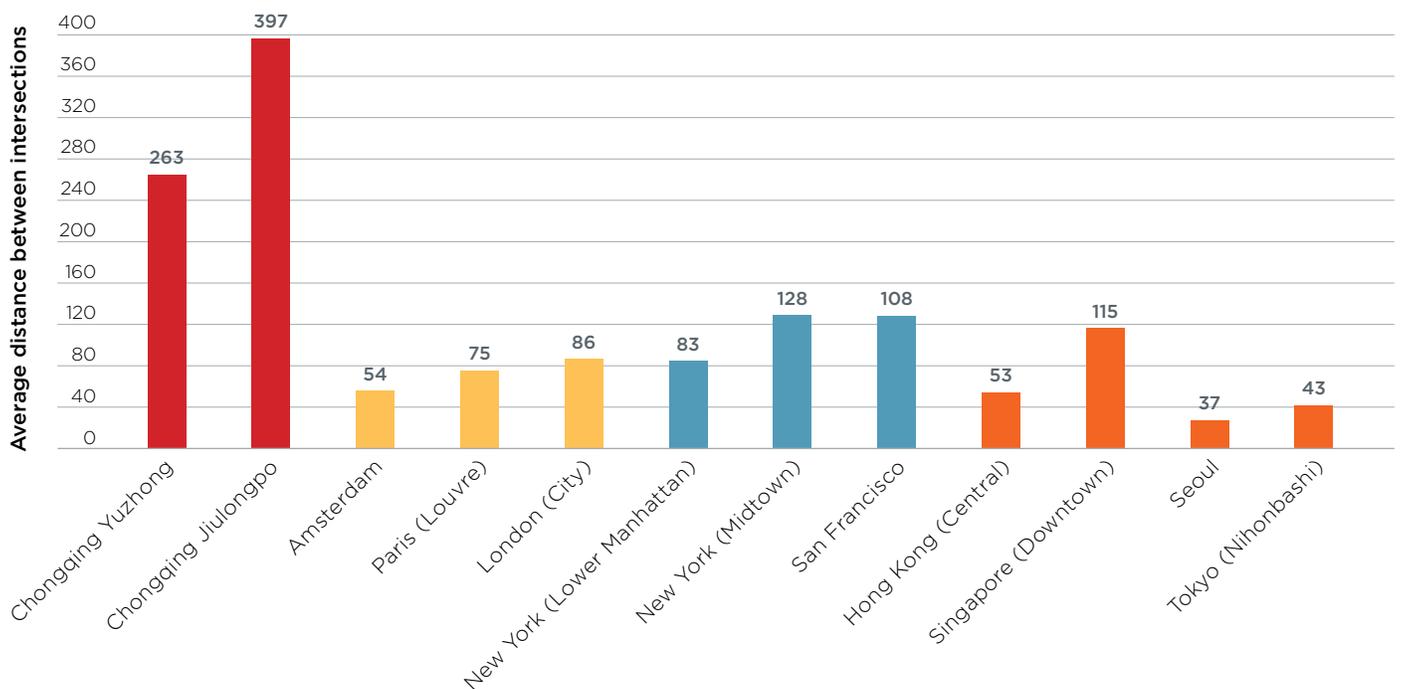
The compact urban form of global cities reduces their environmental impacts. Tokyo, for example, has achieved the world’s highest energy productivity (the ratio of energy consumption to value added)—nearly three times the global average—through a combination of a compact urban form, the alignment of densities with the most extensive urban rail network in the world,¹⁹ stringent national regulations on emissions standards, a comprehensive energy policy, and investments in renewable energy. Japan has succeeded in reaching an absolute decoupling in its industry and service sectors as well.²⁰ Hong Kong SAR’s compact development model has also led to a decoupling of economic growth and per capita consumption of hydrocarbon resources. Its gross value added per capita increased by 50 percent between 1993 and 2011, while per capita CO₂ emissions and per capita gasoline consumption fell by about 10 percent in the same period (Rode et al. 2013).

Lessons learned from global cities suggest that compact urban forms and small block patterns have many positive effects. These include increased productivity due to agglomeration-scale economies and innovation due to the higher number of interactions and exchange of knowledge; the reduction of commuting time and transportation costs due to shorter trips; resource and infrastructure cost savings and a smaller ecological footprint

FIGURE 20 Share of Population (Left) and Jobs (Right) Within Walking Distance of Public Transport (15-Minute Walk)



Source: Produced by the Urban Morphology and Complex Systems institute for this report, based on information provided by Calthorpe Associates and Rode et al. 2013.

FIGURE 21 Intersection Density in Chongqing Yuzhong and Jiulongpo Compared to Selected World Cities**FIGURE 22** Average Distance between Intersections in Chongqing Yuzhong and Jiulongpo Compared to Selected World Cities

Source: Produced by the Urban Morphology and Complex Systems institute for this report, based on Jacobs 1993; Salat, Labbé, and Nowacki 2011, UN-Habitat 2013; and the information provided by CSTC.

due to lower energy and land use (Ahlfedlt and Pietrostefani 2017). Finally, closer proximity increases the opportunities for accessible employment, in particular for the urban poor, which contributes to

a more inclusive society, while the development of fine-grained urban fabrics creates more livable and attractive cities for the young and talented workforce.

BOX 3 Lessons from Singapore, Hong Kong SAR, Tokyo, and Seoul for a Transit-Oriented Polycentric Urban Form

Asian global cities, such as Tokyo, Seoul, Singapore, and Hong Kong SAR, have successfully integrated transit infrastructure development and land use for decades. This integration, complemented by a high transit modal share, has resulted in highly efficient urban forms, both for creating wealth and for reducing the demand on resources and energy while improving congestion and air quality. These cities share the following characteristics:

1. Compact and dense urban core and radial public transport routes that link the core to new growth centers
2. High-density in terms of population, jobs, and economic density (GDP/km²)
3. Polycentric urban structure

Singapore

As early as 1991, the revised Singapore Concept Plan emphasized sustainable economic growth and proposed the idea of decentralization. The city was planned to be surrounded by several regional centers, sub-centers, and fringe centers. This policy has been gradually implemented since then.

Hong Kong SAR

The development of the Hong Kong SAR subway led to the emergence of rail towns, for example along 31.3-km Tung Chung Line, which links the city to Tung Chung and the airport.

Tokyo

Tokyo's polycentric urban structure results from the Yamanote rail line encircling Tokyo's core area, which is about the size and shape of Manhattan, with major terminals and high-rise office

developments at or near Marunouchi, Shibuya, Shinjuku, Shinagawa, Ikebukuro, and Ueno stations. At a larger scale, the polycentric urban structure also results from the development of new towns by private railway operators along corridors radiating from the Yamanote Line, such as the Den-en Toshi Line starting from Shibuya and extending over 31.5 km with a total of 27 stations (figures 23, 24, 25, 26).

Seoul

Transportation has shaped Seoul's city form. Its grid-like subway network has fostered the emergence of sub-centers such as Gangnam-gu. Seoul Basic City Plan 2020 suggests a spatial restructuring plan to make Seoul Special City a multi-core distributed metropolis that is spatially divided into five neighborhood areas for more balanced living environments among different areas. At the regional scale, high-density compact new towns connected to Seoul by transit have been developed. Seoul has also preserved its unique identity through its inclusion of a landscape of protected hills. Forty percent of the city center is mostly undeveloped areas and natural parks. The skillful and highly differentiated use of floor area ratios (FARs) and land use ensures residents live in comfort despite its high density. Density is unevenly distributed, with spikes around City Hall and very quiet and low-density neighborhoods such as Bukcheon. The hyper-density with high FARs is correlated to the density of subway hubs in the center. Outside Seoul, new towns in highly dense urban forms are linked to the city with high-speed trains (figure 27).

FIGURE 23 The High Density of Stations in Tokyo's City Center as Defined by the Yamanote Line

The Yamanote Line is 34.5 km and encircles a land area about the size and shape of Manhattan. It ensures a 10-minute-walk accessibility to everything in central Tokyo and most of its 23 wards (622 km²).

