THE GHOST CITY of CHINA

A Revitalization Strategy for Ordos

by

Difei Xu

Bachelor of Architecture
Tongji University, 2013

SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN ARCHITECTURE STUDIES
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2015

Signature of Author: Signature redacted
Department of Architecture
May 21, 2015

Certified by : Signature redacted
Brent D. Ryan
Associate Professor of Urban Design and Public Policy
Thesis Supervisor

Accepted by : Signature redacted
Takihiko Nagakura
Associate Professor of Design and Computation
Chair of the Department Committee on Graduate Students

鄂尔多斯

THE GHOST CITY of CHINA

A Revitalization Strategy for Ordos

Difei Xu | MIT SMArchS Urbanism Thesis

"Many Palaces"

THESIS COMMITTEE

Thesis Advisor

Brent Ryan
Associate Professor of Urban Design and Public Policy

Thesis Readers

Tunney Lee
Professor Emeritus of Architecture and Urban Studies and Planning

Michael Dennis
Professor of Architecture

THE GHOST CITY of CHINA

A Revitalization Satrategy for Ordos

Difei Xu

Submitted to the Department of Architecture on May 21, 2015 in Partial Fulfillment of the Requirements for the Degree of Master of Science in Architecture.

ABSTRACT

Lots of reports about "Ghost Cities" in China have been seen these years, with pictures of thousands of empty high-rise residential buildings and meanwhile acres of vacant land. To maintain high economic growth, the buildings without buyers are made possible by government driven loans. These cities were entirely driven by the GDP-focused government, and were planned with buildings, infrastructures, parks, jobs—a capital utopia, described by New York Times as the cities with everything, but people.

As an extreme version of Ghost Cities, Ordos, a city in Inner Mongolia, was once a village on desert with only two thousand people. Thanks to the discovery of huge coal and oil deposits, the city generated immense amounts of wealth and spent billions of dollars on urbanization. However, the fantasy did not stand long when the coal industry collapsed ten years later due to the price downturn. The new town was planned to build capacity for one million residents. Right now, it is at around 500,000, with only 100,000 residents. What we witness now are enormous aborted developments and abandoned structures.

By understanding the economic and social mechanism of Ghost

Cities, the thesis seeks industrial and infrastructure reforms as opportunities to revise the flawed initial planning of Ordos. Electricity, the major outcome of Ordos' single advantage—coal reserves, could be the leverage for sustainable and interconnected industries which will eventually stimulate economic recovery. Ordos would utilize the opportunities to insert new infrastructures and to reprogram and reuse the excessive and abandoned structures, which would be the framework for new urban pattern. Such new urban pattern and resulted public realm would create an urban and humane built environment. The thesis integrates the relationships between economy, policy, industry, infrastructure, and urban form, and ultimately tries to explore a new model of urbanism and a reversal of planning principles of contemporary China.

Thesis Supervisor: Brent D. Ryan

Title: Associate Professor of Urban Design and Public Policy

ACKNOWLEDGEMENTS

These past two years at MIT has truly been my best experience in my entire life so far. I never regretted for a second.

Particular thanks:

To Brent Ryan, my thesis advisor, for your exceptional knowledge, wisdom and guidance.

To Michael Dennis, most attractive boy in 1955, for all the barbecue, parties, and fun with us; for leading us in the past two years; and for your consistent advice along my thesis.

To Tunney Lee, for your precise suggestions, and for imparting me your knowledge about planning in China.

To Yu-hung Hong, Raymond Torto, Alexander D'Hooghe, and Amy Glasmeier for meeting me or emailing me and help me sort through initial thoughts.

To Yu Yifan and Sha Yongjie, for giving me useful suggestions in the perspective of China.

To Bo Yao and your father, for helping me reach out to right person and guidance in Ordos. And to Zhang Hui, who talked with me about Ordos for a whole afternoon.

To those who helped me in the final weeks, Qiuying Sun, Jie Zhang, Tengjia Liu, Kun Qian, Xuanyi Nie, Rungu Lin and Yinjia Gong (chronological sequence).

To the best SMArchS team forever, Agustina, Ariel, Chaewon, David, Gabriel, George, Kairav, Manos, Naichun, and Wenji, for such a cohesive and stimulating family that sustains me and everyone for two years. I will miss you all.
And to my companion in SMArchS room in the last semester, Chin-yi Cheng.

And finally,

To Fanshu Qin, for sustaining me, encouraging me, staying with me physically or mentally every day. Love you.

To my parents, my mom and dad, for making my journey at MIT happen. I would never have had such priceless experience without your support. I am truly grateful.

TABLE of CONTENT

04

REVITALIZATION STRATEGIES

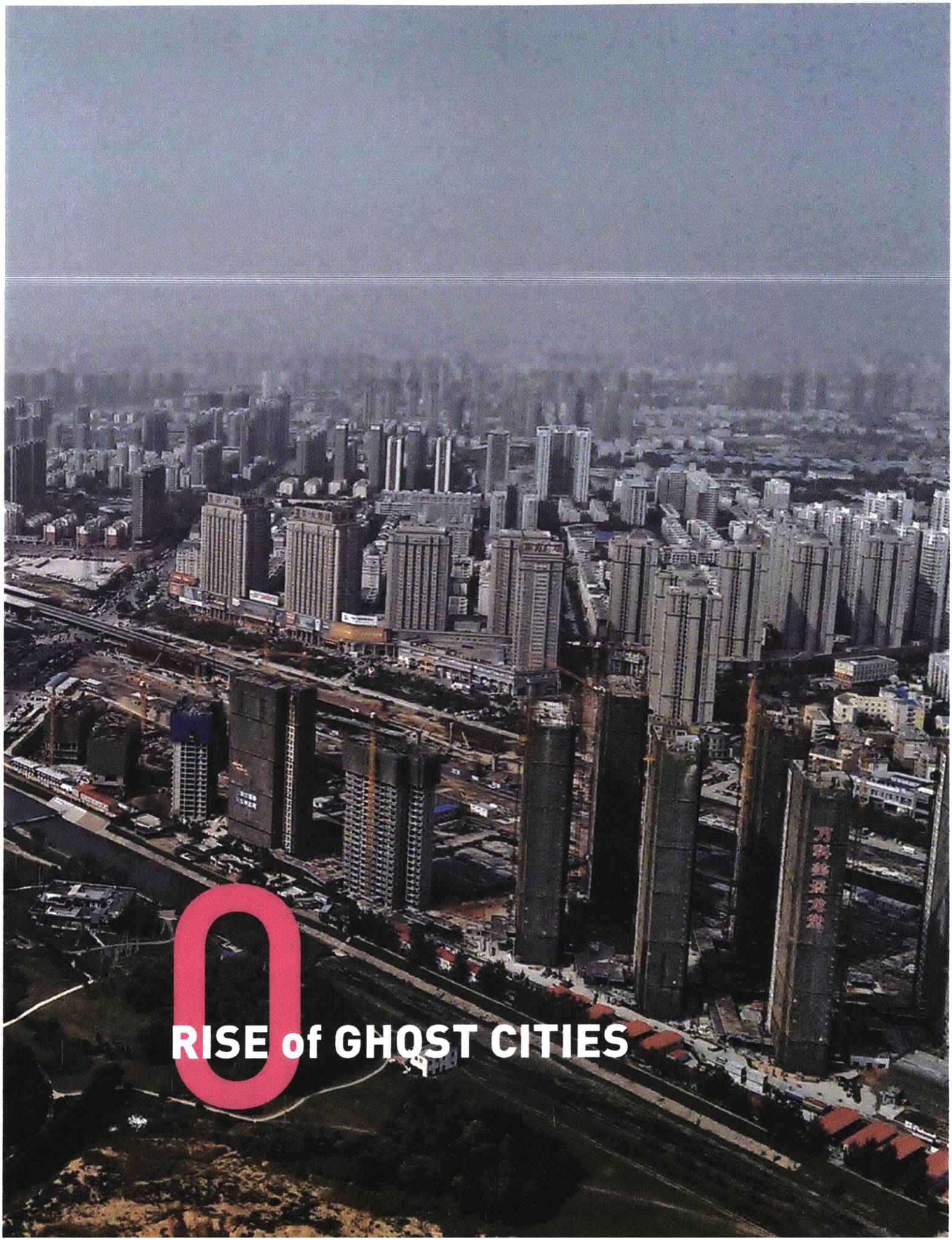
05

NEW URBAN PATTERN

06

PILOT AREA

07



0 RISE of GHOST CITIES

FIG 0-1

Expanded Urban Parcels
from 2007-2012


Shenyang
Beijing
ORDOS
Taiyuan
Dalian
Urban Land Expansion
90.5%
83.41%
Population Increase
52.96%
45.12%
1990-2000
2000-2010
1.85 > 1.12
Zhengzhou
Xi'an
Nanjing
Shanghai
Wuhan
Changsha
Quanzhou
Shenzhen
Guangzhou
Hong Kong

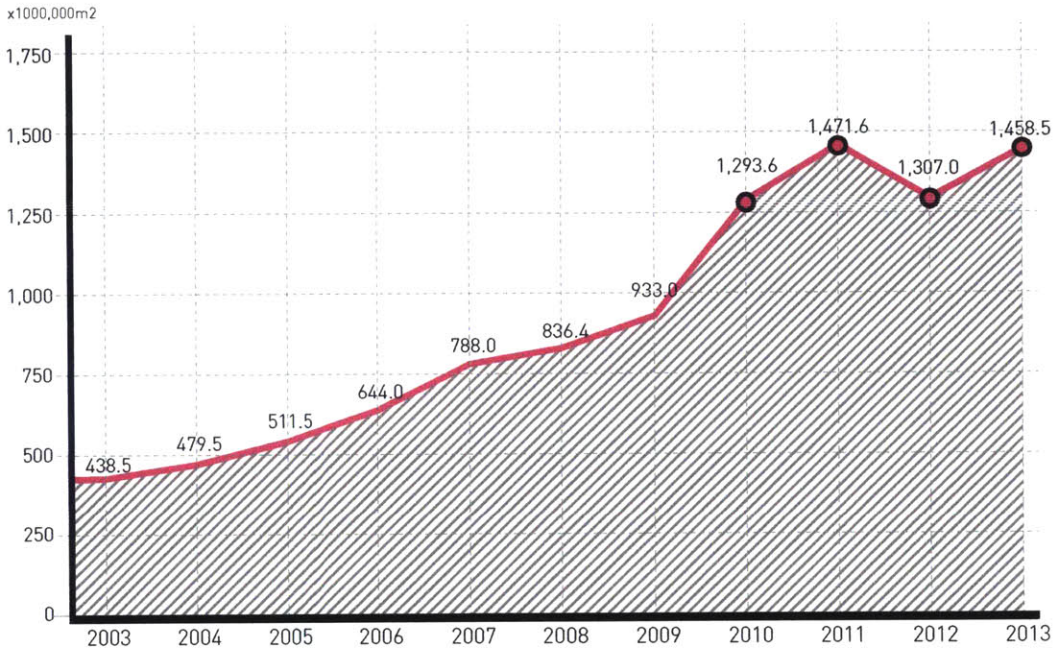


FIG 0-2

Annual Construction of Residential Real Estate in China

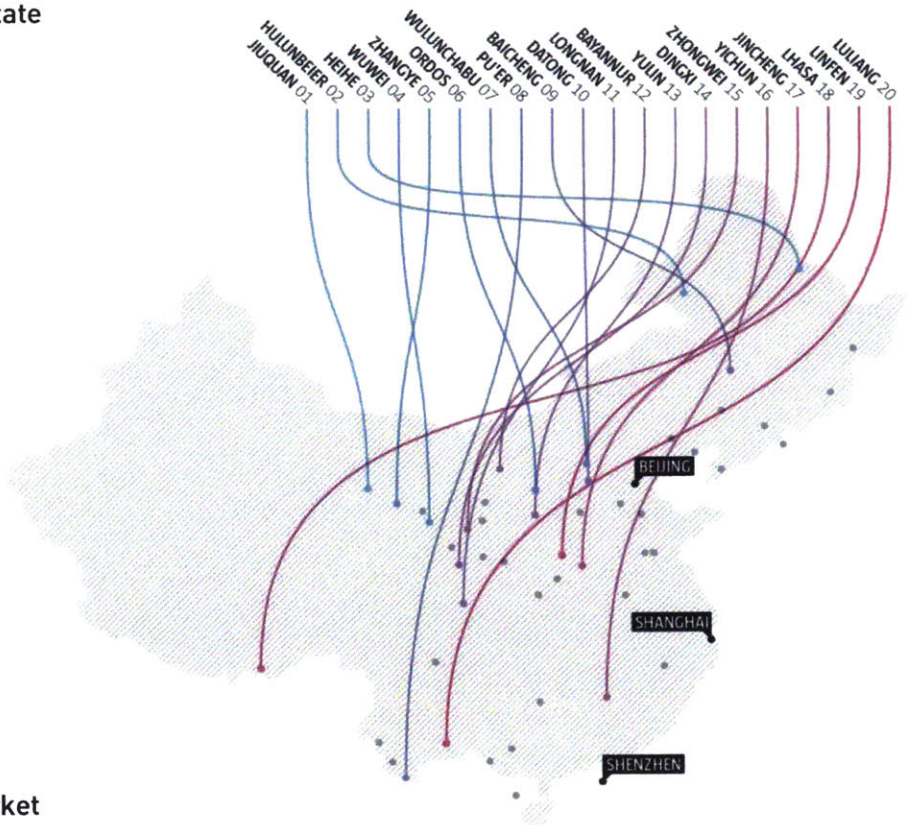


FIG 0-3

20 Highest Risk Cities in the Real Estate Market

0.1 Unprecedented Urbanization

There is no need to explain how unprecedented the scale of urbanization in China has been. Sixty years ago, only 13% of people lived in cities in China. Until 2010, the proportion of urban population reached 45%, and by 2030 the number is predicted to be 60%.

Urbanization in China is totally nation-wide, although at different phases. Most developed cities-such as Beijing, Shanghai, Guangzhou, and Shenzhen-now have to compete with newly developing cities for investment and business. Thousands of villages have been transformed into cities, equipped with rapid transit system, shopping centers, and skyscrapers. Figure 1-1 is a map shows the expanded parcels from 2007. No doubts that those most developed regions have the largest red spots; however, some third tier cities also contributed a lot, including the city this thesis will focus on-Ordos. The urban land expansion rate in entire China during 1990-2000 and 2000-2010 were 90.5% and 83.41% respectively, which were much faster than population increase. The ratio of land and population expansion of China was 1.85, while the acceptable average of the world was 1.12. [1]

Urbanization no doubt provided tremendous economic growth for the country, and has been the engine that would drive the global economy for years. China has claimed top spots in num-

1
Wang, Lei, CongCong Li, Qing Ying, Xiao Cheng, XiaoYi Wang, XueYan Li, LuanYun Hu, et al. "China's Urban Expansion from 1990 to 2010 Determined with Satellite Remote Sensing." *Chinese Science Bulletin* 57, no. 22 (June 7, 2012): 2802–12. doi:10.1007/s11434-012-5235-7.

The New York Times

Chinese City Has Many Buildings, but Few People

By DAVID BARBOZA OCT. 19, 2010

A worker built a pathway in front of a construction site in the exclusive Jinxia Hill gated compound where most of the complexes are already sold but lie uninhabited in Ordos, Inner Mongolia. Adam Dean for The New York Times

CNN

News Video TV Opinions More

U.S. World Politics Tech Health Entertainment Living Travel Money Sports

Can China breathe life into 'ghost towns'?

By Ivan Watson and Connie Young, CNN

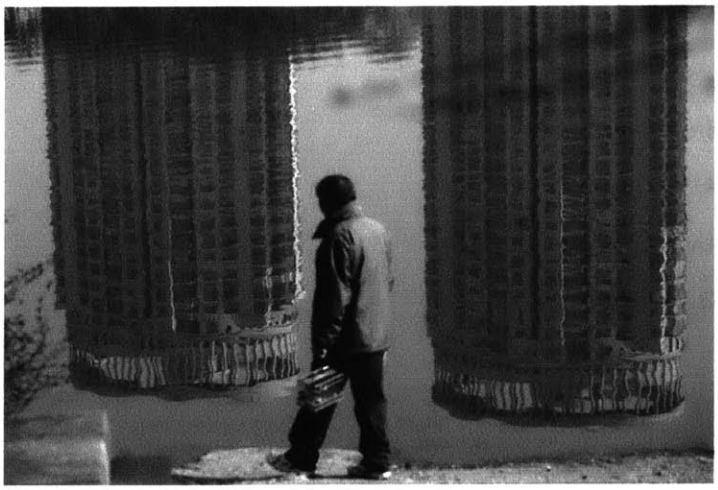
Updated 3:26 PM ET, Tue May 28, 2013

Source: CNN

Build it, and will they come in China? 03:32

THE WALL STREET JOURNAL.

China's Ghost Cities to Get Spookier



A man walks past the reflection of newly built residential buildings at a park in Shenyang. — Reuters

REUTERS

The myth of China's ghost cities

By Wade Shepard | April 22, 2015

Tags: CHINA | CONSTRUCTION | ECONOMY | GHOST CITIES

Thames Town, near Shanghai, China. REUTERS/Courtesy of Wade Shepard

FIG 0-4

Headlines for GHOST CITIES

bers of economic reports: Annual growth for the last decade was more than 10%, three times world average; from 2009, China has replaced Germany to be the largest exporter in the world; in 2010, China became the largest energy consumer and doubled their number in the past decade; etc [2]. Huge amount of development stimulated especially the real estate market. Residential construction amount of 2013 tripled of that in 2003, reaching around 1.5 billion square meters[3].

2
Wearden, Graeme. "Chinese Economic Boom Has Been 30 Years in the Making." *The Guardian*. http://www.theguardian.com/business/2010/aug/16/chinese-economic-boom.

3
National Bureau of Statistics of China (Department of Investment and Constructution)

While such amount of wealth and success have been created, risk and challenges are inevitable. The hottest topic in China recently is of course the smog, following the release of a self-financed documentary film by Chai Jing, a former CCTV (China Central Television) Journalist. Environmental issues have been around for a while since China became the world factory. With the spurt in burnt fossil fuels and building constructions, the atmosphere on top of China can no longer self-purify, leaving the smog cover hundreds of cities. The air quality in the capital Beijing got so bad that several whiteout happened that shutdown airports, schools and highways. Foreigners who visit these cities are all encouraged to wear a filtering mask to prevent pneumonia.