Sources: Sakaki 2017. ©Shige Sakaki. Reproduced with permission; further permission required for reuse.

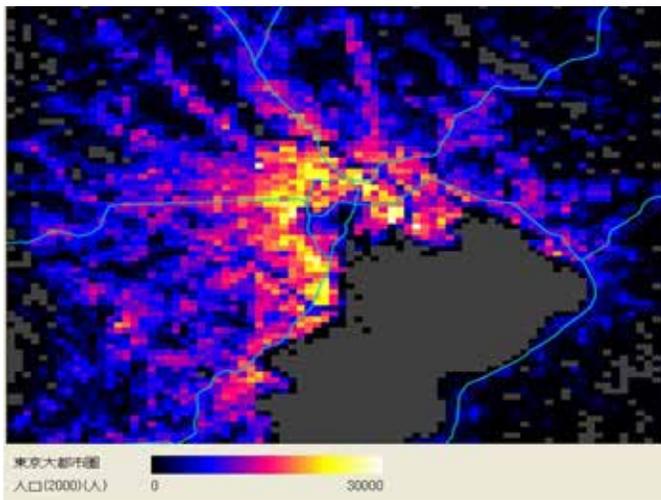
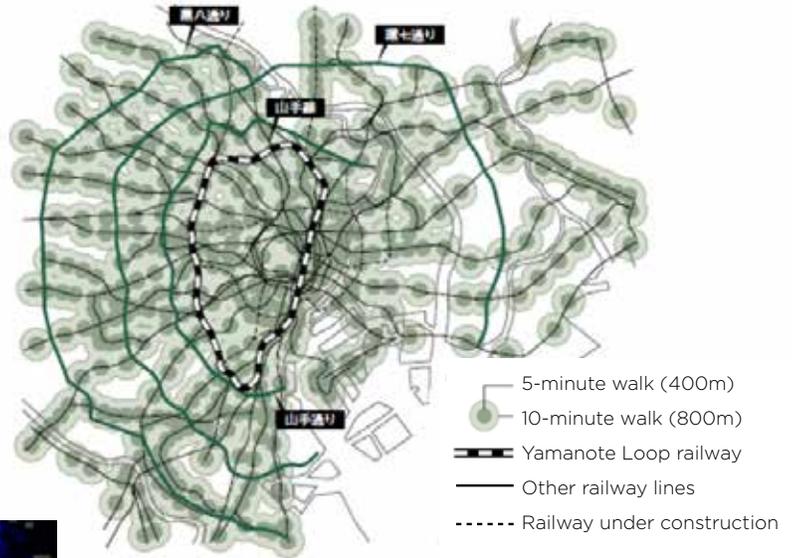


FIGURE 24 Residential Densities in Tokyo

The residential densities in Tokyo follow patterns of transit accessibility and transit coverage, with densities of 30,000 people/km² within and around the Yamanote Line where transit coverage and centrality are the highest. Density remains high along transit corridors and levels of density match transit accessibility.

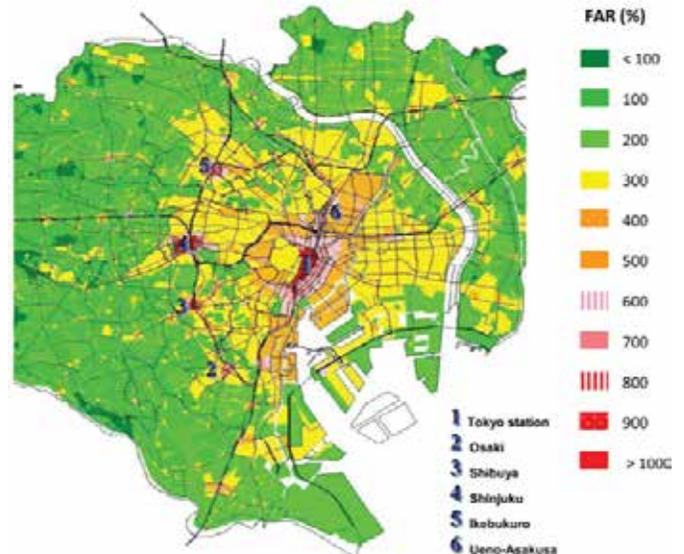
Sources: Ogata 2011. © Noboru Ogata. Reproduced with permission; further permission required for reuse.

FIGURE 25 High Levels of Centrality in Tokyo Concentrated along the Yamanote Line



Sources: Chorus and Bertolini 2011. © Paul Chorus and Luca Bertolini. Reproduced with permission; further permission required for reuse.

FIGURE 26 Tokyo Zoning Map with High FARs along the Yamanote Line

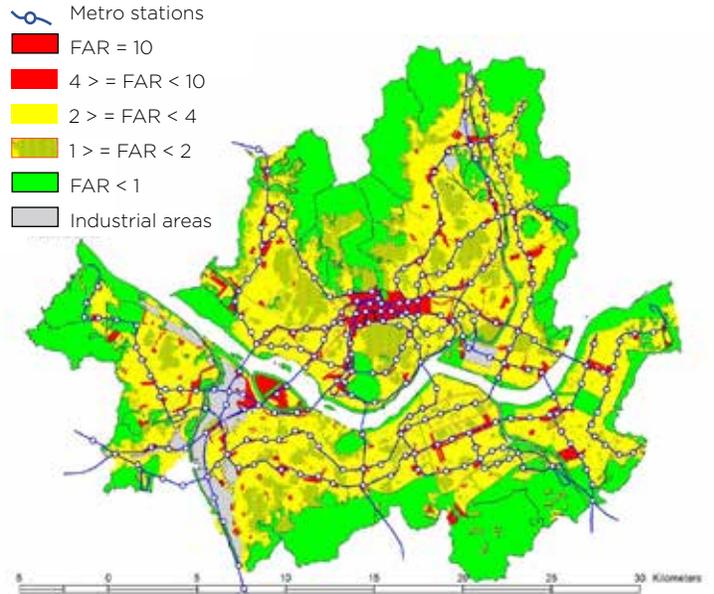


Sources: Chorus and Bertolini 2016, drawing on original source from the Tokyo Metropolitan Government. © Paul Chorus and Luca Bertolini. Reproduced with permission; further permission required for reuse.

FIGURE 27 Using Higher FARs Values to Encourage High-Density Development around Major Transit Nodes in Seoul

Seoul’s zoning regulations set floor area ratios as high as 10 for commercial uses around the most connected and central transit stations, 2-4 for mixed residential and business areas, and 1-2 for residential uses. Uses are defined with fine granularity, depending on the proximity and importance of transit stations. The result is a varied city in which small residential neighborhoods abut thriving business districts and higher FARs (indicated in red) are allowed near metro stations (indicated with blue circles).

Sources: Bertaud 2008. © Alain Bertaud. Reproduced with permission; further permission required for reuse.



4. Payoffs to Successful Spatial Planning Are Large:

Comparing Two Urban Growth Scenarios for Central Chongqing

To highlight the stakes of getting spatial policy decisions right, two different urban growth scenarios were modeled for central Chongqing:

a Trend scenario, in which current patterns of development are extrapolated into the future, in particular the concentration of job growth in the urban core and the development of housing and single-use superblocks in the core-adjacent areas; and a Compact Growth scenario, in which development leads to a polycentric regional structure created through focused, walkable, mixed-use development around existing and planned transit nodes.²¹ Implementing the Compact Growth scenario

would reverse the development pattern of the past two decades by ensuring that nearly all new housing and over half of new jobs would be allocated to walkable areas. Occurring largely in the core-adjacent area, this projected new growth represents an opportunity for Chongqing to reinforce and expand its unique character through the definition of a cohesive structure of new communities. In contrast, the baseline Trend scenario allocates most new housing to superblocks. Figure 28 and figure 29 compare population and employment growth by place type in the two scenarios.

FIGURE 28 New Population Growth by Urban Form Type

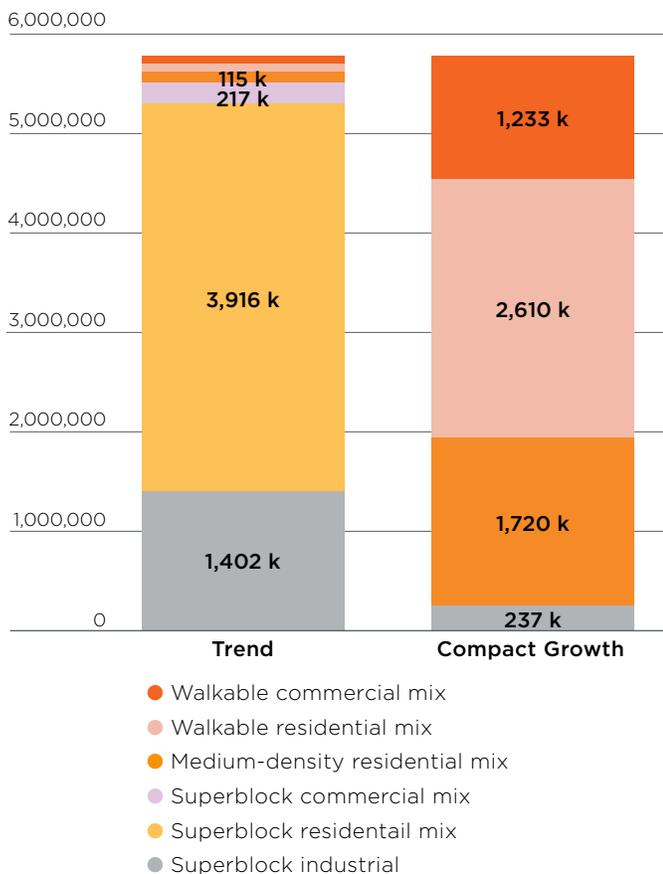
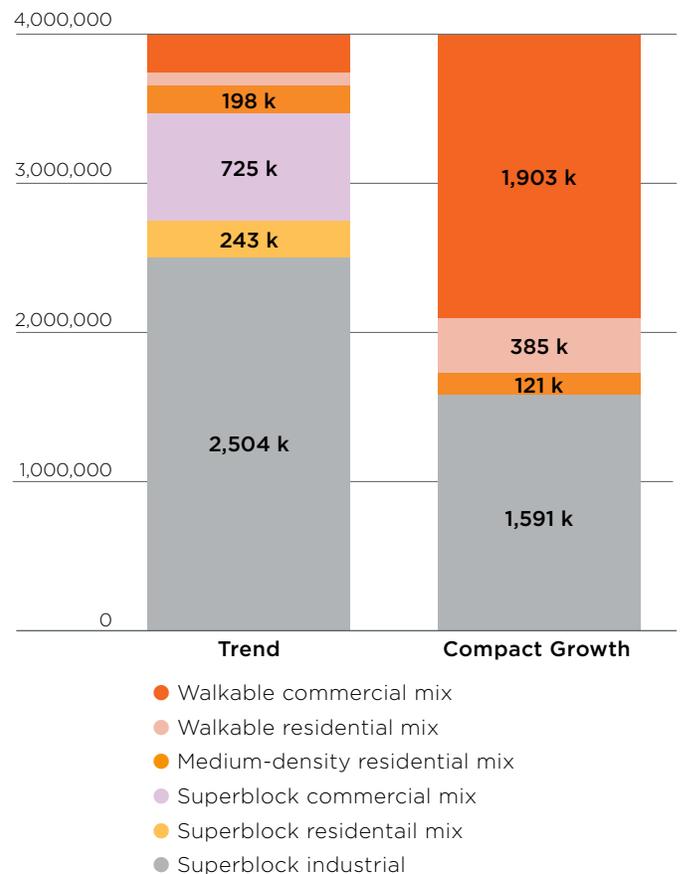


FIGURE 29 Job Growth by Urban Form Type



Source: Produced by Calthorpe Associates for Chongqing 2035: Urban Growth Scenarios.

The modeling results are clear: land use, urban livability, household expenditure, infrastructure costs, and environmental sustainability could be greatly improved with compact growth. In the Compact Growth scenario for central Chongqing:

- **About 200 km² of land is saved**, preserving a valuable asset for future expansion beyond 2035, and increasing economic density, agglomeration, and productivity (figure 30).
- **Cumulated expenditure in infrastructure²² to 2035 is reduced by 30 percent**, achieving RMB 34 billion in savings, and allowing the redeployment of public expenditure to R&D to improve competitiveness and to the extension of social services, such as education and health (figure 31).
- **Chongqing is more affordable.** Household costs for transportation and home energy are 32

percent lower, achieving an annual savings of RMB 5,100 per household, thus enhancing inclusiveness (figure 32).

- **Job distribution across central Chongqing is more balanced**, ensuring a better access to local jobs and reducing commuting congestion and costs (figure 33).
- **Central Chongqing is significantly more walkable.** More than half of the population and jobs are located in walkable areas instead of only less than 15 percent in the Trend scenario (figure 34).
- **Central Chongqing is less car-dependent.** There is a reduction in congestion and an increase in accessibility to jobs with affordable transportation. Mode share of walking and public transport increases by 9 percentage points in the compact growth scenario compared with the trend scenario (figure 35).

FIGURE 30 New Greenfield Land Consumption

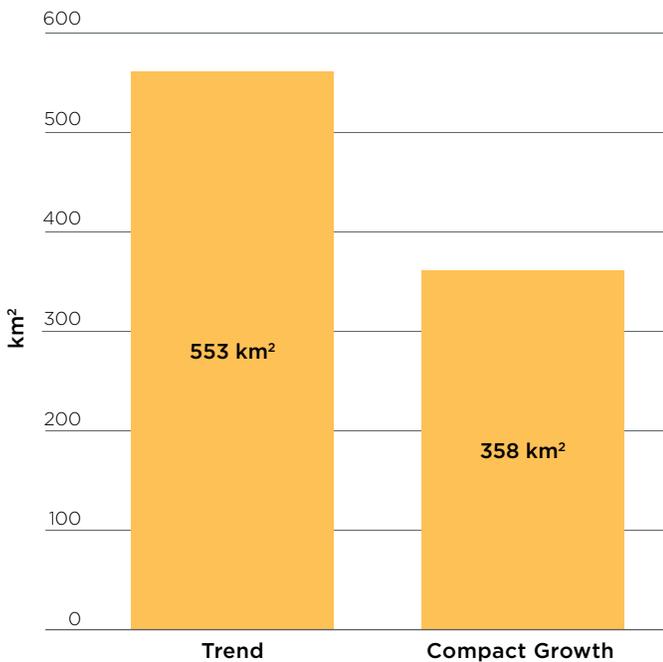
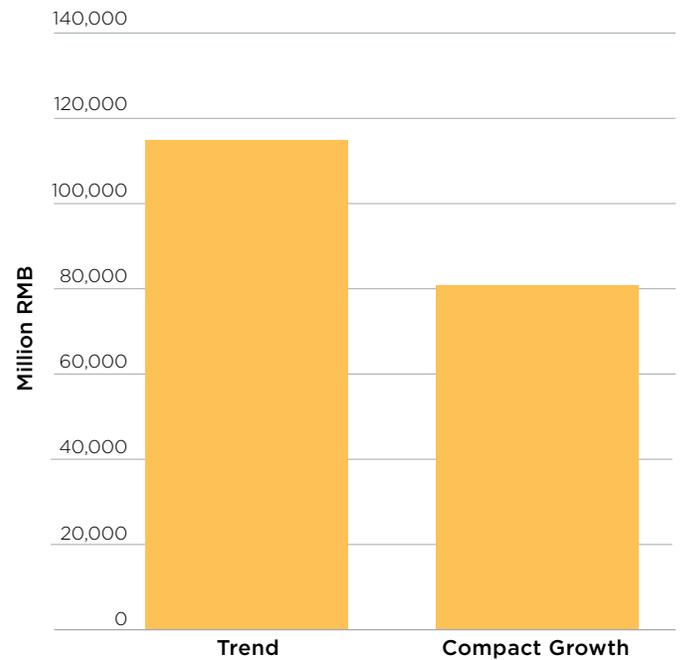


FIGURE 31 Cumulative Infrastructure Costs to 2035



Source: Produced by Calthorpe Associates for *Chongqing 2035: Urban Growth Scenarios*.