0.2 Rise of Ghost Cities

Environmental issues are just the tip of the iceberg. Another big

Dantu New Town, Zhenjiang, Jiangsu Province, China

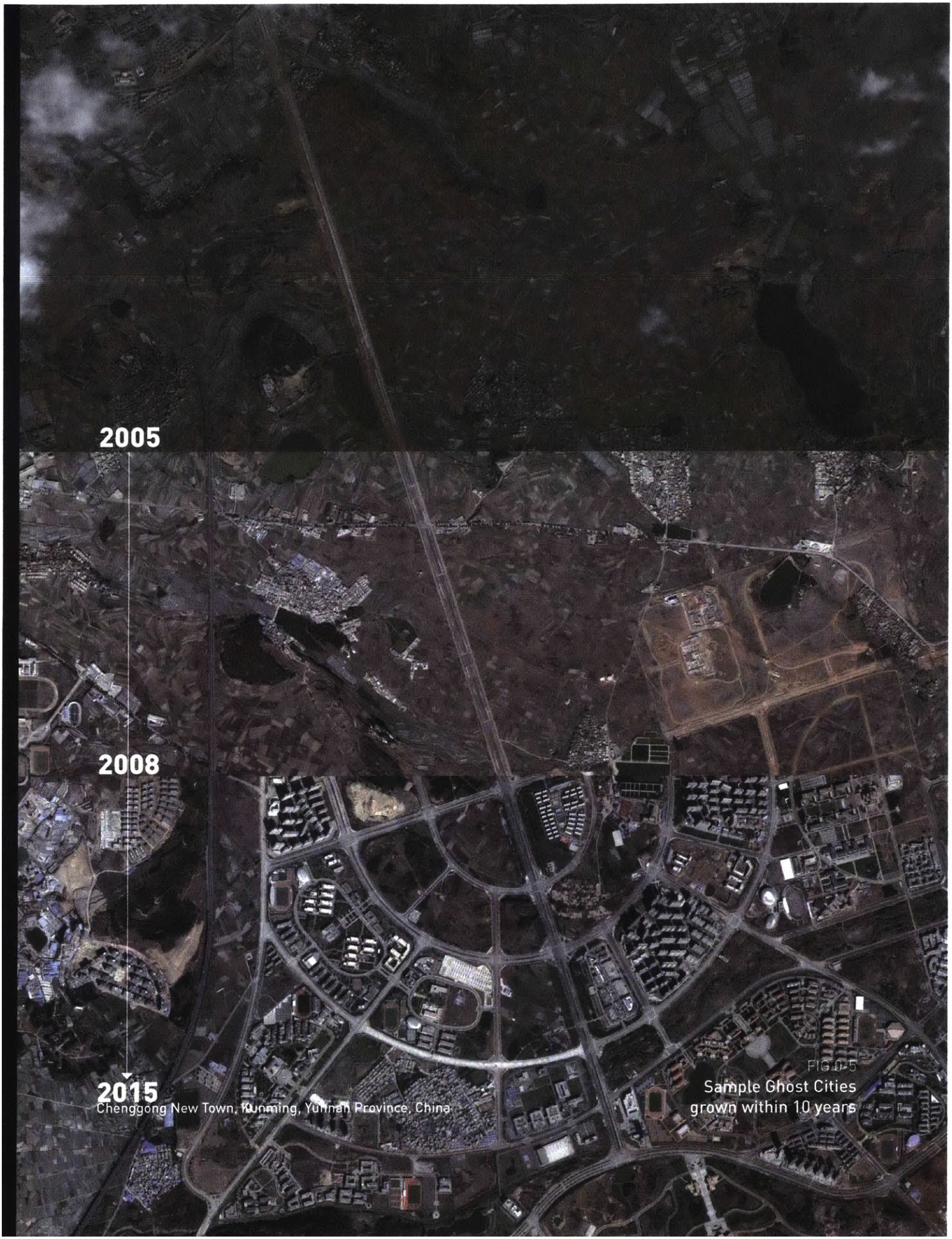


FIG 0-5
Sample Ghost Cities
grown within 10 years

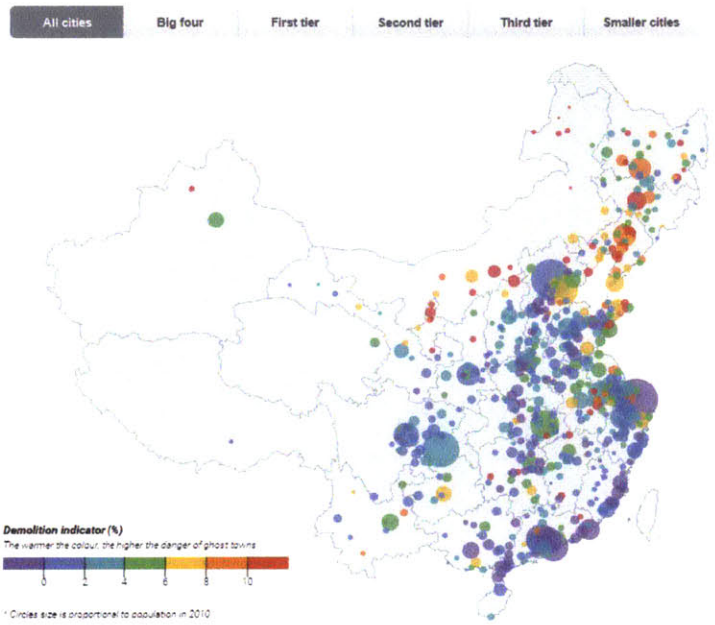


FIG 0-6

Chasing Ghosts: Where Is China's next Wave of Empty 'New Towns'?

problem is the speculative investment driven by the huge amount of wealth, resulting in excessive development. The ratio of urban land expansion and population increase clearly indicated this. Figure 1-3 is the twenty cities with highest risk real estate market defined by the China Real Estate Information Corporation. Most of them are second or third tier cities, and curiously enough, many of them are in the middle part of China, the historically less developed regions.

It was good news to architects once when these cities created tremendous job opportunities for architects around the world. The famous Ordos 100 organized by Ai Weiwei and co-curated

by Herzog and de Meuron offered so many paper-architects the chance to actually build one project. However, ironically speaking, these architects, urban designers and urban planners would not want to witness what they have created.

So what are ghost cities? Tons of headlines of mainstream media have given our answer, and I'll quote one of New York Times' headlines: The Chinese cities that have everything, but people. These towns were built seemingly overnight. The examples shown in Figure 1-5 indicate the transformation of two towns within only ten years from pure farmland to an entire city. Chenggong New Town in Kunming, Yunnan Province is another notorious ghost town that invested 22.8 billion RMB. Fortunately, the government halted the fast pace of development before too late, and they hired Peter Calthorpe Associates and Energy Foundation to re-masterplan applying the notion of TOD (Transit-oriented development)[4]. The other example is in Jiangsu Province, one of the wealthiest provinces in China. Even first-tier cities like Shanghai and Beijing have satellite towns that could be categorized as ghost towns. For instance, Shanghai started to implement the 'One City Nine Towns' project in 2001, four of which were to be developed from scratch. The nine towns were themed as different city styles ranging from European cities to American ones. The most famous one was Thames Town with medieval setting, where rare people could be spotted there except young couples taking wedding photography.

4
"How to Bring China's Ghost Towns Back to Life." *ArchDaily*. http://www.archdaily.com/425651/how-to-bring-china-s-ghost-towns-back-to-life/.

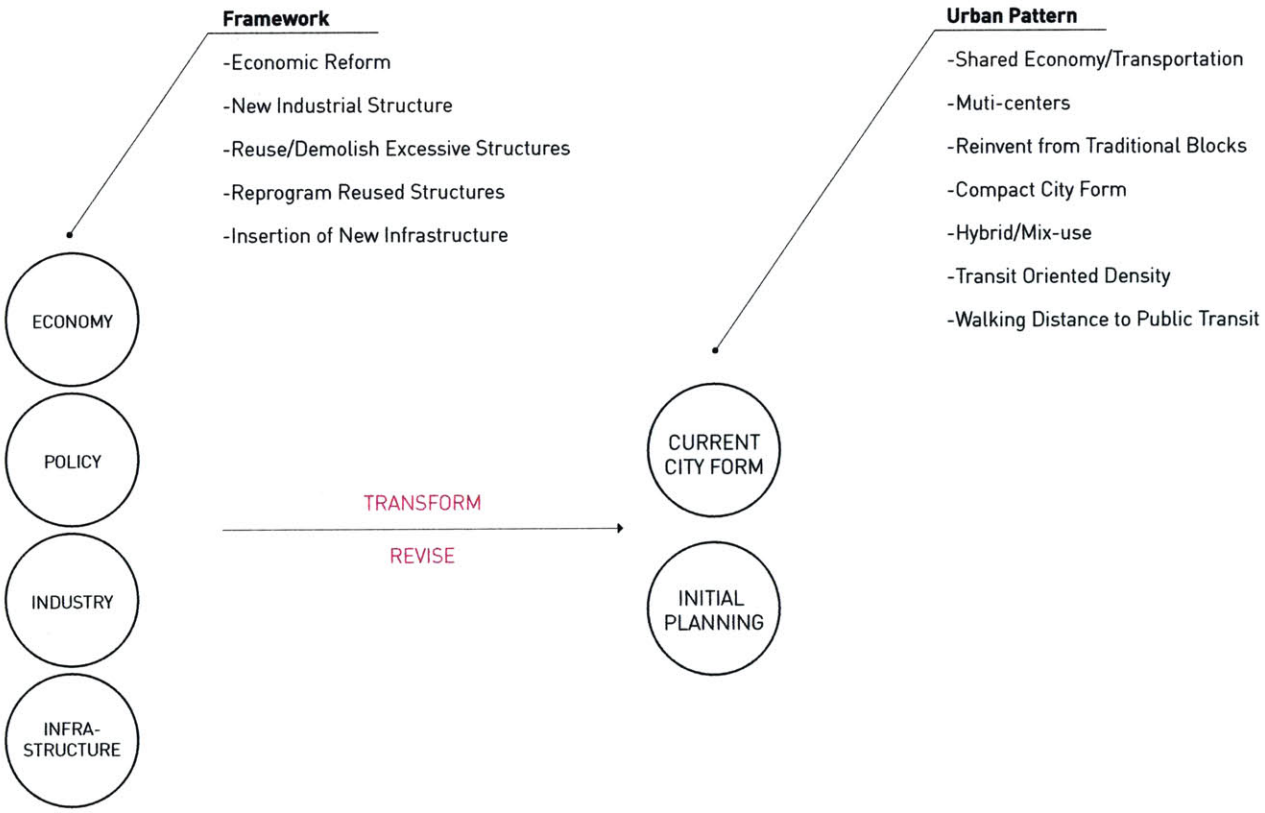
As a GDP driven government, vast area of land was sold and tons of developments were proved to maintain the high-speed growth. At the same time, these "achievements" became the qualifications of promotion of government officials. Speculative investments poured great amount of wealth into real estate market. In 2014, the largest real estate company in China, Vanke, exceeded 200 billion RMB in sales[5]. However, all these achievements contribute significantly to the 424 million square meters of vacant apartments which will accommodate 120 million populations, while there are thousands of people are struggling in slums and urban villages. Ghost cities always project an incredible expectation of population but high vacancy rates make these ambitions daydreams. The spooky atmosphere at night in these cities help claimed the title of 'Ghost City'.

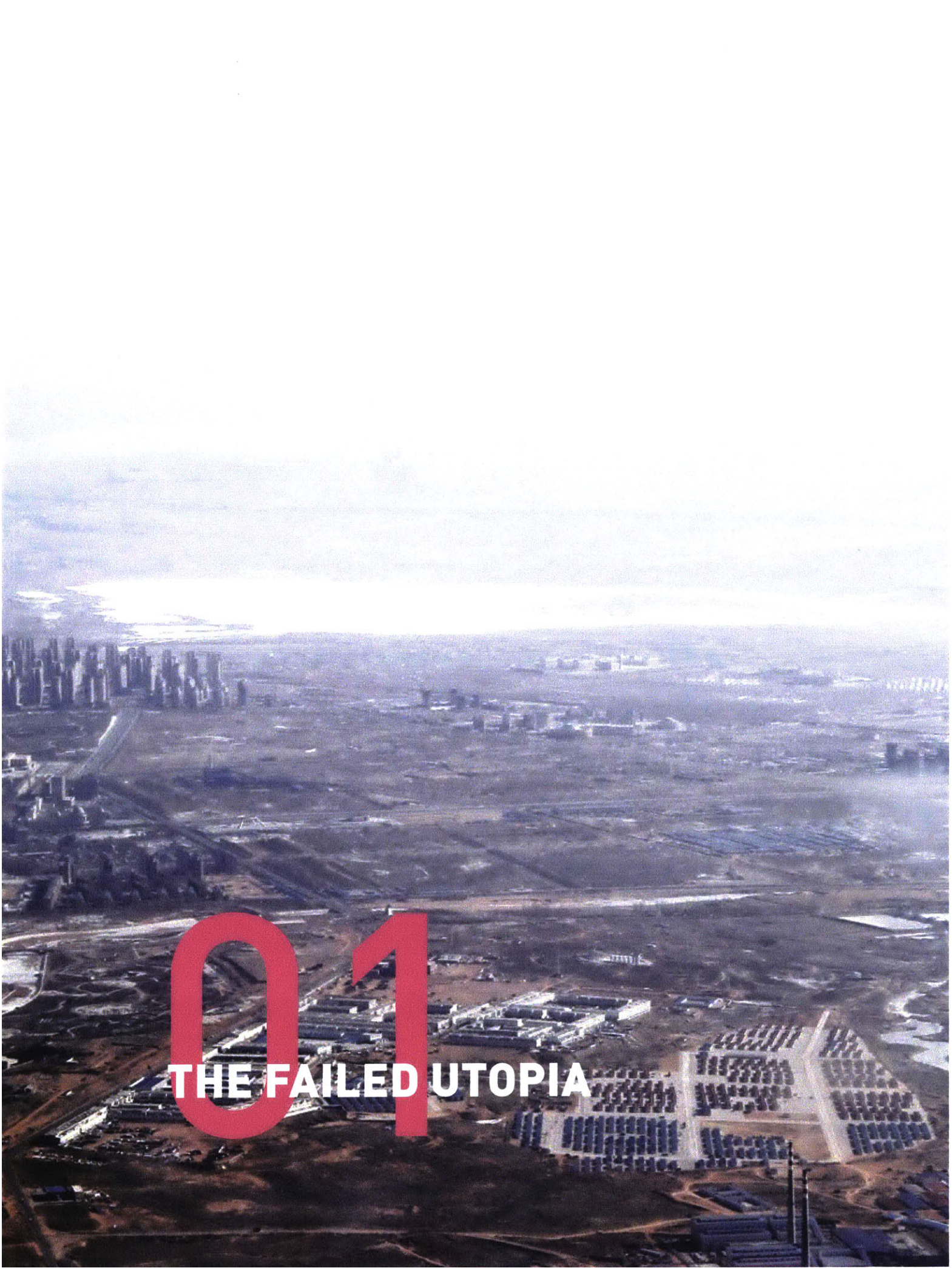
5
Cao, Bonnie. "Vanke Jumps in Hong Kong Debut as Developer Seen Resilient." *Bloomberg.com*. http://www.bloomberg.com/news/articles/2014-06-25/china-vanke-jumps-10-in-hong-kong-after-converting-b-shares.

0.3 Thesis Trajectory

The thesis would start with the research on the underlying social and economic mechanisms of ghost city phenomena. Property right and land reform policies are beyond the problems that this thesis would tackle, as they are really the realm of political science and law departments and are under hottest discussion among scholars and professors all over China and abroad. The future of reform can be foreseen since some provinces started to abolish "Hukou".

Strategies will include the reform of economy, industry, and infrastructure. Opportunities created could be utilized to transform current city form and to revise the initial planning. A series of planning principles and architectural typologies would be suggested with consideration of the context of whole China. Eventually this thesis offers a new paradigm for master-planning and planning revisions under contemporary political and economic environment.





01 THE FAILED UTOPIA


KANGB
(New O
EJIN HORO

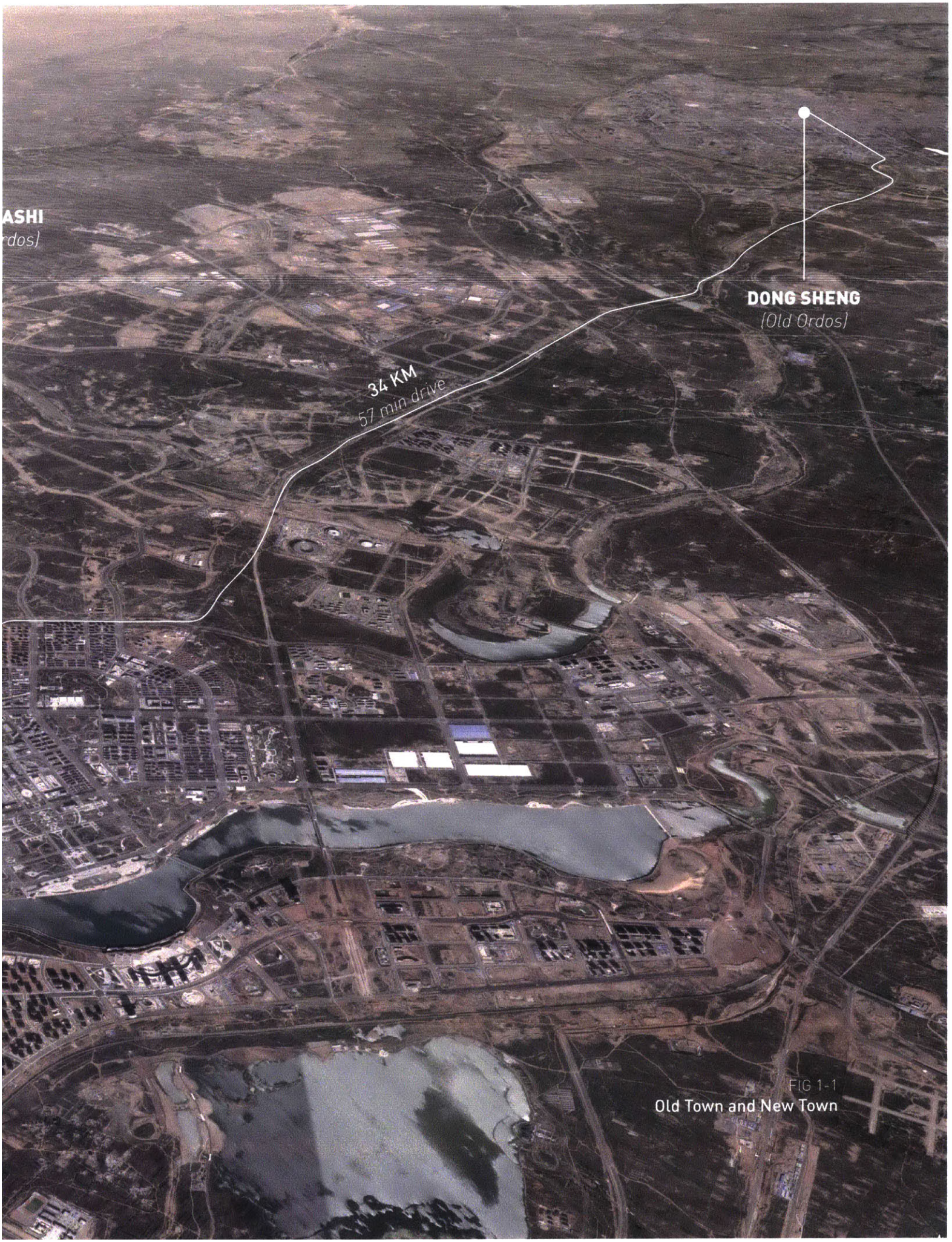


FIG 1-1
Old Town and New Town

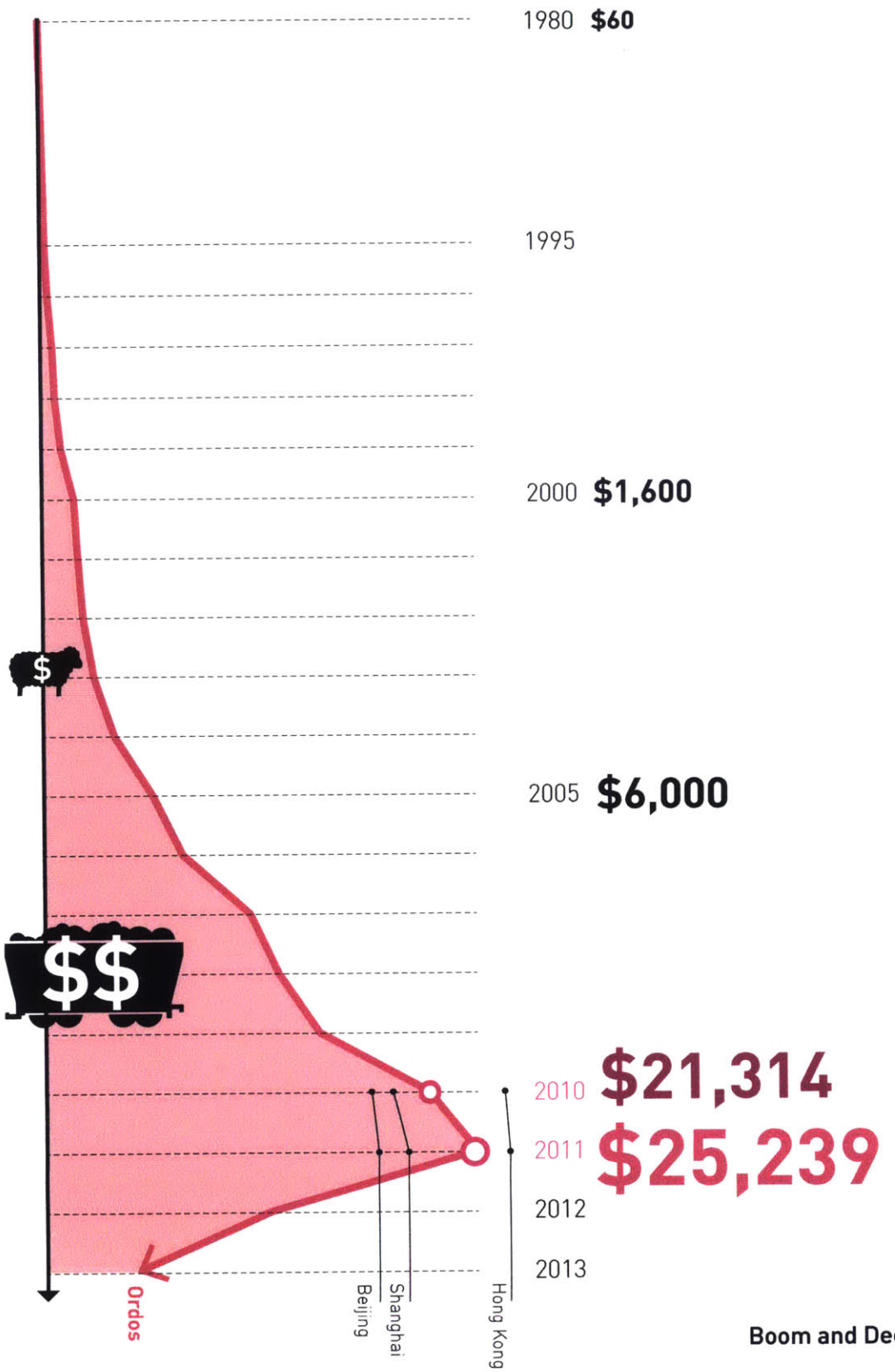
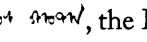


FIG 1-2
Boom and Decline of Ordos
GDP per capita

1.1 Boom of Ordos

While so many ghost cities have sprung up, Ordos won the champion in terms of both statistics and public awareness. When everyone says Ordos is a ghost city, they are actually referring to Kangbashi New District, once a village in the middle of desert but now a city targeting one million populations. Dongsheng was supposed to be the city of Ordos. In 2005, the government started to plan the new city-Kangbashi-which is 34 kilometers away from Dongsheng. After all government centers were relocated, Kangbashi claimed the city of Ordos.

 , the Mongolian of Kangbashi, means the palace of nomad tribes. Ten years ago, Kangbashi only had two villages with 1,400 people[1]. If we roll the time back to thirty years ago, Ordos was curiously one of the poorest regions in Inner Mongolia . In 1978, GDP per capita of Ordos was 60 USD, and they were called "western" region of Inner Mongolia (western region of China is generally less developed due to distance to coast). Thanks to the discovery of coal and other fossil fuel reserves, Ordos was able to annually accumulate up to 225 billion RMB wealth those years. In May 2004, the government passed the planning and announced the break ground of Kangbashi New District. 5 billion were spent on development, and after only three years, the government of Ordos was relocated to Kangbashi.

1
光欣. "迷局: 一座豪华空城的诞生——鄂尔多斯市康巴什新区空城现象调查." 中华建设 1 (2012): 27-29.

FIG 1-3

"Achievement"

<My Happy Life> Published by the Government

It was an ambitious plan. The entire area of plan consists of 155 square kilometers land, 49 roads, 9 kinds of pipelines under constructions at the same time. The new city was located so far away because of the proximity to water. Although the river was just a creek and now has been dig much wider water was still a treasure in a such dry region in the middle of desert. To attract or perhaps "force" people to move to the new town, almost all government offices, No.1 Middle School of Ordos, No.1 Elementary School were moved to Kangbashi. Several statues of Genghis Khan are among the largest ones in the world. Prosperous development helped Ordos claim the highest GDP per capita at 25,239 USD of mainland China in 2010, surpassing Beijing and Shanghai.
It was such an honor for Ordos citizens and the government. A book was published to "show off" these magnificent achievements, and even with the failure these years you could still read this book if you stay in the rooms of some hotels. Earliest pages of the book showed pictures of Kangbashi before development-pure farmland.

1.2 Backbone

Such prosperity would not be possible without the immense coal reserves underneath the land of Ordos. The amount of coal detected till now is 780 billion ton, up to 1/6 of entire China[2]. From the mapping of coal fields in China, clearly Inner Mongolia and their neighbor Shanxi province are two largest coal-bearing regions and have densest gas pipelines. In addition, natural gas also occupies

2
"Ordos City." *Wikipedia, the Free Encyclopedia*, April 5, 2015. http://en.wikipedia.org/w/index.php?title=Ordos_City&oldid=655003749.

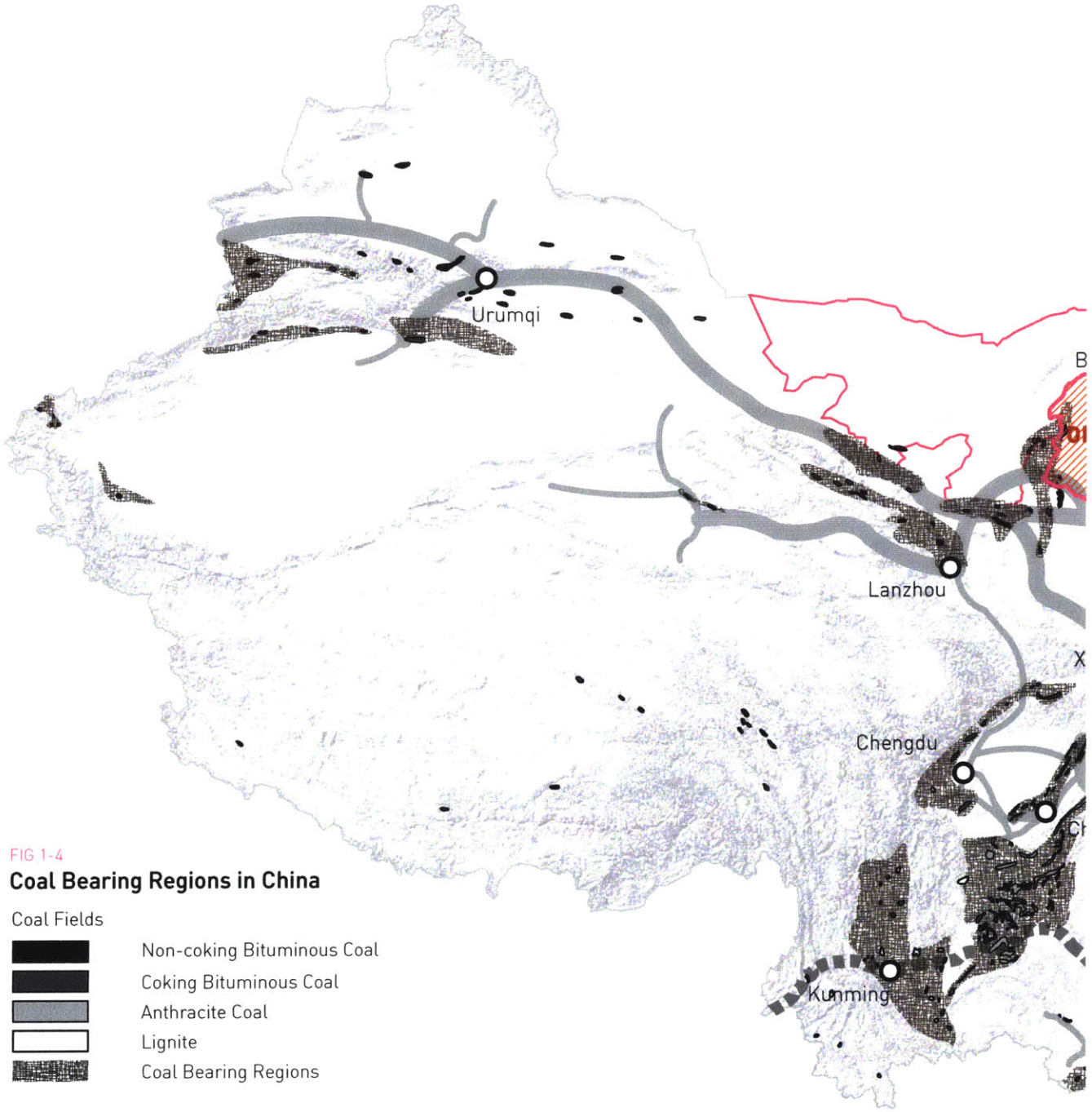


FIG 1-4

Coal Bearing Regions in China

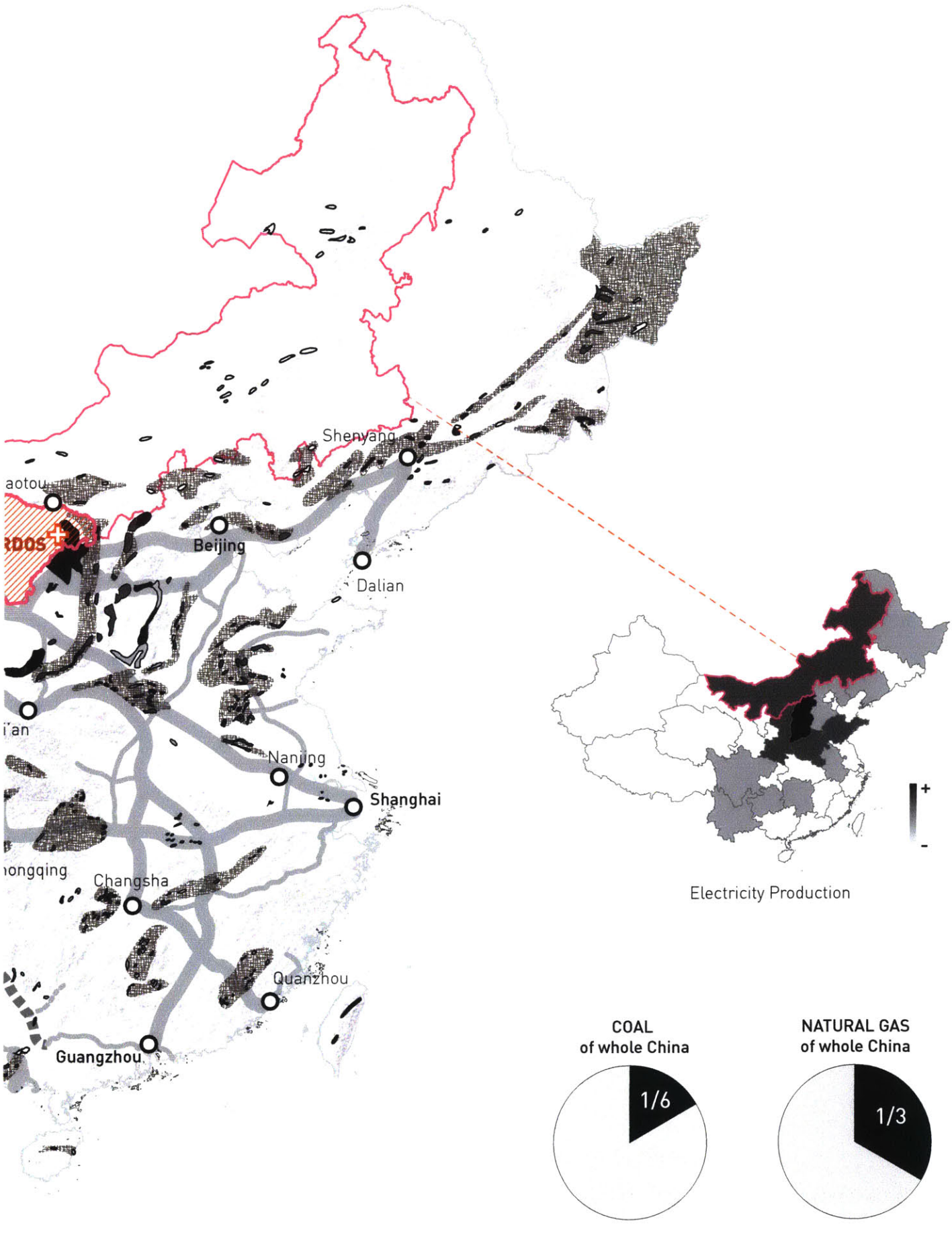
Coal Fields

- Non-coking Bituminous Coal
- Coking Bituminous Coal
- Anthracite Coal
- Lignite
- Coal Bearing Regions

Gas Pipeline

- Trunk
- Branch
- Future Trunk
- Future Branch

Data Source: US Geological Survey


Shenyang
aotou
Beijing
Dalian
Nanjing
Shanghai
ongqing
Changsha
Quanzhou
Guangzhou
+
-
Electricity Production
COAL
of whole China
1/6
NATURAL GAS
of whole China
1/3

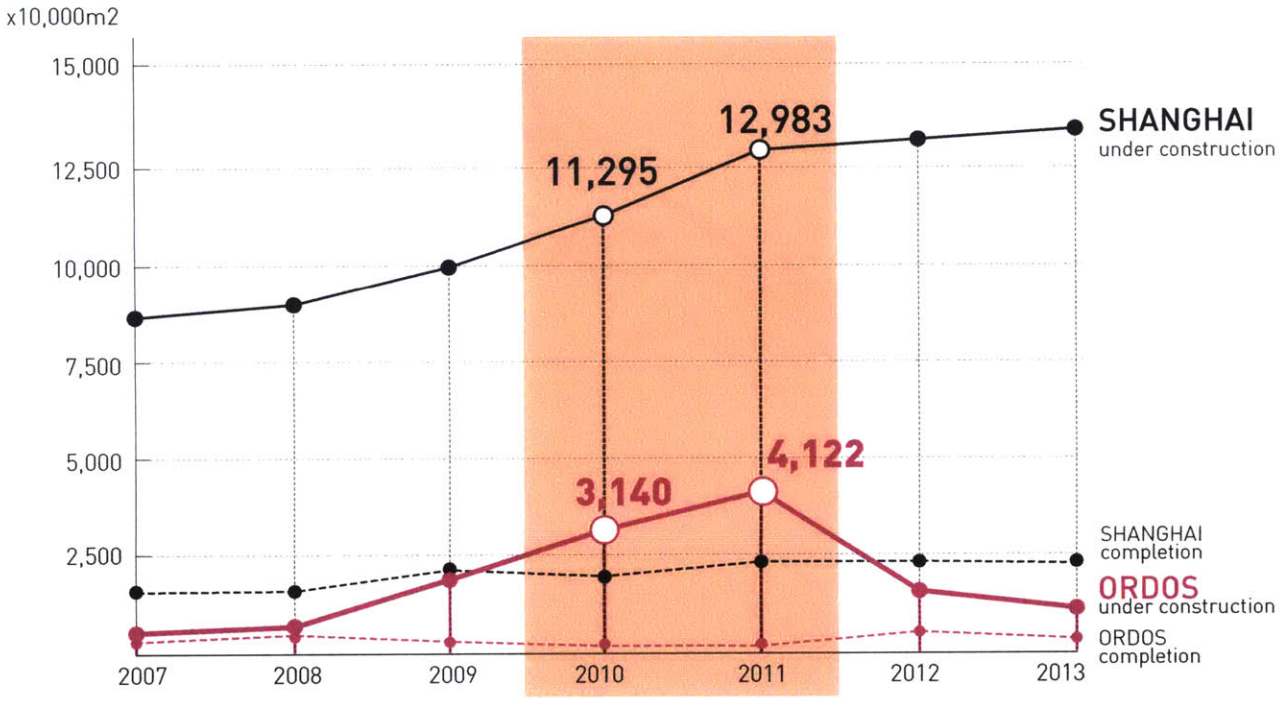


FIG 1-5

Real Estate Construction

Comparison between Shanghai and Ordos

1/3 of whole China.

However, export demand and consumption of coal dropped dramatically during the last decade. Environmental requirements have been a big discussion of policy makers. More than 80 low-carbon programs have been brought up, and obviously coal industries are the victims. Meanwhile, other countries, such as Russia, are able to provide wider range of coal products and better quality, which also grabbed significant amount of share.

The decline began in 2013. The PPI (Producer Price Index) data in April, 2013 showed that, resource extraction industries had the highest percentage of decline at 8.2%. In the meanwhile, the stocked coal was still increasing. Coal price all dropped at least 100 RMB per ton, among which pulverized coal was sold less than half price[3].

3
"鄂尔多斯煤矿陷入停产危机 一吨煤利润仅几十元."
http://finance.sina.com.cn/china/dfjj/20130521/214215539008.shtml.