FIGURE 32 Annual Household Driving and Residential Energy Costs in 2035

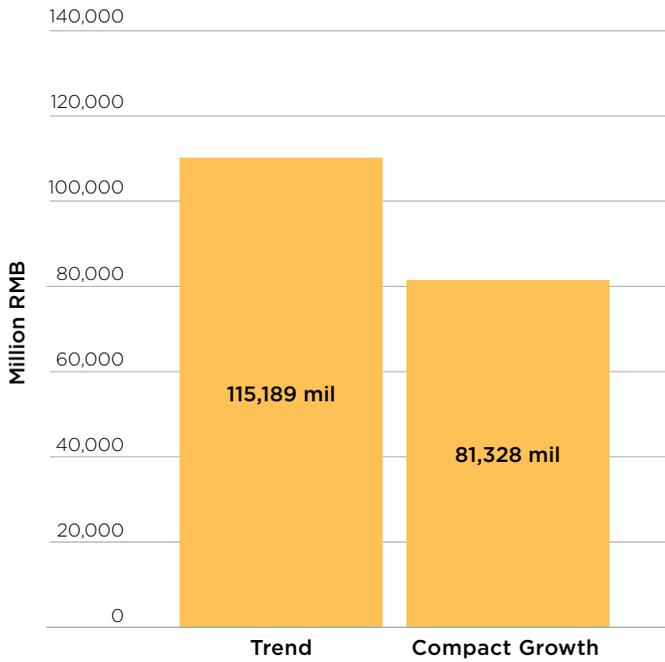
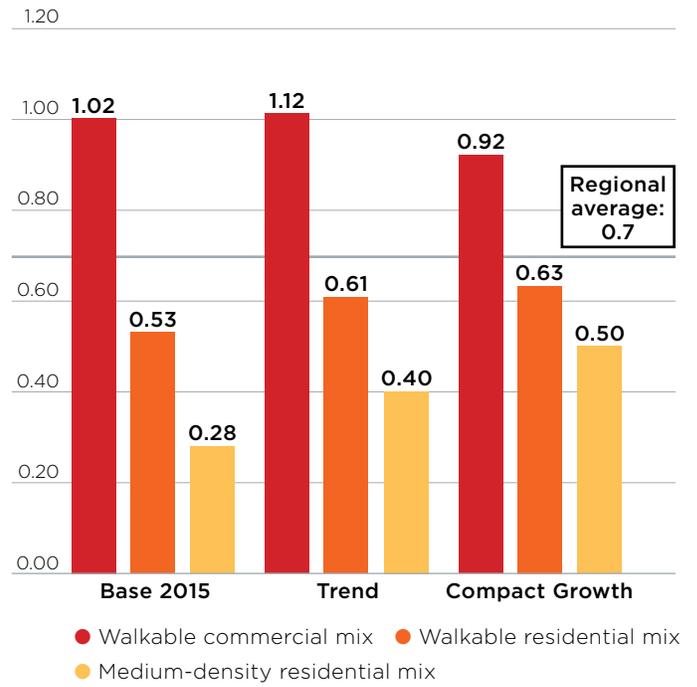


FIGURE 33 Jobs/Population Ratio in 2035



Source: Produced by Calthorpe Associates for *Chongqing 2035: Urban Growth Scenarios*.

FIGURE 34 New Population and Jobs in Walkable Transit-Oriented Development Area

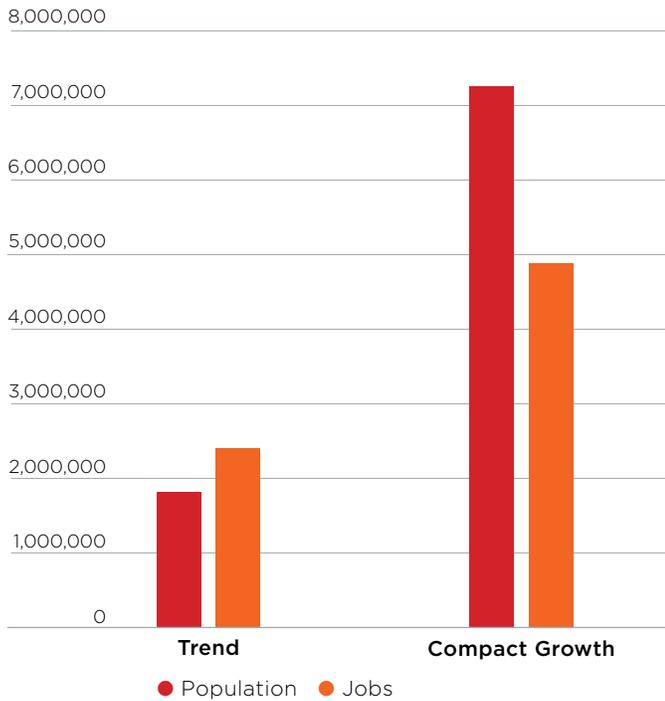
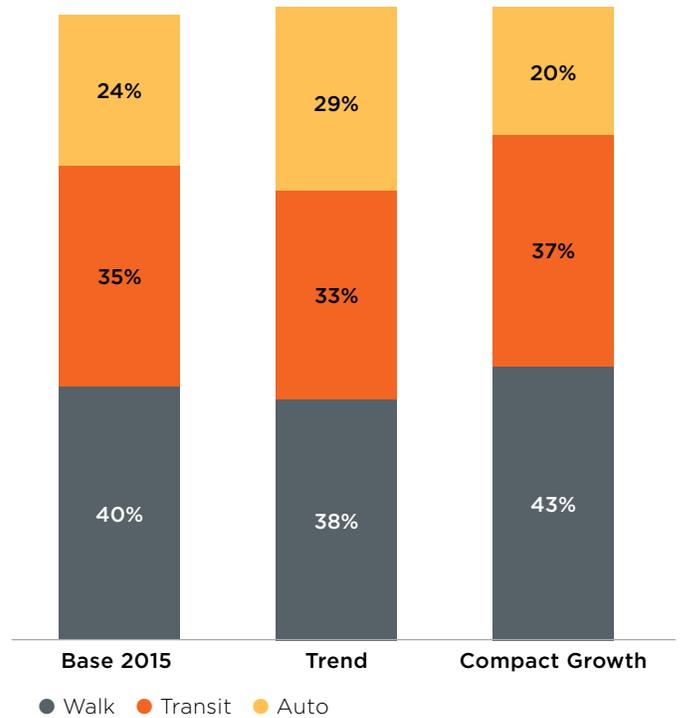


FIGURE 35 Transportation Mode Share



Source: Produced by Calthorpe Associates for *Chongqing 2035: Urban Growth Scenarios*.

FIGURE 36 Annual Auto VKT, 2035



FIGURE 37 Annual Auto GHG, 2035

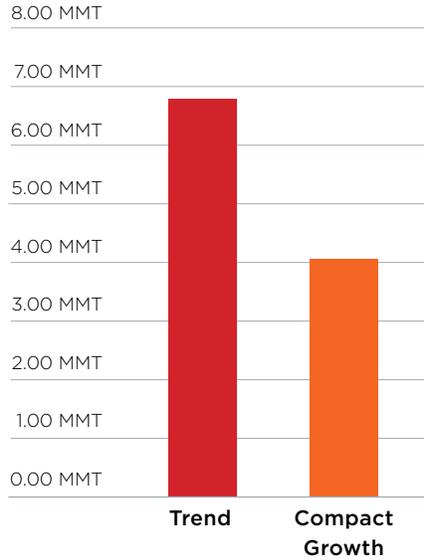
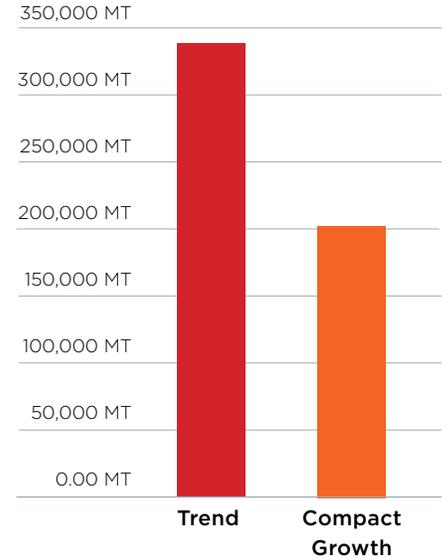


FIGURE 38 Annual Auto Air Pollutant Emissions, 2035



Source: Produced by Calthorpe Associates for *Chongqing 2035: Urban Growth Scenarios*.

Note: VKT = vehicle kilometers traveled; GHG = greenhouse gas.

The modeling exercise demonstrates that successfully implementing compact growth, transit-oriented development, and new livable neighborhood planning and design can make a

major contribution to Chongqing’s Vision 2035.

The following section highlights three key spatial transformations that are necessary for central Chongqing to pursue compact growth.

5. Recommendations: Chongqing's Spatial Transformation

Further urbanization in Chongqing will act as a powerful driver of growth but entails high risks if current trends continue into the future. By 2035, Chongqing's urban population is likely to grow by 5.8 million— a number equivalent to the present population of Singapore.²³ As these new residents are absorbed, Chongqing's spatial planning needs to encourage the development of a compact urban form that takes into account land use, transportation planning, economic density, and neighborhood livability with density, diversity, and small block design. **Three transformations** are needed to achieve this: compact growth, transit-oriented development, and livable neighborhood planning and design.

Spatial transformation I

Pursue compact growth to reduce land consumption and increase economic density

This transformation points to curbing Chongqing's excessive land consumption and addresses the risks of land shortage if current land use patterns continue into the future. It also increases central Chongqing's economic agglomeration and, as a result, enables productivity gains. It includes the following actions:

A. Manage land as an asset

- **Develop by infill rather than by rural land conversion.** Rather than filling all designated developable area in Chongqing's present master plan, compact growth would first consider the infill capacity of existing urban areas and limit expansion beyond it. This would curb unsustainable trends in land conversion. For example, 69 percent of Singapore's growth and 50 percent of Hong Kong SAR's growth requirements between 2002 and 2013 have been realized by infill, which has allowed these two cities to contain their land expansion to less than 50 m² for each new inhabitant (Angel, et al. 2016).

- **Manage land with a fine granularity.** This can be done by (1) assessing and designating redevelopment sites based on minimum density and economic development needs; (2) aligning floor area ratios with transit accessibility to incentivize development near new subway lines; and (3) increasing the granularity of land markets with smaller parcels that can be further redeveloped based on the market's needs.
- **Consider containing urban expansion with an urban growth boundary.** When managed with flexibility, urban growth boundaries (UGBs), such as those used in London and Seoul, can be an effective planning tool for achieving compact development. The boundary should encompass enough land to accommodate future growth and incorporate suitable development areas so that it has no inflationary impact on land and housing prices. A UGB for Chongqing would provide a strong foundation for prioritizing infill in those areas mostly in the core that are already urbanized; and it would contain greenfield growth throughout the core-adjacent and extension areas, where the pressure to convert agricultural land is high due to abundant land resources and high resettlement costs in developed areas.

B. Increase economic density

To support its economic transformation and move up the industrial value chains, Chongqing needs to significantly increase its economic density to reap productivity gains derived from agglomeration. A project which has good potential as an example is the Liangjiang New Area in the northern section of the core-adjacent area that, if planned well, could accommodate a significant amount of the region's projected growth and potentially become a new engine of growth for the city (box 4).

BOX 4 Liangjiang New Area

Established in 2010 and located in central Chongqing, Liangjiang New Area is the third Chinese state-level development zone. With a total of 1,205 km² and a developable land area of 550 km², the area can accommodate a major portion of Chongqing's projected growth. Liangjiang New Area is a growth priority for the city and an opportunity to increase economic density and agglomeration.²⁴ It already has a comprehensive multi-modal transport network covering water, air, road, and railway transport. In addition, it has dedicated functional areas such as the China-Singapore Connectivity Demonstration Project, Port Area, Industrial Park, and Free-Trade Zone. As a result, growth has been fast.²⁵ According to the current development plan, by 2020, its GDP is expected to exceed RMB 1 trillion through the creation of "one center" and "four belts,"²⁶ which is equivalent to doubling Chongqing's economy within 10 years.²⁷

Liangjiang New Area has the potential to allow the city to increase its land use efficiency and absorb a significant part of the expected population growth of 5.8 million. If the area is planned so that the population density of its built-up area reaches the current average of the four provincial-level municipalities (13,993 people/km²), it could accommodate 7.2 million people, which is 5.1 million more than its registered population of 2.1 million.²⁸ This would represent 88 percent of the 5.8 million people the city is expected to accommodate by 2035. For each new inhabitant, only 71.4 m² of land would need to be converted, which is about half of the 136 m² rate of land conversion seen in Chongqing's expansion since 2000.

Source: Chongqing Liangjian New Area Government 2018.

Spatial transformation II

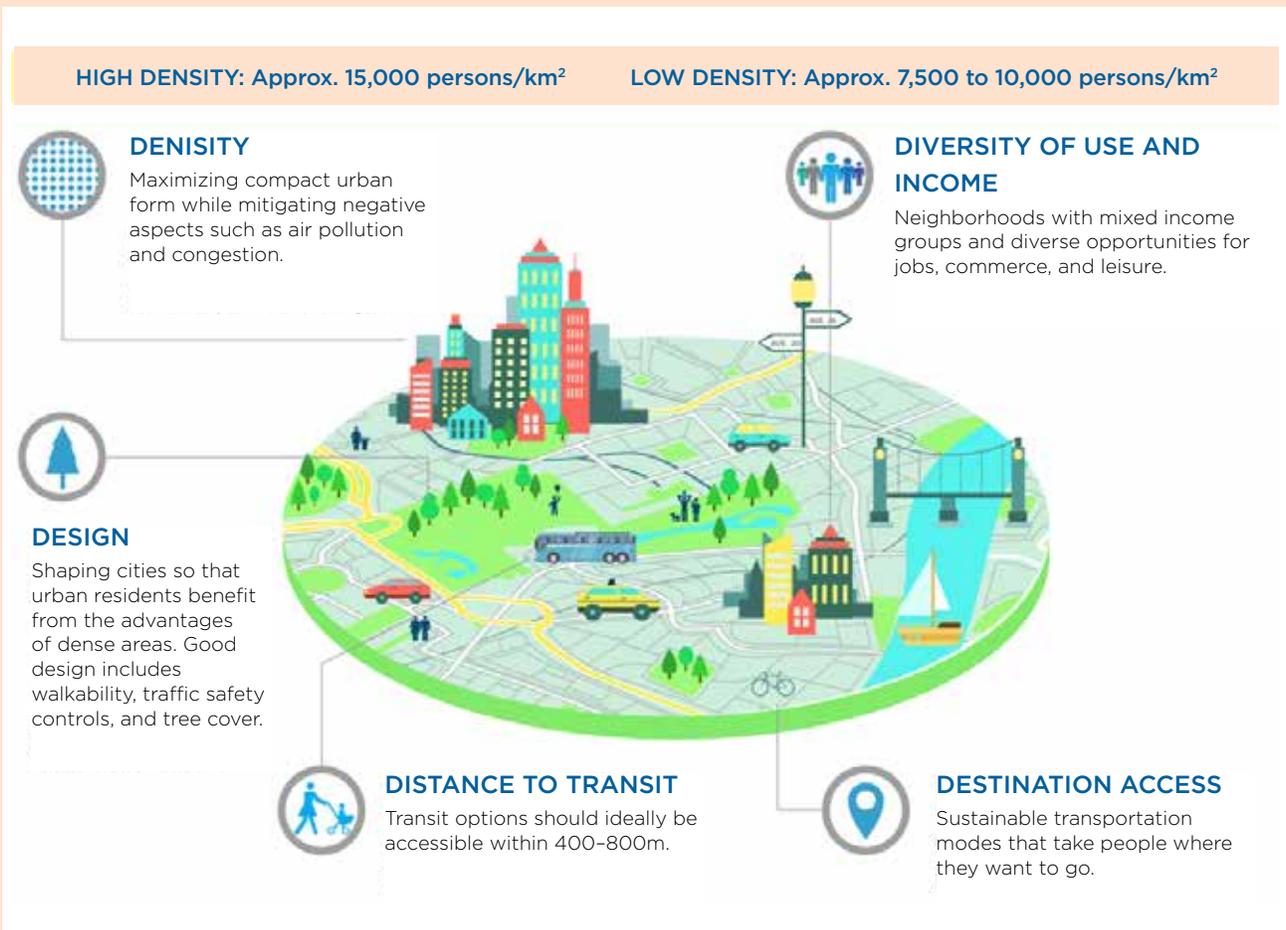
Pursue transit-oriented development that articulates accessible densities