The real estate market and development pace went hand in hand. The fate of coal industries also projected to the real estate market. During the booming 2010 and 2011, the square footage of real estate under construction was about 1/3 of Shanghai when there were only two million people. And right from 2012, the increase of real estate slowed down significantly. Another interesting take away from this chart are the completion numbers. While square meters under construction skyrocketed, completion amount remained fairly low, which resulted in abandoned structures everywhere. The abandonness and fragmentation will be addressed explicitly in later chapters.

"In fact, **the first human** beings spotted on a taxi ride from the airport into the center of Ordos weren't pedestrians — there were few of those — but **municipal cleaning crews**, tidying the sidewalks and broad, multi-lane thoroughfares."

--David Barboza, The New York Times.

1.3 "Champion" of Ghost Cities

Now what is Ordos look like? People around the world have come to know this most extreme ghost city through pictures on media coverages.

Empty roads. When walking on the streets in Ordos, I could hardly spot pedestrians except lunchtime. Car ownership in Ordos is very high compared to other third-tier cities. In average, each family owns two cars and use for commute as most of them live in Dongsheng or the nearby Ejin Horo. Parking lots of shopping malls were full of vehicles but they all belong to employees rather than customers. In addition, residential neighborhoods are gated without street retail, making walking on the streets unnecessary.

As quoted, cleaners were the most frequent people you could come across on the streets. They were sitting and did not have much work to do except for the dust from the deserts.

FIG 1-6 (Previous Page)
Empty Roads in Ordos

FIG 1-7 (left two)
Lonely and Idle Street Cleaners

The city completed most of the buildings and plazas along the main axis. Yet, lots of abandoned buildings could be witnessed especially at the periphery of the city, including the infamous Or-

FIG 1-8 (Previous Page)
Abandoned Structures in Sunset

FIG 1-9 (Right Three)
Abandoned and Vacant Buildings

dos 100. Right beside a large vacant residential community there was an elementary school. Around 4pm, that's the only time you could see so many people when parents were waiting to pick up their children. I asked one of the parents who was my taxi driver: were you living here and why you were still doing business in this empty city. He said, for the education of his child everything was out of question, and living close to the school was a must even in an almost empty apartment buildings.

The government has been reluctant to reveal vacancy rates because it would arouse people's anger for the continuously increasing housing prices. Fortunately, I was able to get some statistics from government officials:
-Completed areas: 6,332,500 sqm; Residential 5,452,900 sqm, Public buildings 879,600 sqm;
-Completed housing units: 27,348;
-Completed but unsaled apartments: 1,439,500 sqm, 7268 units;
-Uncompleted housing: 5,341,400 sqm; Among which, 2,876,900 sqm finished main construction; 1,819,400 sqm under construction; 645,100 sqm under foundation construction[4].

4
Information from government official.

No only residential buildings are suffering. There were six office towers right across the river, where the government wanted there to be the new CBD. Currently two of them are in use, one of which has 40 floors but only is only opening 25 floors occupied by two companies. The other office tower is being used by some


时尚
绿之韵
RESGREEN
BOYGIRL
FOTILE方太


redkids
红孩儿
Disney
YGADR
康佳 易TV slim
范冰冰的选择

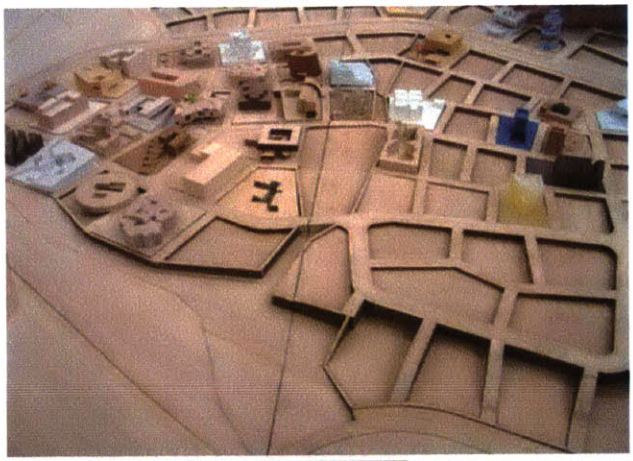
FIG 1-10 (Previous Page)
Unleased Space of the Shopping Mall

government departments.

Two shopping malls sit on the axis right across road to each other. One mainly sells electronics and appliances while the other focus on food and clothes. The electronics mall is run by one of the largest appliances retailers in China, Suning Appliance, which helps maintain certain occupation rate. The mall across the road is not that lucky. Only first and the top floor were rented as the top floor has the lowest rent; washing machines and other appliances were covered by dust; salespeople always outnumbered customers.

The famous project "Ordos 100" locates to the northeastern corner of the city. It was a construction project curated by Swiss architect Herzog and de Meuron and Chinese artist Ai Weiwei, consisting of 100 villa projects designed by 100 architects from 27 countries. The plan started from 2008 when some of the selected architects were thrilled about the opportunity of being able to actually construct a real building out of paper drawings in the middle of China. The developer, Jiang Yuan Water Engineering Ltd, organized three site visits for the architects[5]. It might be a great site for luxury villas, as even taxi drivers did not know how to get there when I asked. With the decline of coal mining, all industries in Ordos lost the engine behind, including this developer. Till end of 2014, there were only 6 of the 100 projects were built. Only the Ordos Art Museum was functioning, yet no one knows that.

5
Ai, Weiwei. *Ordos 100*. Documentary, 2012.



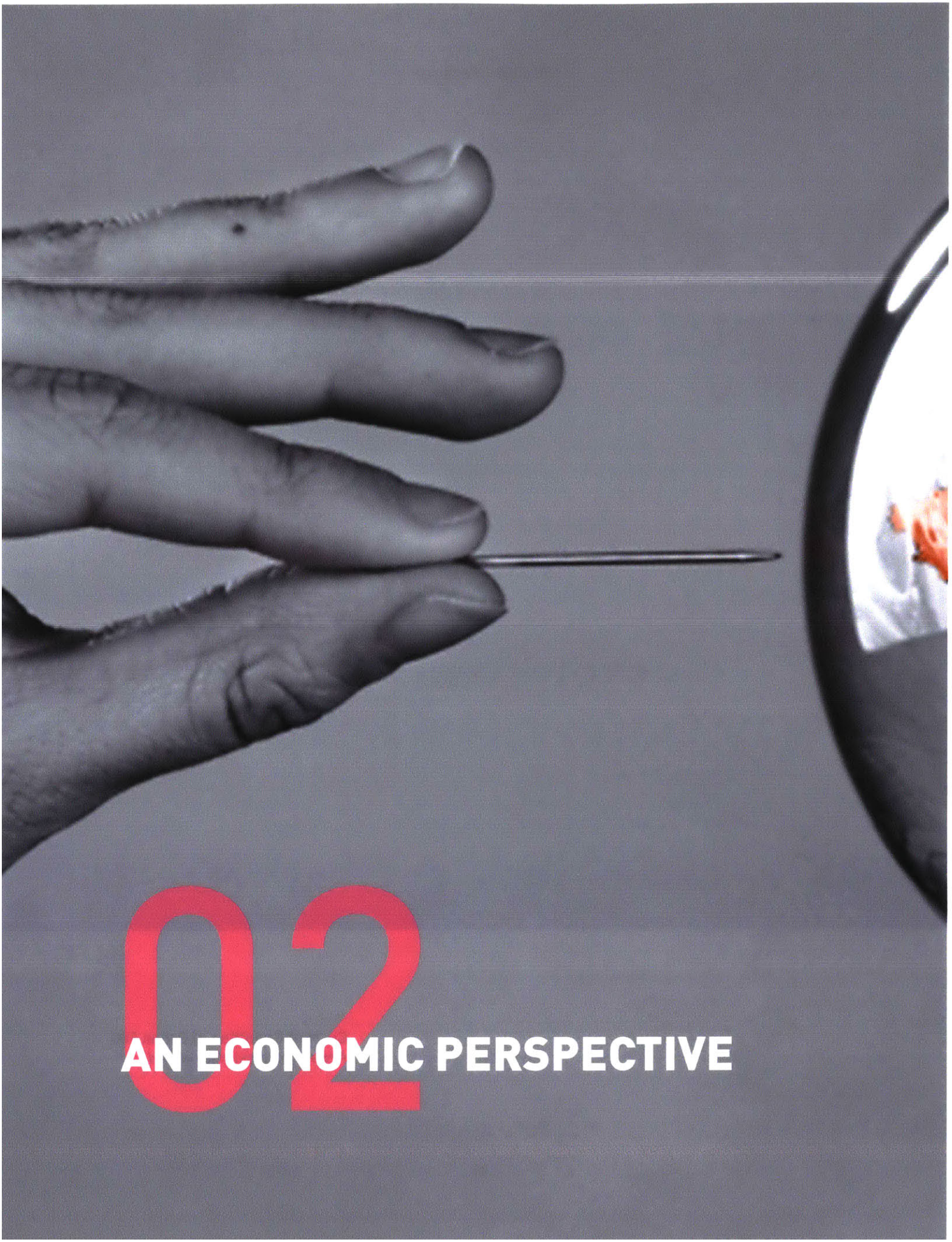
with at the level of each individual villa, while the latter is unavoidable given the project's location. The careful selection of internationally up-and-coming and locally established young practices has created an exciting setting for architectural discussions and experiments of all kinds in a Chinese context characterised by a desire for innovation, alternatives, distance, and local culture.

For many of the participating architects it is a great way to have almost carte blanche to express their desires and test them in the unique conditions of contemporary China. More than an 'architectural zoo' one gets the feeling of an 'architectural jewellery box', a series of precious villas put in proximity to each other in the wide open desert. Once all of them are built our understanding of the impact, legacy, and reality of Ordos 100 might change again.

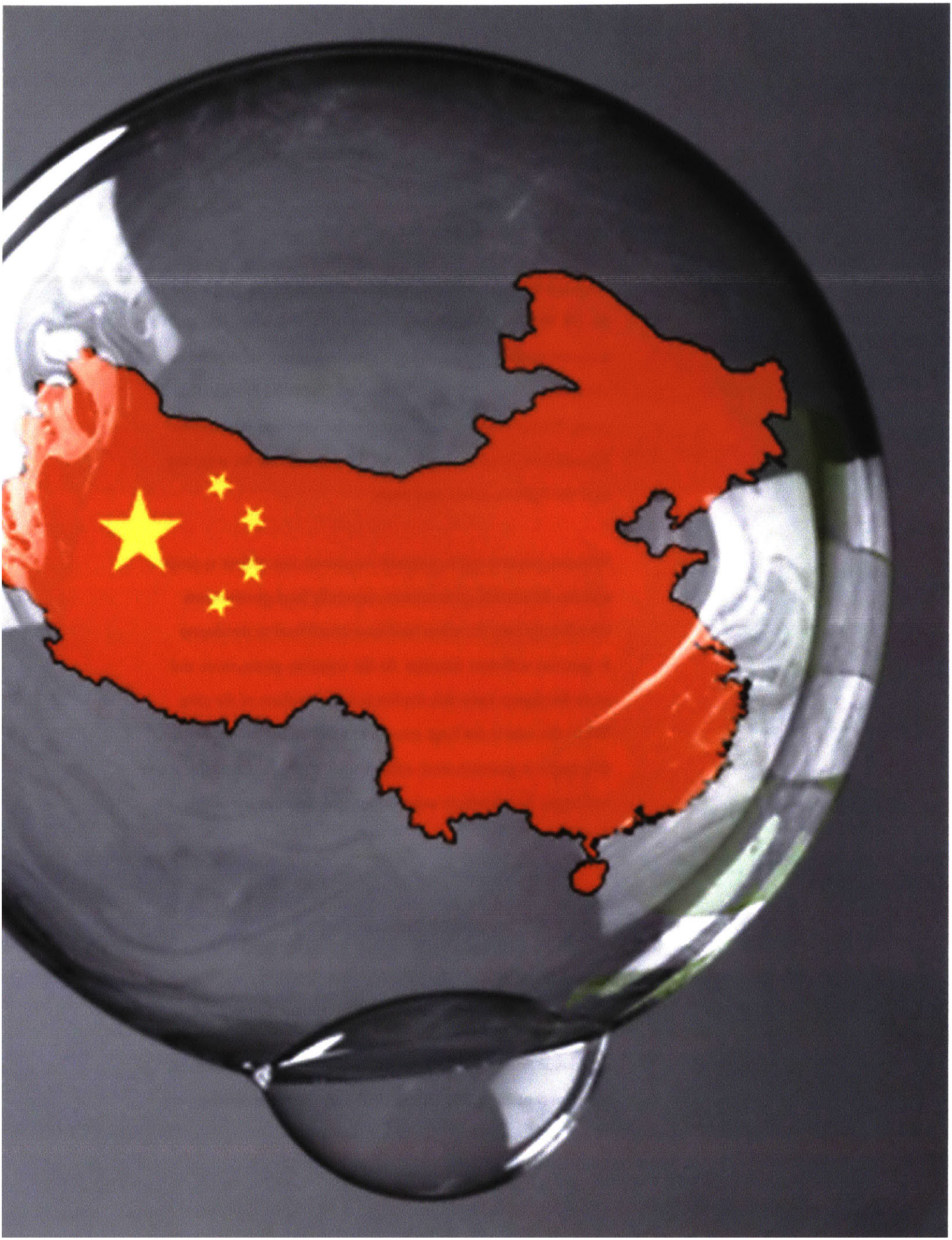
FIG 1-11

Ambitious Ordos 100 Project

FIG 1-12
Current Condition of Ordos 100
A totally deserted piece of land



02 AN ECONOMIC PERSPECTIVE



2.1 Land Policy

There is a huge difference of land ownership between China and the US. While land is privately owned in the US, land in China is almost publicly owned. There are two categories: urban land is owned by the state; rural/agriculture land is owned by collective group. Private property rights virtually not exist and land transfer is prohibited. Land leasing became the primary rule for assigning land use rights to urban land users.

Without property rights, property owners are not subject to property tax. As a result, governments, especially local governments who directly own the urban land have to sell land to developers to generate sufficient revenues. As the economy grows, more and more developers enter this market and want a share of the cake. When the cake is not large enough to fulfill all the profit pursuers, they begin to generate more urban land, making the cake larger and larger. Kangbashi, to some extent, was the outcome of this process.

2.2 Speculation Bubble

The overheating economy around 2007 and 2008 stimulated speculation investments all over China. In 2008, to face with the worldwide financial crisis, China launched an economic stimulus program containing 586 billion USD and a series of development

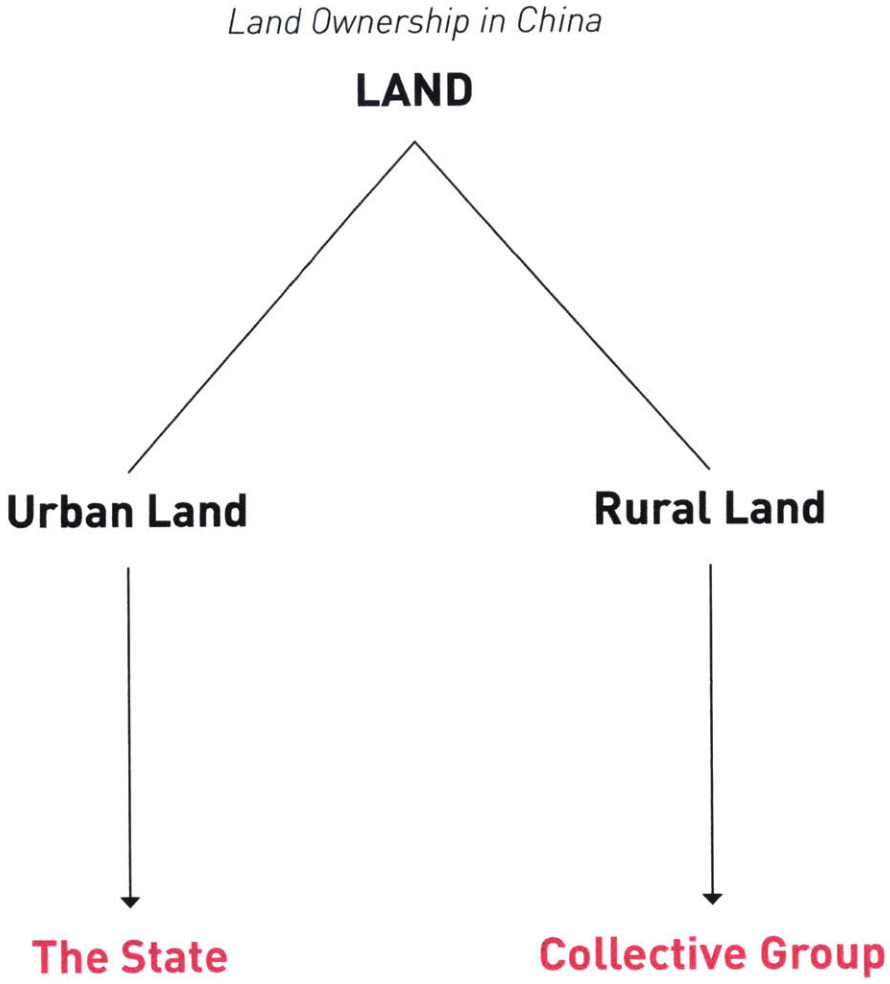


FIG 2-1
Land Ownership in China
No Private Property Right

projects for public infrastructure, housing, rural development, and the restoration of Sichuan earthquake[1].

Mortgage loans played a significant role in this speculation bubble. Around 20% of loans from state-owned bank went to the government and developers[2]. Too much credit on housing development was provided without sufficient risk evaluations. Yet, during the booming period, no evaluation could predict the future. With such amount of money trapped in the real estate market, a burst of bubble could harm the entire economy.

The chart indicated the size of house-price bubble of major Chinese cities. Looking into different regions, the market was more risky in special economic zones and the south-eastern coastal cities. Among all these cities, Shenzhen reached the peak in 2009 at 68% of housing prices above the long-term equilibrium.

As the instability of other investment options, especially the stock market, real estate became the top choice for storing money and earning appreciation. Real estate became the game of wealthy people who carry bunches of cash. Price-to-income ratio was driven too high for normal people to purchase. Housing prices are not only an economic problem but also a social issue that will affect stability.

1
"China's Bubble Economy or 'The China Bubble'." http://www.thebubblebubble.com/china-bubble/.

2
"On the Chinese House-Price Bubble." *VoxEU.org*. http://www.voxeu.org/article/china-s-housing-bubble-new-evidence.