Chongqing is planning to extend the subway network fourfold to 820 km and 482 stations—a length similar to the Seoul subway. The extension gives Chongqing the opportunity to shape its urban form efficiently like other global cities such as

Tokyo, Hong Kong SAR, and Seoul. **Average density is less important than articulated and accessible density** (UN Environment 2018). Articulated density is achieved by mixed uses around transit nodes and street networks with human-scale blocks that facilitate walking and diverse travel modes. The 5D Compact City Framework (box 5) is a helpful tool for planners to develop compact, connected, and polycentric cities.

BOX 5 The 5D Compact City Framework

A city can combine multiple nodes of articulated density with a rich mix of housing, jobs, and amenities at the neighborhood level.



Source: UN Environment, GI-REC, International Resource Panel, "Building Better Cities: ASEAN Looks to the Future," https://citiesipcc.org/wp-content/uploads/2018/03/Fact-Sheet_-_South-East-Asia_Future_Infrastructure-1.pdf.

The benefits of articulated density and transit-oriented development (TOD) include significant increases in economic agglomeration and productivity by concentrating jobs at higher densities around transit nodes. TOD also increases employment opportunities and job opportunities for the entire population, and it creates a larger labor market and thus a more inclusive society. Cities around the world that have pursued TOD have proved to be more desirable places to live and work as it allows the creation of complete communities with multiple transportation options. With its recent plans, like those for the new Liangjiang district, Chongqing has already embarked on the concept of mixed-use TOD centers as polycentric nodes for targeted employment and housing (figure 39).

FIGURE 39 Illustrative View of Liangjiang New Area's TOD Concept Plan



Source: Produced by Calthorpe Associates for the Liangjiang New District Transit Oriented Districts Plan in 2013.

The TOD transformation requires the following actions:

A. Set targets for the amount or proportion of new housing and jobs to occur in TOD—region-wide and by district—and match densities of people and jobs to transit capacity

- **Policies must effectively address superblocks or low-density development near public transit, which wastes valuable land capacity and development potential.** This can be achieved by using a hierarchy of TOD types, using both redevelopment and new construction. The development characteristics and intensity of new centers must be tuned to their regional location, level of transit service, and proximity to key sites such as educational centers, new central business district (CBD) areas, and the new convention facility.

B. Define TOD standards

- **This policy aims at ensuring that the urban form and development features near public transit support pedestrian and bike access to stations and discourage the use of automobiles.** It encompasses: (1) creating higher density mixed-use nodes around transit; (2) concentrating commercial and major retail developments within the TOD areas; (3) increasing walkability around transit stations and creating a sense of place by using parks and plazas; (4) emphasizing bike and pedestrian connections to stations by integrating bike parking and shops; (5) ensuring convenient and safe entrances to transit stations;

LEGEND

- TOD Boundary
- Primary Center (800 & 600 m radius)
- Secondary Center (600 m radius)
- Metro Station (existing/ planned)
- Metro Station (proposed)
- Metro 'Hub' Category Station
- Metro Transfer Station
- Metro Depot/ Parking Facility
- Metro Network (existing/ under construction/ final planning stage)
- Metro Network (future phase)
- Metro Network (suggested new route)
- Railway Lines

and (6) setting maximum commercial parking ratios (Calthorpe Associates, China Sustainable Transportation Center, and Glumac 2017).²⁹

C. Make public transit the first transport mode

- **Making public transit accessible and convenient is one of the best ways to reduce dependency on private vehicles.** Public transit must be well integrated with cycling and walking to solve the ‘last mile’ issue of how people reach their final destinations. The main recommendations for Chongqing include:
 - Creating a transit plan that targets a public transit mode share of 40 percent;
 - Locating all new major housing and job centers within 500 m of a local transit station and 1 km from public transit with exclusive right-of-way;
 - Ensuring frequent and direct transit service with interconnected transit technologies;
 - Integrating metro, BRT, light rail, streetcar, and bus services;
 - Building a smart transit card system; and
 - Coordinating transit so it is easy to switch modes or lines and limit transfer distances to 150 m.

Spatial transformation III

Design vibrant mixed-use neighborhoods based on Chongqing’s unique landscape of mountains and water, on small blocks, and on streets as places for people

This transformation consists of a reversal of Chongqing’s current superblock approach—86 percent of the central city is made up of such blocks that fail to give identity and sense of place to Chongqing extensions. It comprises the following actions:

A. Design neighborhoods according to the unique mountain and river landscape of Chongqing

Chongqing’s urban landscape should incorporate the city’s invaluable natural assets—the river, the mountain’s undulating ridges, and lushly landscaped parks.

- **Integrate the landscape into the city’s design to create a unique urban fabric.** Unique landscapes have shaped the identity of cities as diverse as Hong Kong SAR, Seoul, San Francisco, Zurich, Rome, and Porto. The impacts of the hills and topography can manifest not only as undulating strips of public space between streets and blocks but also as determinants of street patterns that follow the contours of the land and provide walking paths. The hilly terrain of Chongqing can create many panoramas, which provide a natural backdrop to urban areas.
- **Protect major visual corridors towards unique topographies.** Developments should not have a negative impact on meaningful views. If well protected, distant nature will remain intact as in Hong Kong SAR, but its visual connection to the city is improved and better appreciated in the urban area. To ensure the design of the urban landscape incorporates the city’s topography, urban design plans that take into account the mountainous landscape should be developed.

B. Retrofit existing neighborhoods to improve livability

- **Retrofitting actions should aim to improve the existing built environment in the densely developed urban areas of central Chongqing.** This mainly entails improving the connectivity and permeability of urban blocks, developing mixed-use spaces, and enhancing public spaces and public facilities (box 6).

BOX 6 The Transformation of Liuyun Xiaoqu from a Gated Residential Community to a Vibrant and Connected Mixed-Use Neighborhood

Initially, Liuyun Xiaoqu, Guangzhou, was an exclusive gated residential complex typical of housing developments built in the past. From about the year 2000, the owners of ground-floor apartments in the area realized that they could make a living by converting their premises for commercial purposes, first for local shops and later for boutiques and cafes. Conversions on the ground floor transformed the place into an open mixed-use area. Its old gates were dismantled, and its narrow pedestrian and bicycle streets were opened to the public.