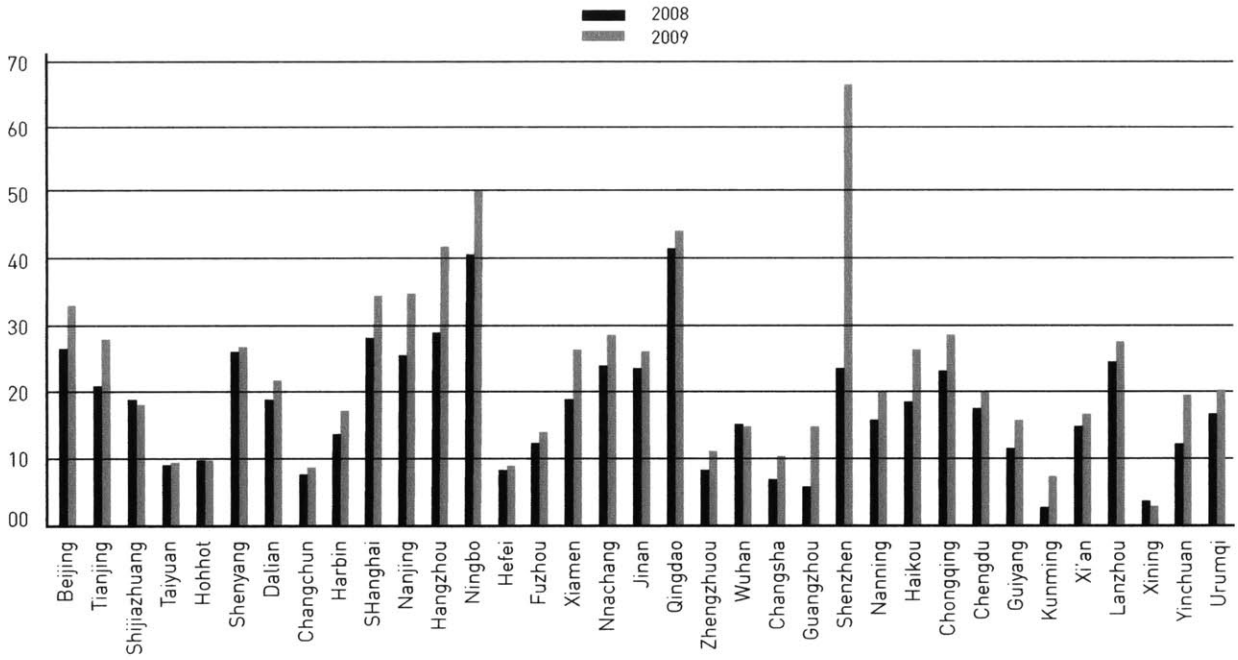
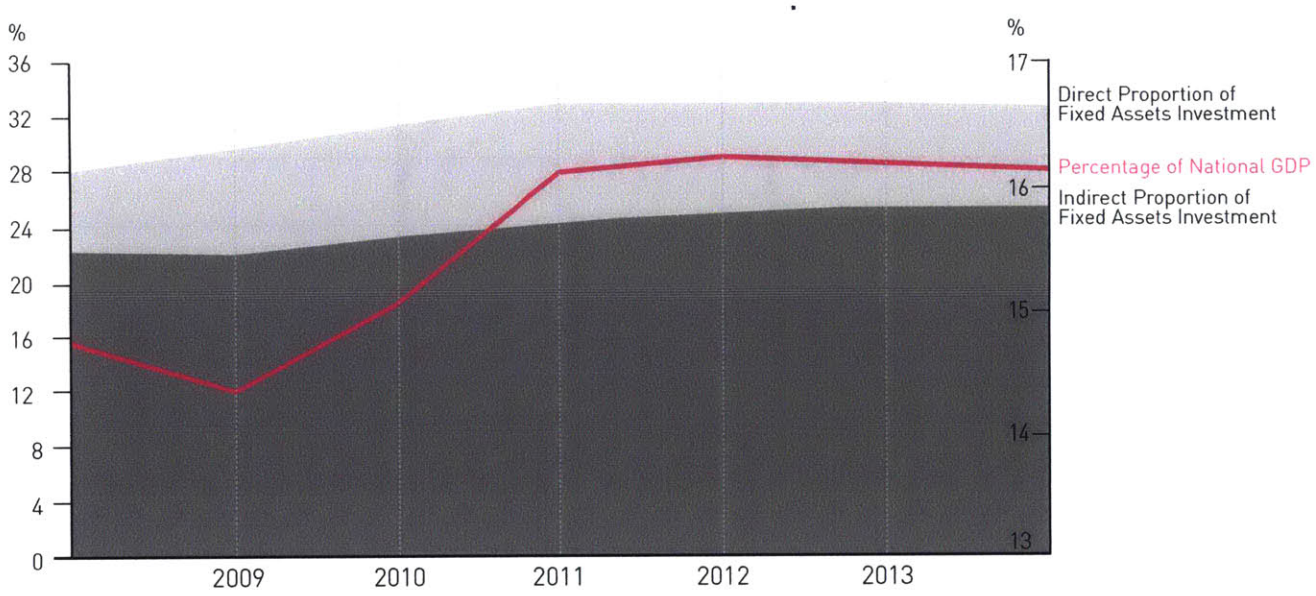


FIG 2-2

House price bubble

Size of Housing Bubble in Major Chinese Cities



Source: Li Xiuting and others (2014); CEIC; Nomura International Economic Research Department

FIG 2-3

Real Estate Direct and Indirect Impact

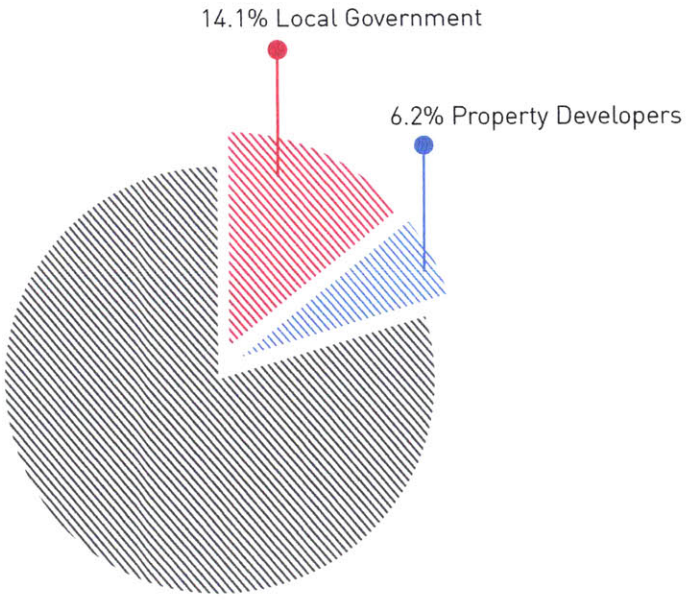


FIG 2-4
State-Owned Bank Loans

2.3 Social Aspect

Socially speaking, marriages are adding fuel to this housing boom. Now an apartment became the necessity required by bride's parents for a young man to get married. A saying goes that, years ago it was "one home one child", and now it is "one apartment one wife". Normally the bridegroom's family (parents will always help with down payment and young couples handle the mortgage) provides the apartment and the bride's family offer home appliances in the apartment and a new car.

Not only the government is GDP-driven, more and more girls are now wealth-driven. "Ernai" and "Xiaosan" became hot words as middle-aged married men tend to keep one or even more woman on the side, and an apartment is the standard requirement. These years, officials in the leadership of the Communist Party are always revealed to own numerous apartments and numbers of mistresses. Recent case for instance, Zhou Yongkang, a member of the 17th Politburo Standing Committee, was found out to own 326 apartments and villas[3].

3
"Zhou Yongkang." *Wikipedia, the Free Encyclopedia*, April 17, 2015. http://en.wikipedia.org/w/index.php?title=Zhou_Yongkang&oldid=656834725.

FIG 2-5
"No Apartment No Wife"

2.4 Decline of Coal

The economic collapse of Ordos went hand in hand with the decline of global coal industries. Not only Chinese coal companies, the largest US coal companies have also suffered more than 75 percentage loss of their highest income since 2011[3]. The US energy workforce has changed dramatically in the last five year. No doubt that environmental regulations are primary reasons for the decreasing demand for coal. As mentioned before, air pollution became a major concern for Chinese government after the capital went whiteout a couple times. Cleaner and sustainable energy are getting cheaper, higher efficiency, and gradually taking over the market. For instance, the chart shows the reversal return on assets between thermal power plant and coal-burnt power plant, which all started from 2011.

However in Ordos, coal and fossil fuel were the backbone of entire economy. In 2012, coal and natural gas contributed up to 85.15% for the whole industries[4]. The economic structure of Ordos is very simple. Resource extraction and manufacture industries took 60% of Ordos' GDP. The simple structure restricts the variety of usage of coal resources. Backward technologies results in low efficiency, less additional value, and hence lower price of resources. In addition, workers, technologies and research institutes have been constraint to one single industry, which do harm to further development of the city.

3
"The Incredible Shrinking U.S. Coal Industry." *EcoWatch.* http://ecowatch.com/2013/10/01/the-shrinking-u-s-coal-industry/.

4
钱帅. "资源型城市可持续发展研究——以鄂尔多斯为例." 世界华商经济年鉴: 理论版 8 (2011): 27-27.

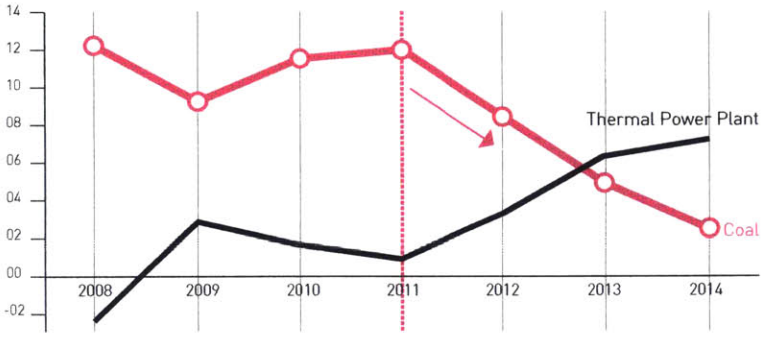


FIG 2-6

Comparison of Return on Assets

between thermal power plant and coal industries

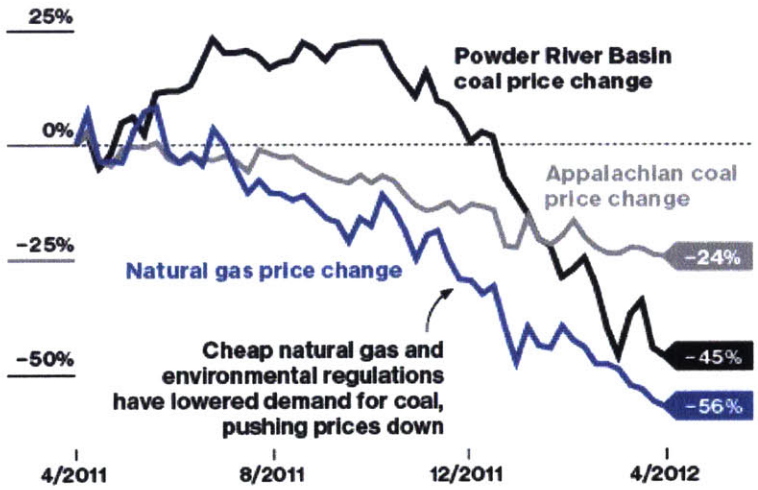


FIG 2-7

Coal's Darkest Hour

Being replaced by abundant natural gas

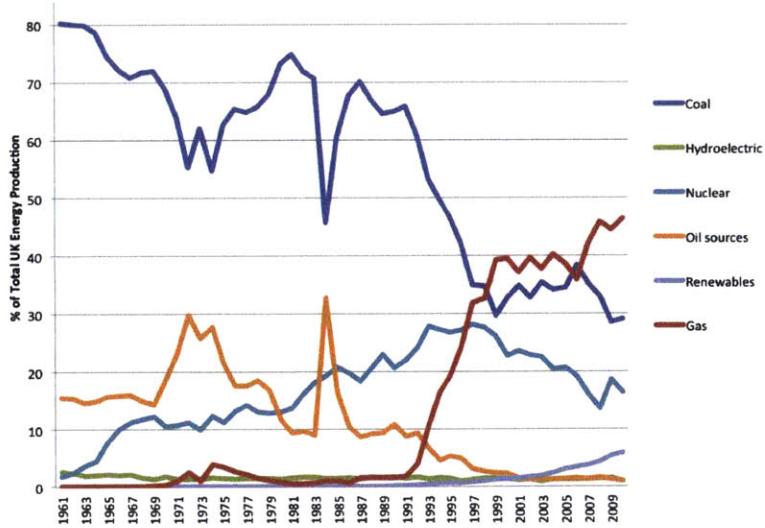


FIG 2-8

Energy Sources UK

2.5 Local Financial System

Private lending plays a significant role in the financial loop of some booming second and third tier cities, such as Wenzhou and Ordos. Due to the backward financial system, private lending actually helped advance the development of private economy. When private banks are banned in China, private lending is inevitable and high interest rate is just one of the derivatives.

However, everything would keep running as long as enough profit could feed the high interest rate. When the coal industries cannot function as the engine, the economy faced crisis. The crisis of the private capital market involved more than a thousand billion USD, and hit most hardly on the real estate market. In 2011, almost all development ceased construction or sale except two boutique projects[5]. To prevent the crisis and avoid being chased by borrowers, some projects were forced to break ground without enough funding, resulting in tons of abandoned structures and deserted land.

5
高和资本. "鄂尔多斯民间借贷危机调查 [N]." PhD diss., 2011.

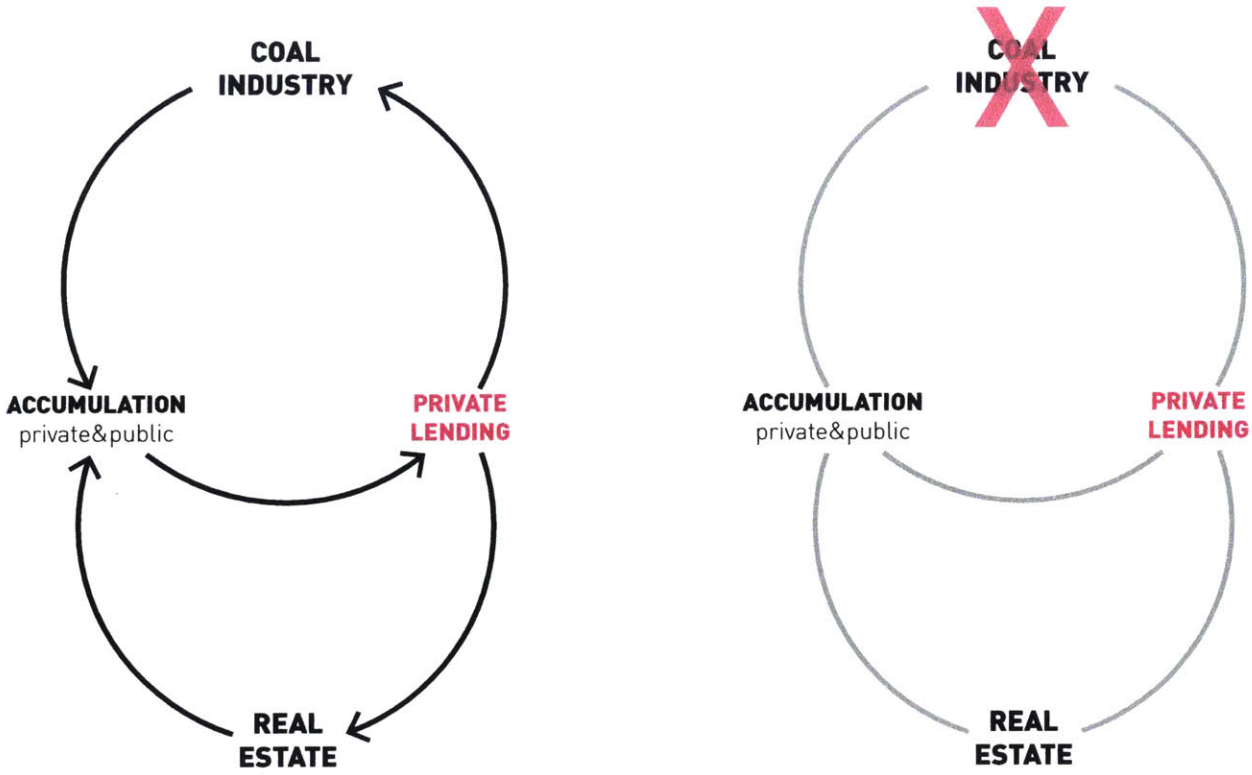
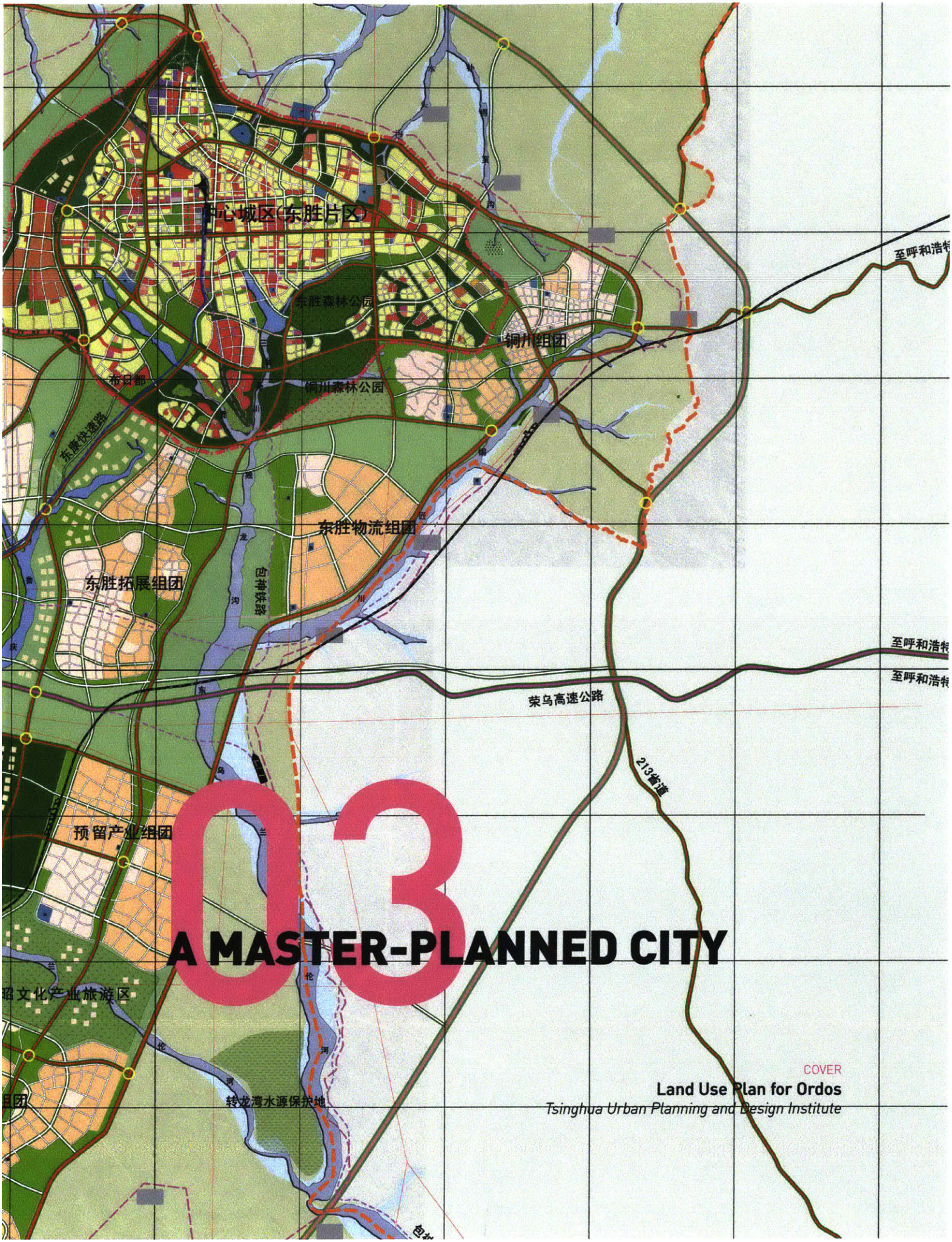