Today, as a result of its fine-grained fabric and its diversity and vibrancy, Liuyun Xiaoqu has become the center of the district's daily life. It is a model for combining community life with commercial activities and is an example for how medium-sized living areas in central Chongqing can be revitalized, in particular through improvements in connectivity and mixed-use functions (figure 40). The fine mesh of people-oriented connected streets in Liuyun Xiaoqu stands in contrast with

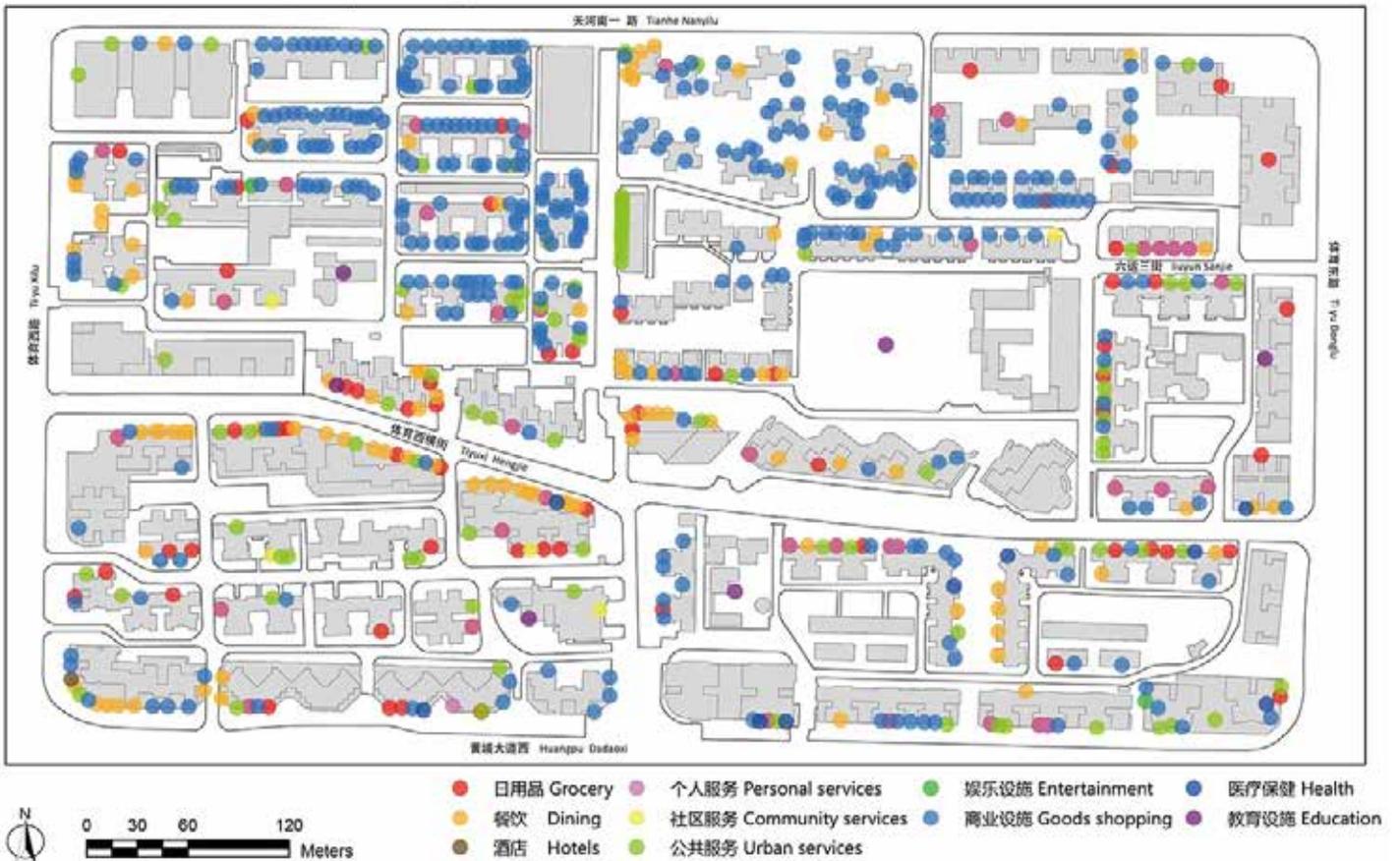


the disconnection of cul-de-sacs in most Chinese developments. It significantly increases the connectivity of the street network. All blocks are open with controlled access in individual buildings during the day (figure 41).

Source: Institute for Transportation & Development Policy China 2016.

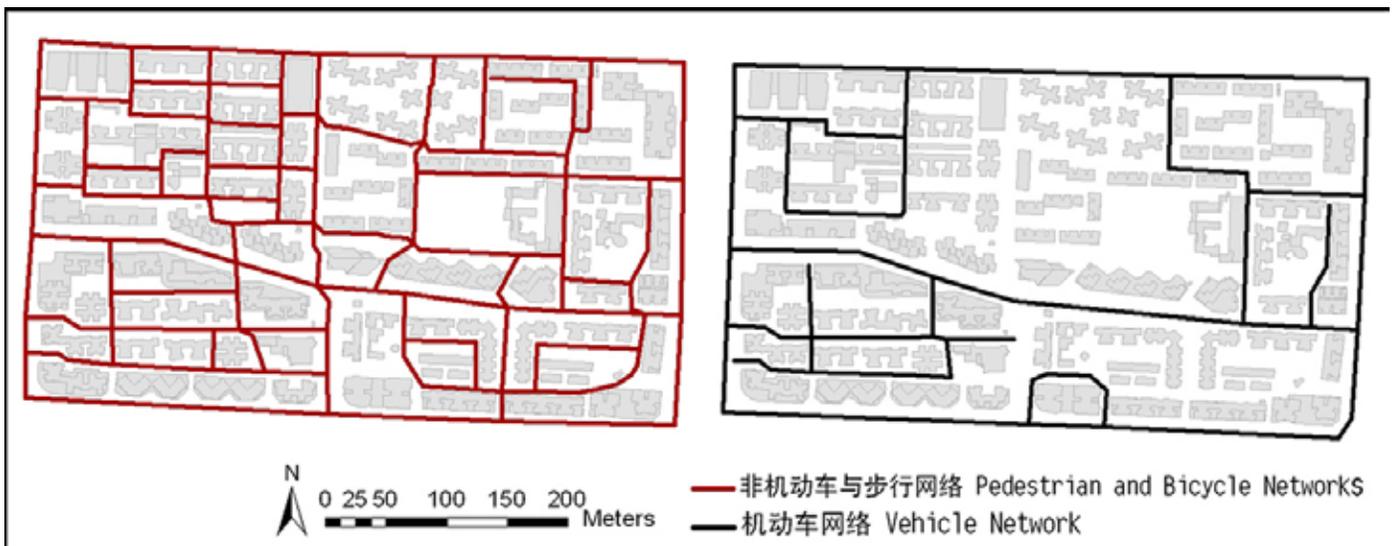
Image credit: Karl Fjellstrom. ©Karl Fjellstrom. Reproduced with permission; further permission required for reuse.

FIGURE 40 Commercial Activity Distribution in Liuyun Xiaoqu



Source: Institute for Transportation & Development Policy China 2016. © Institute for Transportation & Development Policy China. Reproduced with permission; further permission required for reuse.

FIGURE 41 Motor Vehicle and Pedestrian-Bicycle Network in Liuyun Xiaoqu



Source: Institute for Transportation & Development Policy China 2016. © Institute for Transportation & Development Policy China. Reproduced with permission; further permission required for reuse.

C. Adopt urban design strategies that enhance livability, identity, and sense of place

- **Plan the city with a wide variety of small, mixed-use blocks.**³⁰ Small blocks—of less than 1.5 ha area—provide a human-scale environment with greater variety in built form and street patterns. Small blocks also offer a variety of public spaces, architectures, and activities. They should be developed with active sidewalks and with perimeter buildings to provide shared interior courtyards.³¹ UN-Habitat recommends that at least 40 percent of floor space should be allocated for economic use in any neighborhood and that land specialization should be limited to single function blocks covering less than 10 percent of any neighborhood (UN-Habitat 2014).³²
- **Create dense and connected street patterns with streets designed as places for people.** Chongqing's street densities are well below international benchmarks. The lack of connectivity reduces the livability of neighborhoods. UN-Habitat recommends at least 18 km of street length and 80 to 100 street intersections per square kilometer. In addition, at least 15–20 percent of land should be allocated to open public spaces (UN-Habitat 2014).³²
- **Provide human-scaled and accessible public realms, green space, and parks.** Chongqing should provide its citizens with a variety of public open spaces and parks and develop parks with a range of uses, from active recreation to passive leisure for a full range of ages.³³ It should target for at least 80 percent of residents in central Chongqing to be located within walking distance of neighborhood parks, a policy already implemented in New York and Singapore, with targets of 90 percent.
- **Promote variety and contrast to enhance the city's identity.** Global cities offer varied and memorable streets. They provide direction, structure, and identity to their surroundings. For example, the three straight, direct streets that fan out from Piazza del Popolo through the labyrinth of central Roman streets immediately identify Rome. Las Ramblas, which crosses Barcelona's Gothic Quarter and Passeig de Gracia, are streets that structure the city (Jacobs 1993). These streets stand out and order the city because of their contrast from other city streets. Variety of sizes and shapes of blocks, widths and lengths of streets, and different rhythms of buildings, contribute to creating a city's identity.³⁴ Chongqing's streets should be designed with a variety of patterns that are adapted to its unique landscape.

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Endnotes

1. This refers to the hukou-registered population. The actual resident population in 2016 was 30.48 million.
2. The populations of these global cities are comparable to that of central Chongqing's nine districts: Tokyo's 23 wards that together make up the city's core and its most populous part (9.37 million in 2016; 619 km²), Seoul Special City (9.84 million in 2018; 605 km²), Singapore (5.6 million in 2018; 719.9 km²), Hong Kong SAR (7.347 million in 2016; 2,754 km²), Greater London (8.778 million in 2016; 1,569 km²), and New York City (8.538 million in 2016; 789 km²).
3. Road, water, and sewer infrastructure.
4. The "1-hour economic circle" includes 23 counties/districts, including nine central districts.
5. In 2000, Chongqing Municipality's economic density (measured by GDP/km² of built-up area) was 2 percent more than the average across China. In 2017, it was 13 percent less.
6. From 2000 to 2014, Chongqing municipality's urban population grew 174% (slightly above the national average of 163%) and on par with Beijing and Tianjin (both 173%). However, Chongqing Municipality's total urban built-up area grew 335%, from 439 km² in 2000 up to 1,470 km² in 2014.
7. Saturation is measured by the ratio of the built-up area within the urban extent of the city and its urban extent. The saturation index reaches its limit when the urban extent has no open space at all and is at its minimum when it has only open space.
8. Measured using satellite picture analysis. Chongqing's saturation index is close to the one observed in Chengdu (0.69) by Angel, et al. 2016.
9. Yuzhong district, with an area of 22 km², is the central district and heart of Chongqing Municipality. It is also the political, economic, and entertainment center of the city. Surrounded on three sides by water, Yuzhong is effectively a peninsula. Due to its limited space, its hilly terrain, and the fact that it is Chongqing Municipality's main business district, Yuzhong has some of the tallest skyscrapers in China.
10. Dadukou district produced only 2.5 percent of central Chongqing's GDP, despite occupying 7 percent of its built-up area.
11. According to an assessment made by Calthorpe Associates for this report.
12. UN-Habitat recommends at least 80 to 100 intersections and 18 km of streets per square kilometer.
13. Studies on road networks (Ingram & Liu 1997) and urban water and wastewater networks (Müller et al. 2013) suggest that per capita network length and material stocks tend to increase with lower urban density. Müller et al. (2013) computed data on a representative sample of about 40 cities, which has been mathematically analyzed by the Urban Morphology and Complex Systems Institute (Salat 2016; Salat, Bourdic, and Kamiya 2017) to calculate the elasticity of water, wastewater, and street network lengths and costs per capita with regard to average residential density. Reducing the density by half generally increases water network costs per capita by 72 percent and street networks costs per capita by 117 percent.
14. The Greater Tokyo Area, with 38 million people, is the most populous metropolitan area in the world, consisting of the Kantō region of Japan, including the Tokyo Metropolis, as well as the prefecture of Yamanashi of the neighboring Chūbu region. In Japanese, it is referred to by various terms, one of the most common being National Capital Region.
15. The Seoul Capital Area (SCA), is the metropolitan area of Seoul, Incheon, and Gyeonggi-do located in northwest South Korea, and has 25.5 million residents.
16. The New York metropolitan area, also referred to as the Tri-State Area, includes New York City, Long Island, and the mid- and lower Hudson Valley in the state of New York; the five largest cities in New Jersey—Newark, Jersey City, Paterson, Elizabeth, and Edison, and their vicinities; and six of the seven largest cities in Connecticut—Bridgeport, New Haven, Stamford, Waterbury, Norwalk, and Danbury, and their vicinities. It has 20.32 million residents.
17. Trends observed at the municipality scale are used as a proxy.
18. Calculations made by Calthorpe Associates for this report.
19. Comprising 158 lines, 48 operators, 4,714.5 km of operational track, and 2,210 stations.
20. Absolute decoupling refers to an economic growth model where resource impacts decline in absolute terms. Resource efficiency must increase faster than economic growth for absolute decoupling to occur.

21. Both scenarios look at central Chongqing only and assume the addition of 5.8 million new residents and 4 million new jobs by 2035. To isolate the impacts of land use, both scenarios assume the same baseline factors for vehicle performance, energy efficiency, and fuel and energy emissions.
22. Road, water, and sewer infrastructure.
23. Projection provided by the Chongqing Planning Bureau.
24. According to the approval document issued by the State Council, Liangjiang New Area shall become “the leader among national experimental zones of comprehensive complementary reforms for rural-urban integration, an important sophisticated manufacturing and modern services base in inland China, a financial center and innovation center in upstream Yangtze River, an important gateway of opening up in inland China and a demonstration window of scientific development.”
25. According to *Rankings of Local Governments in China 2017*, the comprehensive development potential of Liangjiang New Area ranks first among 163 development zones in China (including 137 national-level development zones and 26 provincial-level development zones).
26. “One center” refers to the financial and commercial center while “four belts” refers to the metropolitan-function industrial belt, logistics and processing belt, high-tech and new-tech industrial belt, and advanced manufacturing industrial belt.
27. The total GDP of central Chongqing’s nine districts was about RMB 703 billion in 2016.
28. In a built-up area of 514.5 km².
29. For example, parking ratios for TOD areas should be at most 80 percent, or lower than central Chongqing’s current standards.
30. City blocks come in a variety of sizes and shapes, square in Barcelona, elongated in New York, and triangular in Paris. Variety and irregularity increase the livability and resilience of cities. In particular, Chongqing’s mountainous topography offers the city an opportunity to have a rich variation in the patterns of blocks, should they follow land contour lines, as Hong Kong SAR or Seoul.
31. Planning should: (1) ensure that at least 70 percent of blocks in residential areas are 1.5 ha or less, and commercial blocks in non-industrial areas are 3 ha or less; and (2) decrease setbacks to a maximum of 1 m for retail, 3 m for commercial, and 5 m for residential (Calthorpe Associates, China Sustainable Transportation Center, and Glumac 2017).
32. This requires creating an additional connective network of narrower streets, some of which should be dedicated to pedestrians and cyclists.
33. Plazas should be human-scale and accessible to the general public, including people with disabilities and the elderly.
34. The turn-of-the-century Barcelona grid, for example, is unique for its diagonal corners and can be distinguished from a similar square grid in Madrid. Seoul has a unique street pattern overlaying a newer, large-scale, regular grid over numerous small roads and irregular linking alleys dating from much earlier periods. The plaid-like street pattern of Tokyo’s Nihonbashi district is also memorable (Jacobs 1993).

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2015