FIG 2-9
Financial System Collapse


乌海
109国道
泊尔江海子
包西铁路
羊台组团
九成宫生态体育休闲旅游区
210国道
乌海
荣乌高速公路
鄂尔多斯装备制造基地
马王庙体育休闲用地
马王庙水源保护地旅游区
康巴什体育、文化产业区
高新技术产业组团
民族团结公园
民族文化产业组团
鄂尔多斯文化产业区
210国道
中心城区(康阿片区)
包茂高速公路
棋盘井
伊克
东红海子市级风景区
阿康物流
机场快速(康阿方向)
西红海子市级风景区



03

A MASTER-PLANNED CITY

COVER

Land Use Plan for Ordos

Tsinghua Urban Planning and Design Institute

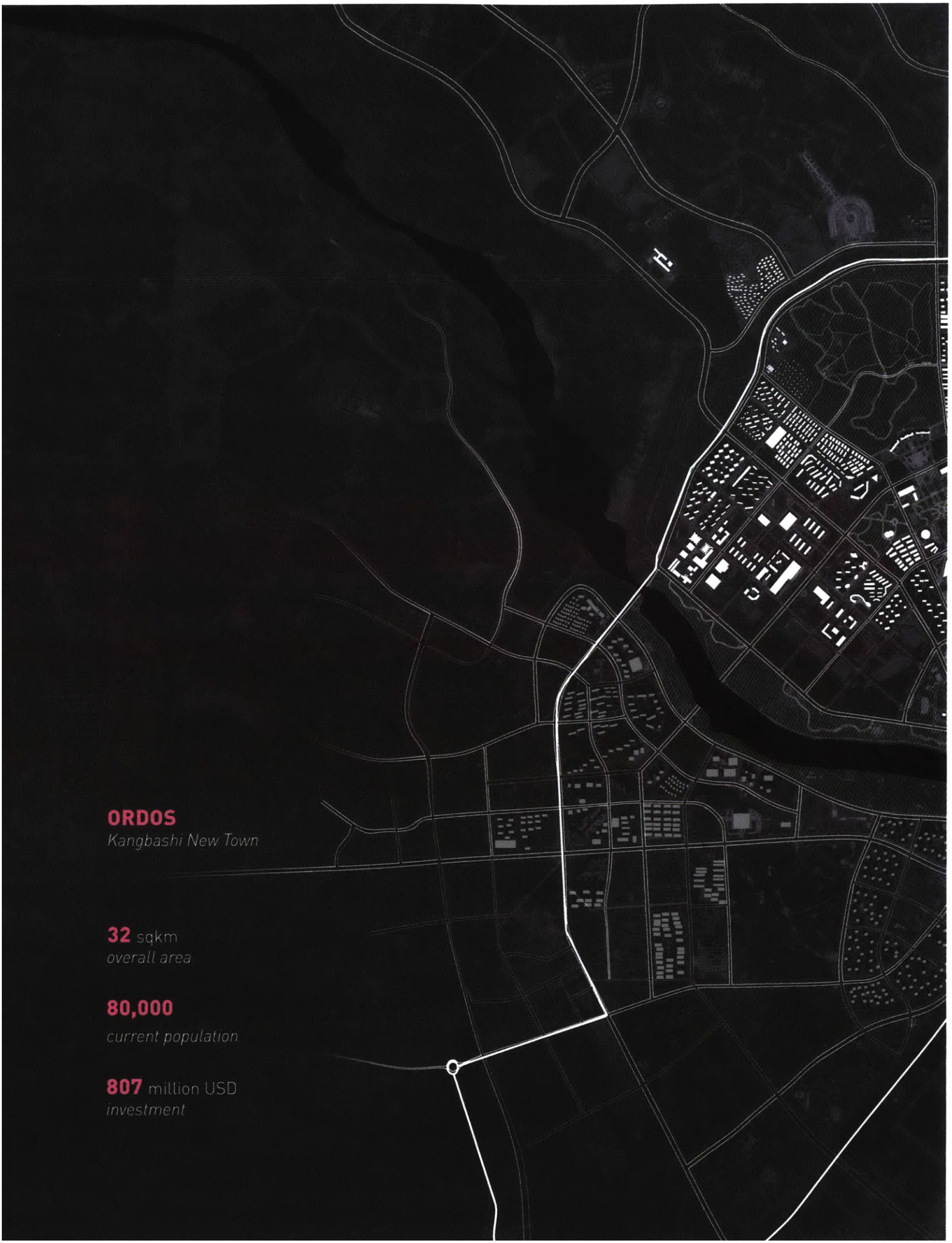

ORDOS
Kangbashi New Town
32 sqkm
overall area
80,000
current population
807 million USD
investment

FIG 3-1
Current Plan for Ordos

3.1 Formation of Ordos

Around 2005, Ordos held a competition for masterplanning the city. Two of the most prestigious planning offices participated-Tongji and Tsinghua (both are their urban planning and design institutes). Tsinghua won the commission, and created the plan, including the land use plan.

The city was generated from a utopian scenario—a city as the center of administration, culture, tourism, research and education, but no industries, logistics and transportation infrastructure. In China, the government can easily insert their wishes even they are not specialists. The centralized axis is no doubt the result of that and probably some concern of "Fengshui".

While industries are the backbone of the city, Kangbashi was planned full of office towers, schools and government offices. Ordos wanted to avoid the failure of those residential new towns but now it is almost a "government-official town". To the south of the river, a new residential community, the largest unoccupied community, was called the government-official community by taxi drivers. People, especially officials who have more flexible working hours, tend to live in the old town and commute about 40 minutes to work in Kangbashi every day. To attract officials settle down in the new town, units in government-official community were sold to them at discount.

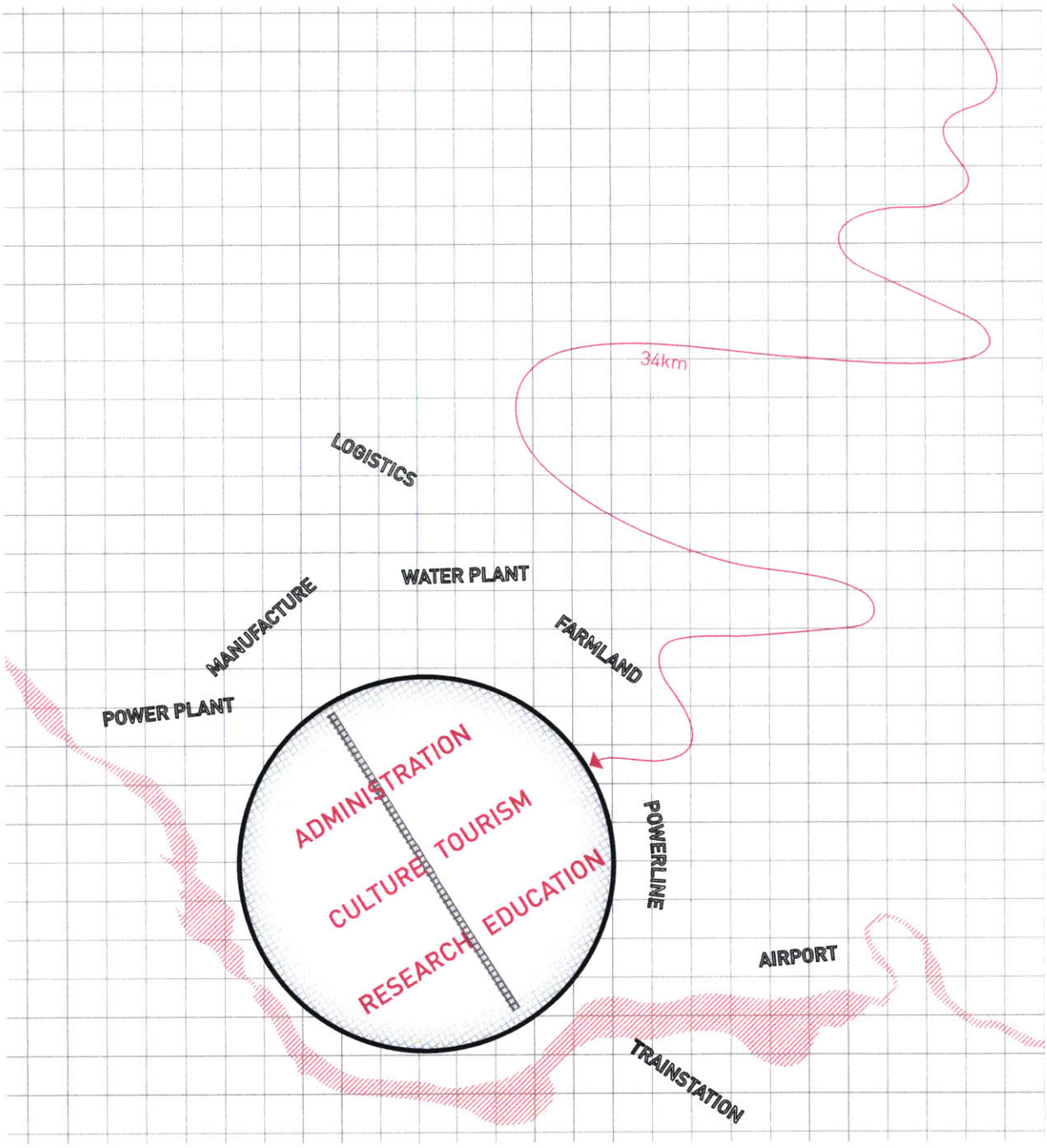


FIG 3-2

Formation of the City

New Location, No Industries, Access to water

That was one day when I was heading back hotel at around 4pm, the taxi driver said he needed to pick up his son in an elementary school. The school was right next to the government-official community. Not much pedestrians and cars could be spotted on the road except at the gate of the school. Every day I had to travel with taxi because I did not trust the bus system in the city, and I could only get a taxi via the "Didi Dache" app, a taxi-hailing service and Chinese version of Uber. All taxi drivers got the same question from me: if there were such few customers here, why didn't you move your business to the old town? Answers were similar, some had child who was attending school in Kangbashi, some still believed in the potential of student customers as more and more college students were moving in. To some extent, relocation strategy worked.

3.2 Inhumane Scale

Lack of complexity is the universal problem of Chinese new towns. Some circles and arrows would determine the whole planning scenario. Few hierarchies of roads; immense residential blocks; wide roads without street activities; one could hardly feel any identity in such city.

It was quite a surreal feeling when crossing the forty-meter wide roads and no need to wait for any traffic. The comparison between Ordos and other cities in same scale could give a sense. The blocks

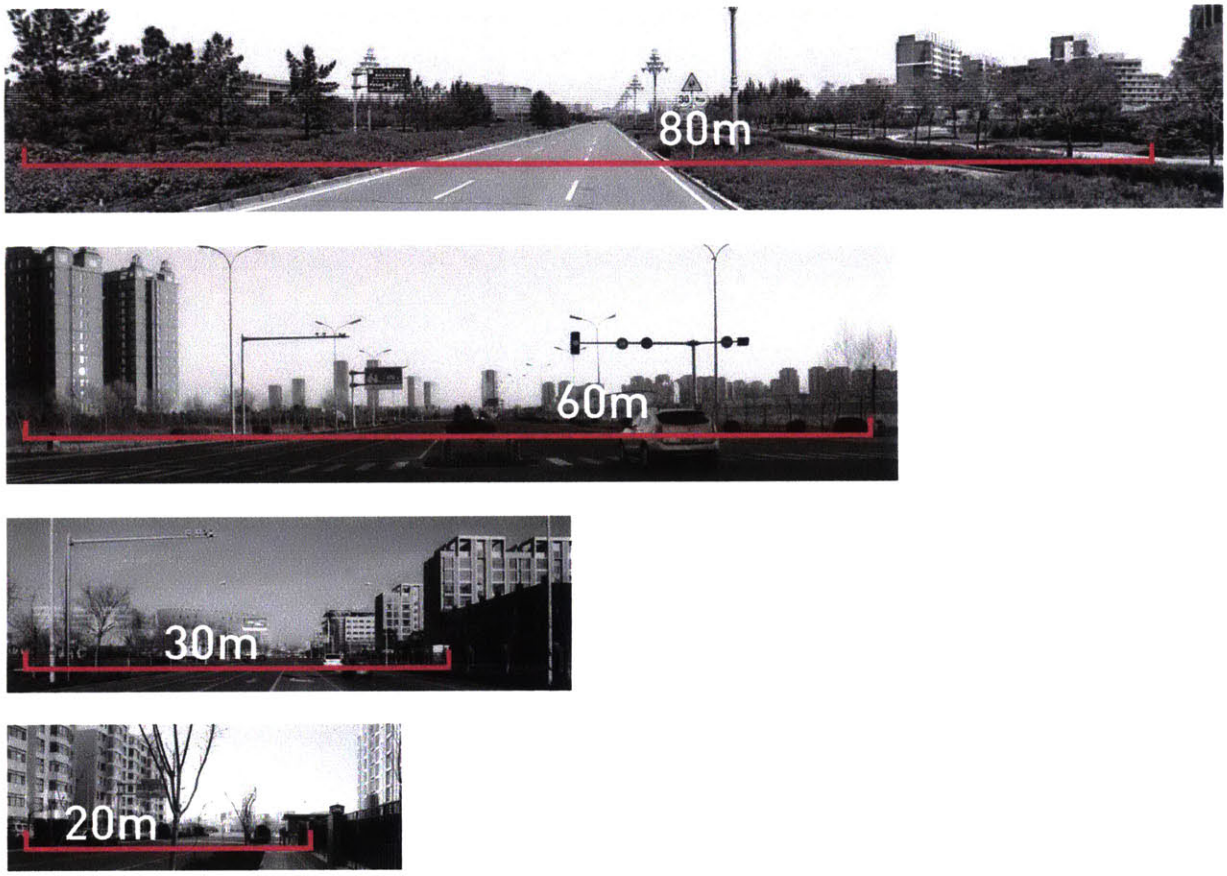
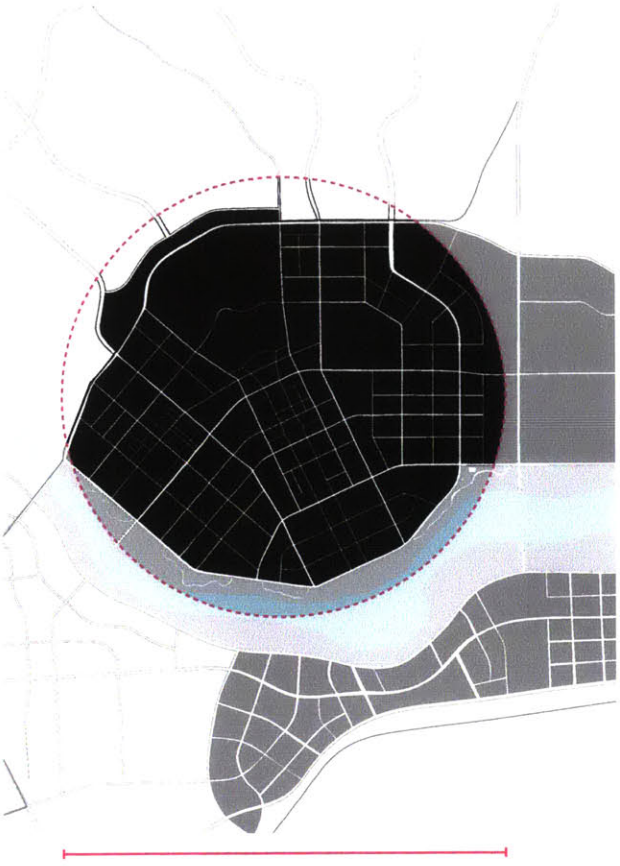


FIG 3-3
Scale of Road
Four Hierachies



ORDOS

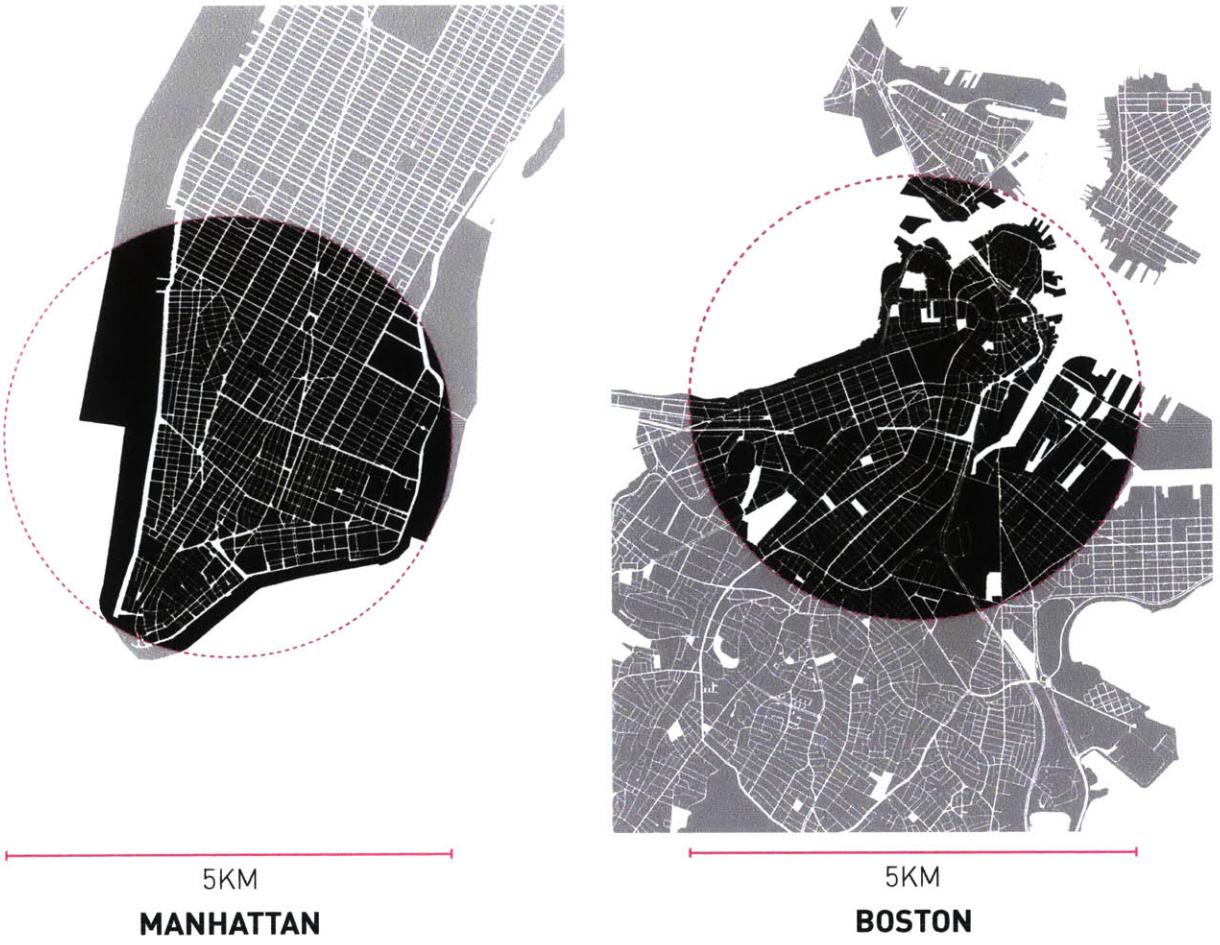
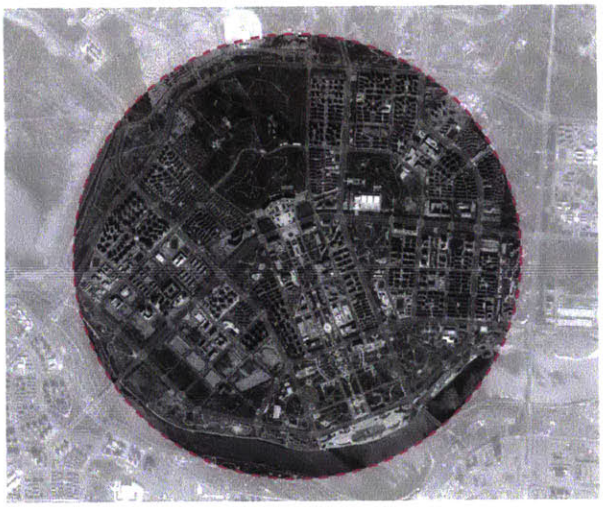
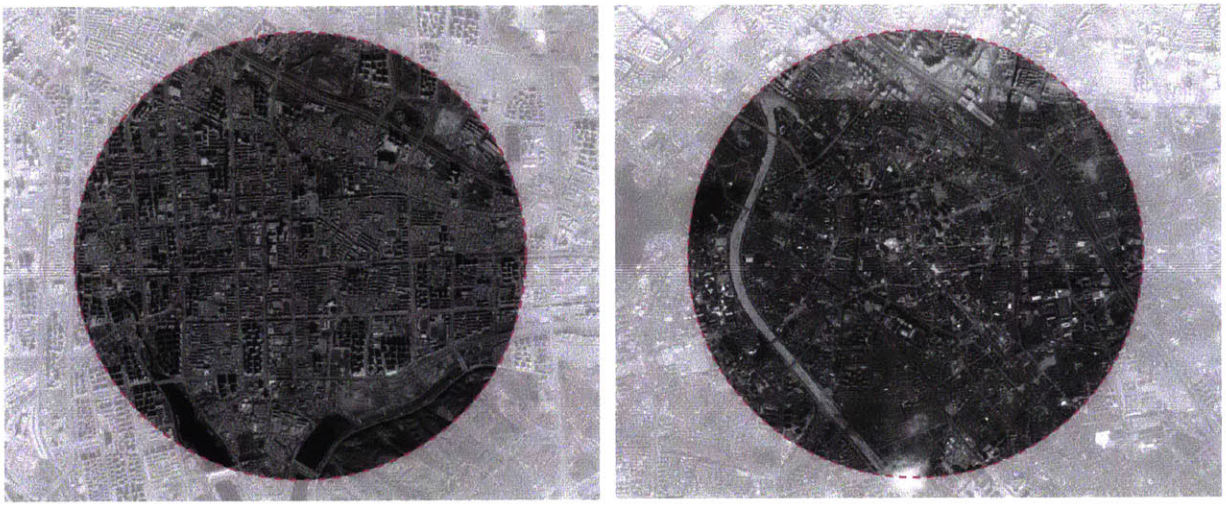


FIG 3-4
Scale of Blocks
Compared to Manhattan and Boston



5KM

ORDOS



5KM

DONGSHENG

Old Town

5KM

WUXI

Jiangsu Province

FIG 3-4

Scale of Blocks

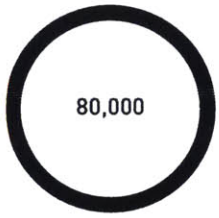
Compared to second/third tier Chinese cities

sizes are normally 200-300 by 300-400 meters, while Manhattan grid is around 80 by 260 meters, Barcelona is around 115 by 115 meters. Even other Chinese cities and the old town have more complex fabric and hybrid scales with the old fabric as mediation.

Economic values also contributed to the formation of superblocks. When the government sells land, small blocks would not satisfy the demand of developers. Instead of combining several pieces of land, the government just divided the land into larger pieces and hand over to developers. In such cities, there are no planning regulations and zoning codes, and master-plan results are highly influenced by the self-interests of the leadership members.

3.3 Real problems

However, although the scale of the city is inhumane, it is not the essential reason why people are reluctant to settle down in the new town. Let us compare Kangbashi with Zhengdong New District from Zhengzhou. A few years ago, Zhengdong New District was among the largest ghost cities. Kisho Kurokawa was the winner of the master-plan competition with the idea of metabolism urbanism. The master-plan with a circular lake in the middle of the city attracted the best architects for office towers to fill the world's largest office building clusters at that time. Like Ordos 100 to villas, Zhengdong New District offered numerous opportunities for office tower experiments.



Population of Ordos (Kangbashi)

Population of Zhengdong New District

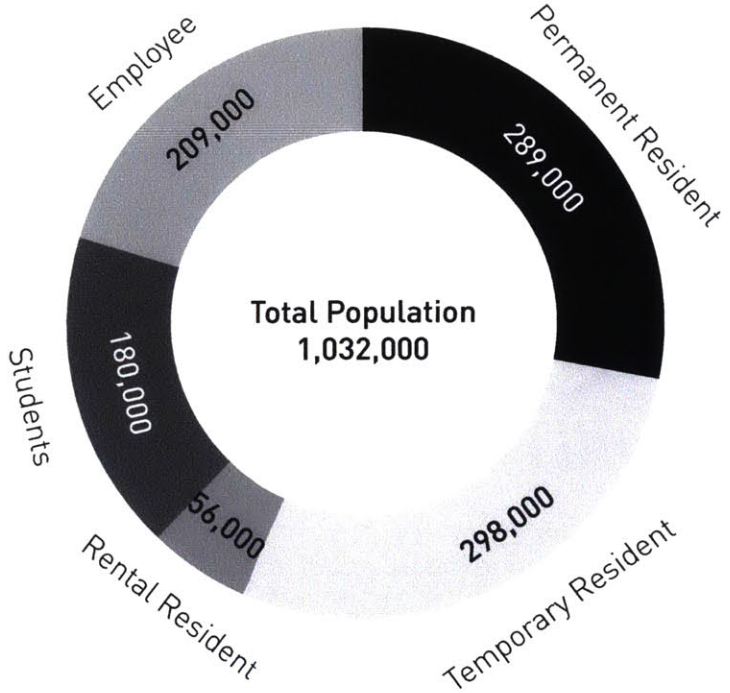


FIG 3-5

Different Situations

What's the real reason that keeps people settling down in Ordos?

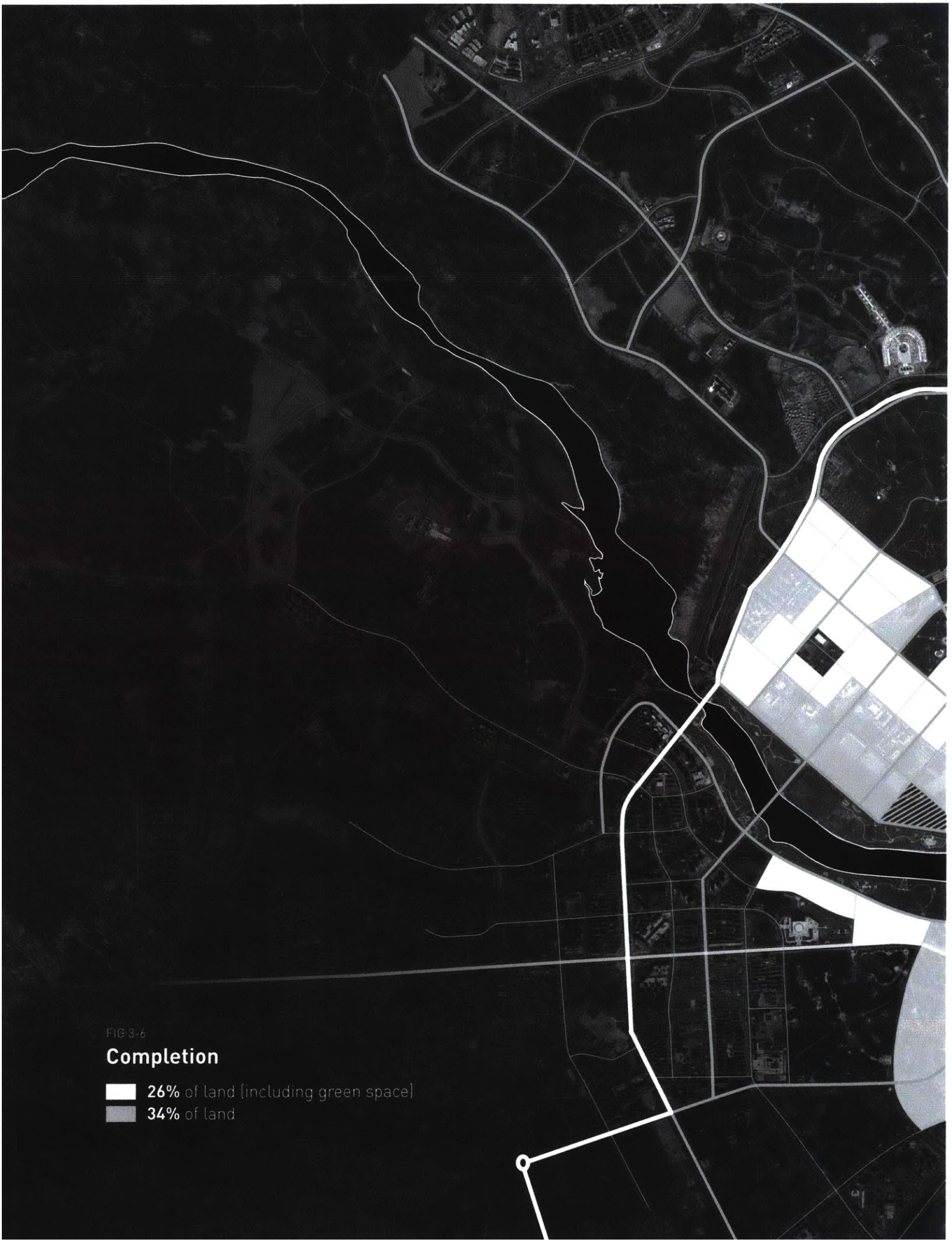


FIG 3-6

Completion

26% of land (including green space)

34% of land

Now Zhengdong New District revived according to some reports as the population reached more than one million. Although the statistics includes 298,000 temporary residents, there are substantial permanent residents and employee[1]. The strategy of mandatory relocation works better in big cities. A city like Zhengzhou, the congested transportation hub for a massive province with 95million people, could provide rigid demand for the new town. Same examples could be found in the nine towns at the periphery of Shanghai, where vivid life could be found.

Then what are the real problems and differences?

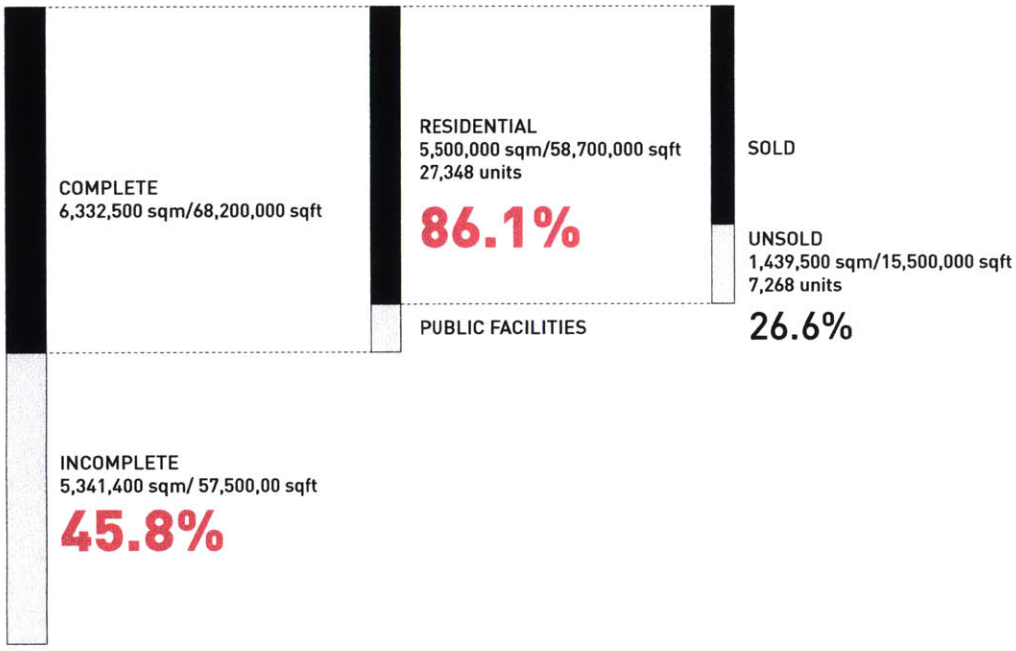
3.3.1 Sustainability of Economy

First is no doubt the size and sustainability of economy. In the boom period, Ordos created an economic miracle; but now, Ordos could hardly compare itself to Zhengzhou. As a city with 20 million populations, Zhengzhou could provide constant rigid demand for the new district. Even though it grew from total speculative investment, the strategy of "build it and they will come" seems worked at Zhengdong New District. By contrast in Ordos, without economic backbone the city lost their engine right away. Two million populations could not guarantee continuous demand for the economy.

1
"Time for a Reality Check on China's Ghost Cities."
https://www.chinadialogue.net/article/show/single/en/6402-Time-for-a-reality-check-on-China-s-ghost-cities.

3.3.2 Incompleteness

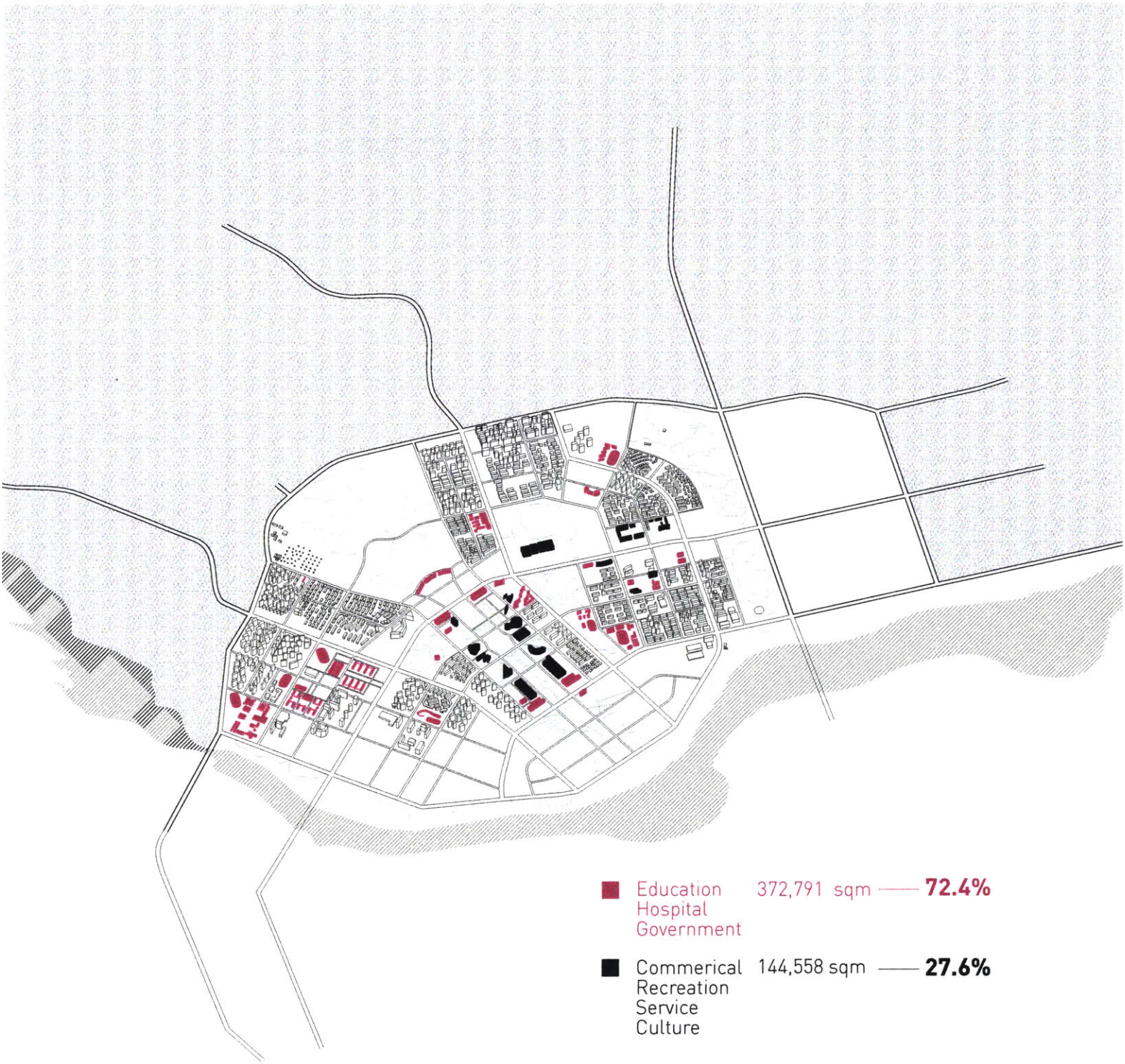
Second is the incompleteness. Due to the collapse of finance, almost all ongoing developments were suspended. Until the end of 2013, 34% of the land contained aborted construction sites, which meant the amount of land was not functioning. The statistics from the government showed that 45.8% of total area of construction (5,341,400 sqm/57,500,00 sqf) remained unfinished. City fabric was so fragmented that the civic life could hardly be complete and rich.

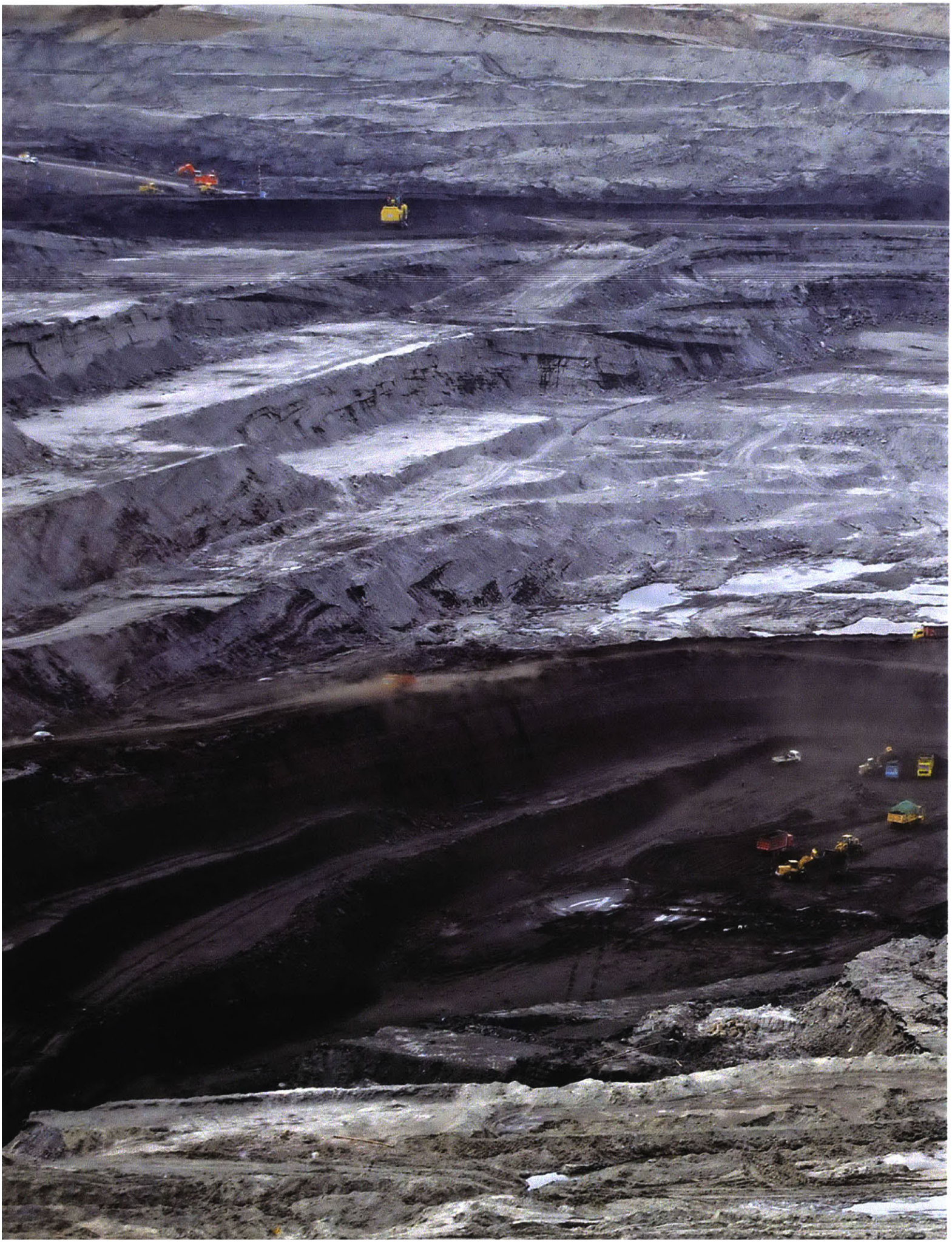


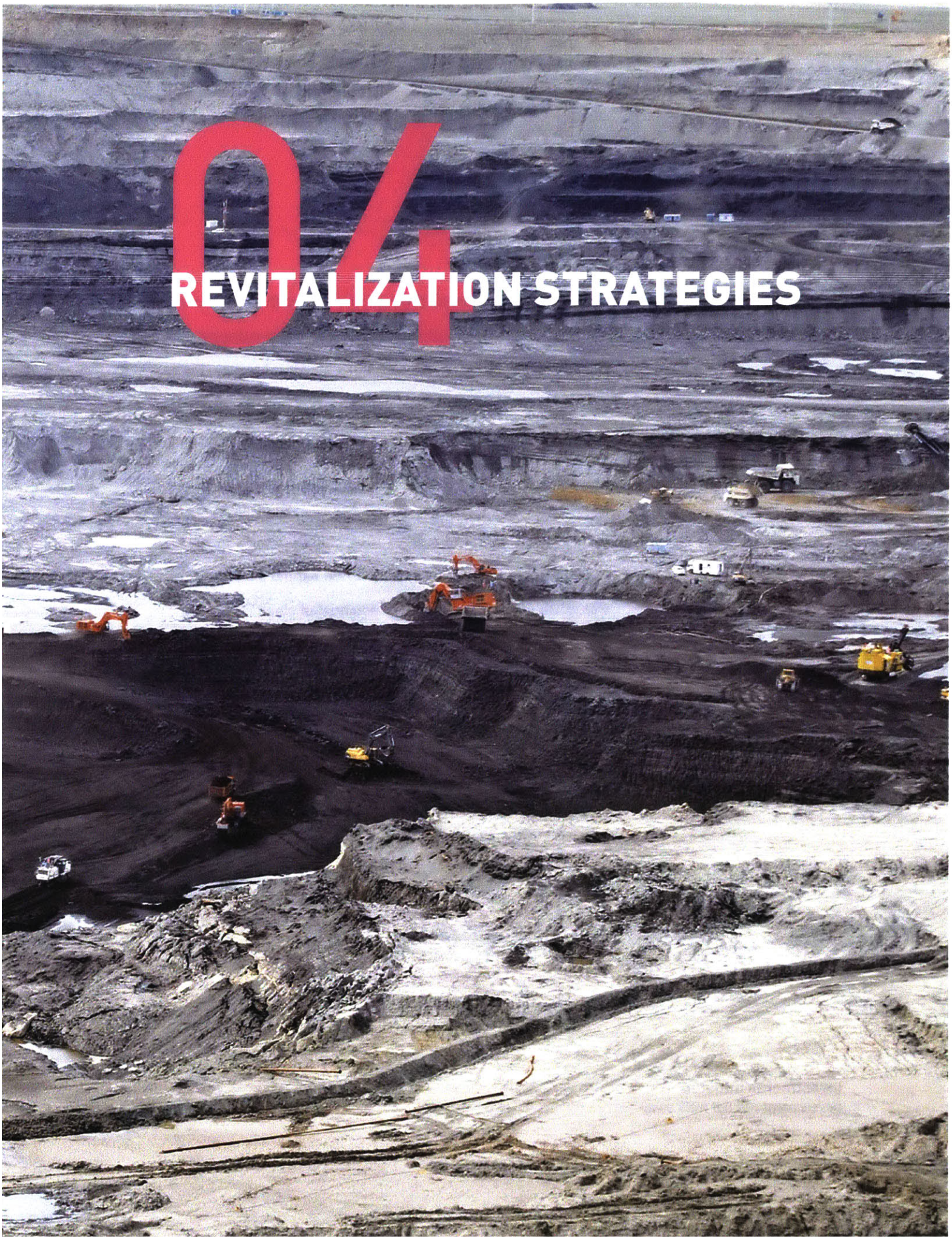
3.3.3 Program Distribution

Thirdly, planned program distribution was also imbalanced. As the government relocated best schools and hospitals and most important government offices, 72.4% of public facilities (land use ratio) are of these functions. However, commercial, recreational, cultural and service programs were not sufficiently planned. The most obvious is the lack of retail. Only two shopping malls were placed in the main axis of the city and remained empty. Girls who need a decent shopping have to go to the old town, Dongsheng. While the city had a radius of 2.5 kilometers, the axis became the only agglomeration spot of commercial and recreational activities. The city was planned as a single community, which was a total flawed sense of scale.

FIG 3-7 (right)
Program
Flawed Distribution


Education
Hospital
Government
372,791 sqm
72.4%
Commerical
Recreation
Service
Culture
144,558 sqm
27.6%





04 REVITALIZATION STRATEGIES

4.1 Economic Reform as Underpinning

Some would argue that all these ghost cities are the experiments of China's rapid urbanization and their failures are indispensable and acceptable. However, China is not a neoliberal society. The political importance of maintaining these experiments are critical. The government now endeavors to recover the industries from bankruptcy.

Only in the last three months of 2014, billions of investments have been initiated. First was a coal-based natural gas project that was worth 660 million USD. The potential of cloud computing and clean energy have been discovered, which led to 100 million

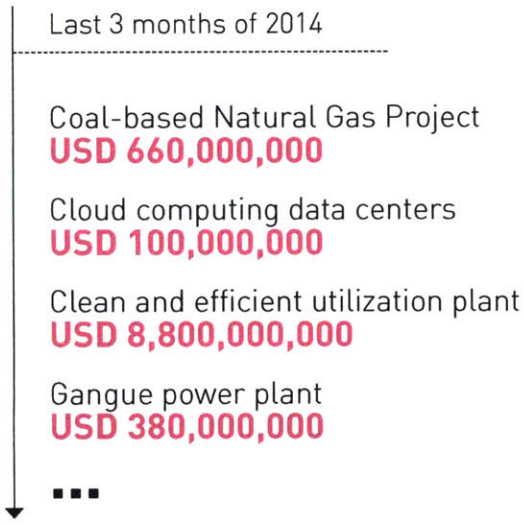


FIG 4-1
Investments Initiated
Government will not walk away

investments on a new data center and 8.8 billion on a clean and efficient utilization power plant. Coal stayed in the market and one power plant with 380 million investments was in planning process, utilizing one of coal residues—gangue[1].

1
MING, BEN SHE YI. *2013 Statistical Yearbook of Ordos(Chinese Edition) : 2013 E ER DUO SI TONG JI NIAN JIAN.*

Ordos now has the population of 2 million including all counties. The initial population target of Kangbashi was 1 million but after the slowdown 500,000 has been the new and reasonable goal. The new plan is targeting 300,000 for Kangbashi plus Ejin Horo till 2015, and 500,000 till 2020.

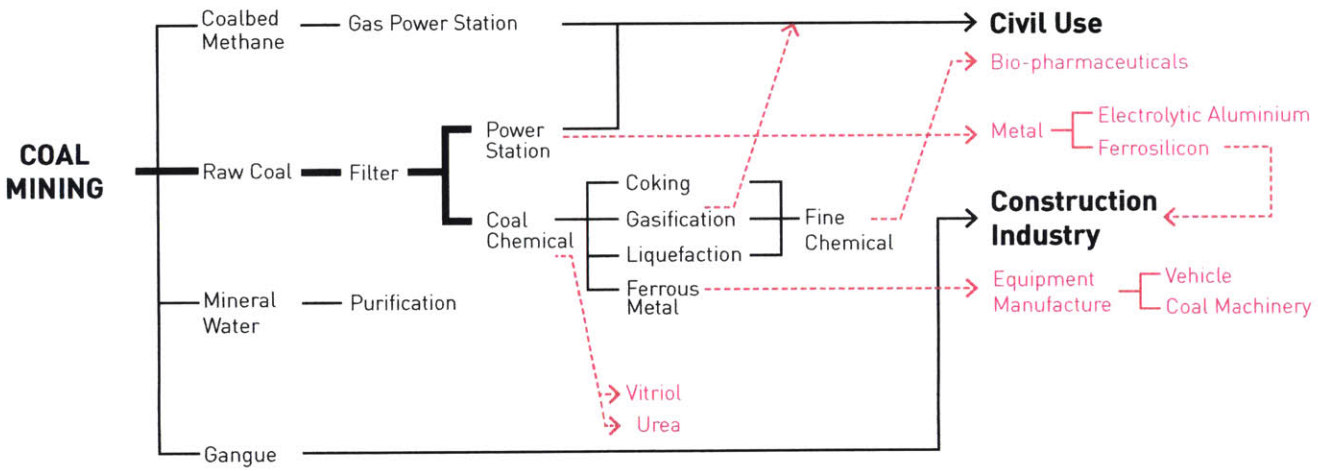


FIG 4-2
Industrial Chain Extension
Action took to better utilize coal resources

4.2 Reform of Industrial Structure

The nature of coal offers a wide range of outcome, covering electricity, chemistry, metallurgy, construction and other further processing industries. The new industrial structure should be able to extend the profit chain of coal mining and hence increase the conversion efficiency of raw materials. As a result, impact on environment would be relieved.

Ordos has made some progress. As mentioned before, a new gangue power plant has been initiated. The diagram shows the circular economic model for coal mining. However, the usage of coal cannot be restrained to merely manufacture, power production, construction, etc. In the meanwhile, environmental requirements made traditional energy extraction technologies unqualifiable.

New technology could provide opportunities. Instead of burning fossil fuel directly, coal is chemically transformed into syngas—a mixture consisting of methane (CH4) carbon monoxide (CO), hydrogen (H2), carbon dioxide (CO2) and water vapor (H2O)[2]. It is not a new technology, but recent drop of coal price and rise of gas price make this process more viable economically. Although currently the energy transformation efficiency is still around 60%, carbon dioxide could be reduced 40%. Carbon capture and storage are among all indispensable process.

2
"Coal Gasification." *Wikipedia, the Free Encyclopedia*, April 29, 2015. http://en.wikipedia.org/w/index.php?title=Coal_gasification&oldid=659854076.

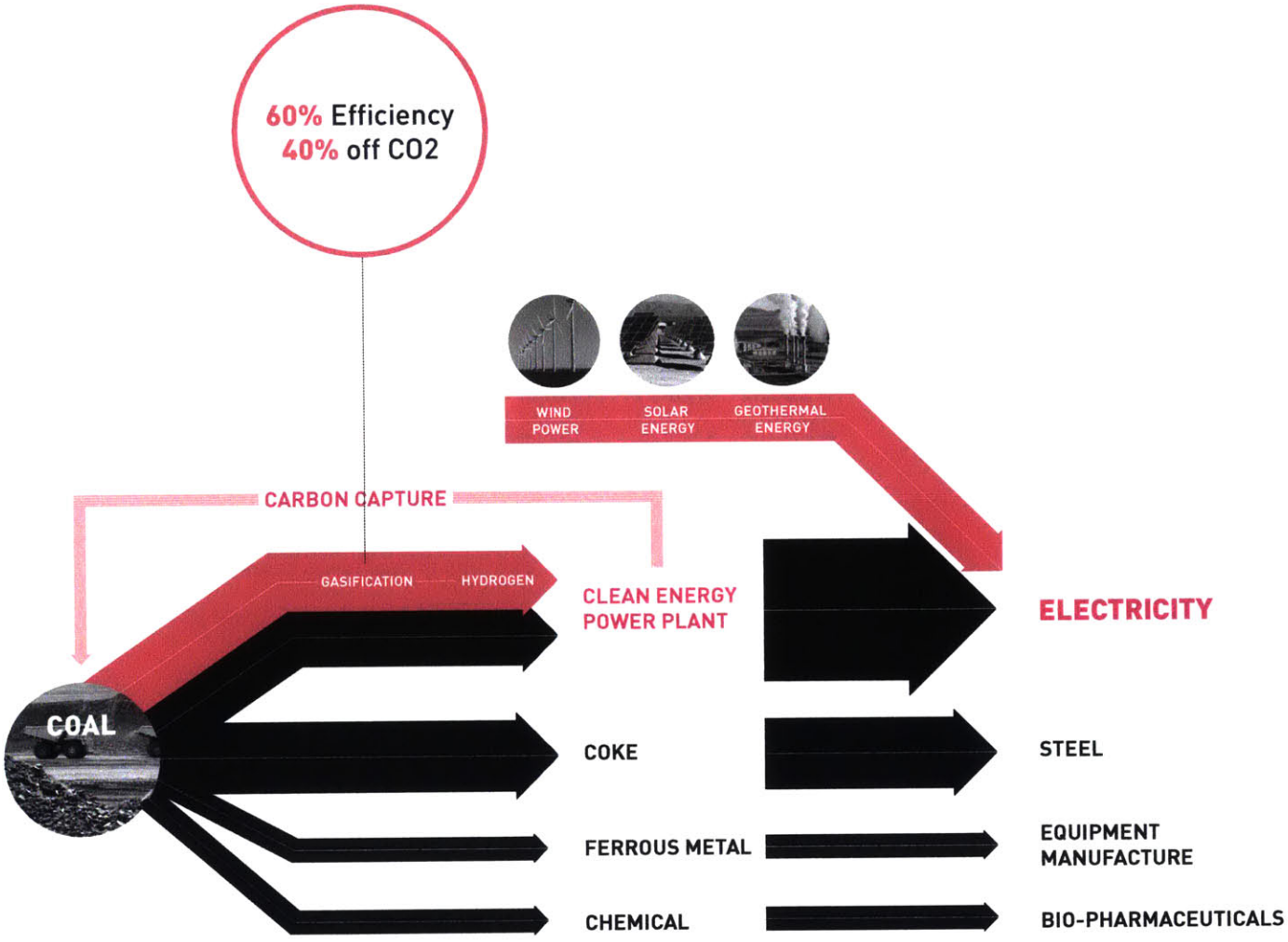


FIG 4-3

New Technology and Interconnection

Gasification, Carbon Capture, Sustainable Energy

Sustainable energies could add up to it, and Inner Mongolia is not unfamiliar with them. Wind Turbine capacity in Inner Mongolia passed 3 million kW in 2008 and remained the highest in China since then[3]. Solar and geothermal energies are also abundant in the territory of Inner Mongolia and keep attracting large investments. Risen energy, a China-based solar PV modules manufacturer has signed a huge deal; Enex China, one of the oil giants, also landed research and development projects for geothermal energy in Inner Mongolia[4].

3
Anonymous. "Inner Mongolia Wind Power Project." Text. *Asian Development Bank*, September 29, 2014. http://www.adb.org/projects/documents/inner-mongolia-wind-power-project-xarr.

4
"Geothermal Developments Coming to Inner Mongolia | Renewbl.com." http://www.renewbl.com/2010/09/30/geothermal-developments-coming-to-inner-mongolia.html.

4.3 Electricity as Leverage

Electricity would be the major outcome of coal reserves and sustainable energies. The right approach to leverage electricity is critical[5]. It is predicted that cloud computing and electric vehicles would be two emerging growth realm of global electricity demand. The cloud computing ecosystem uses as much electricity as lighting did in 1985, but in 20 years, will almost catch up with lighting and use triple the energy of all electric vehicles in the world[6].

Cloud computing and electric vehicles are qualified to be the two major industries for Ordos in near future not only because their usage and capacity, but also the potential of interconnection. A large data center might only have as many employees as 300. But such simplistic calculation misses a large part that data centers are the physical embodiment of digital services that could create

5
Mills, Mark P. "The Cloud Begins With Coal." (2013).

6
Ibid.

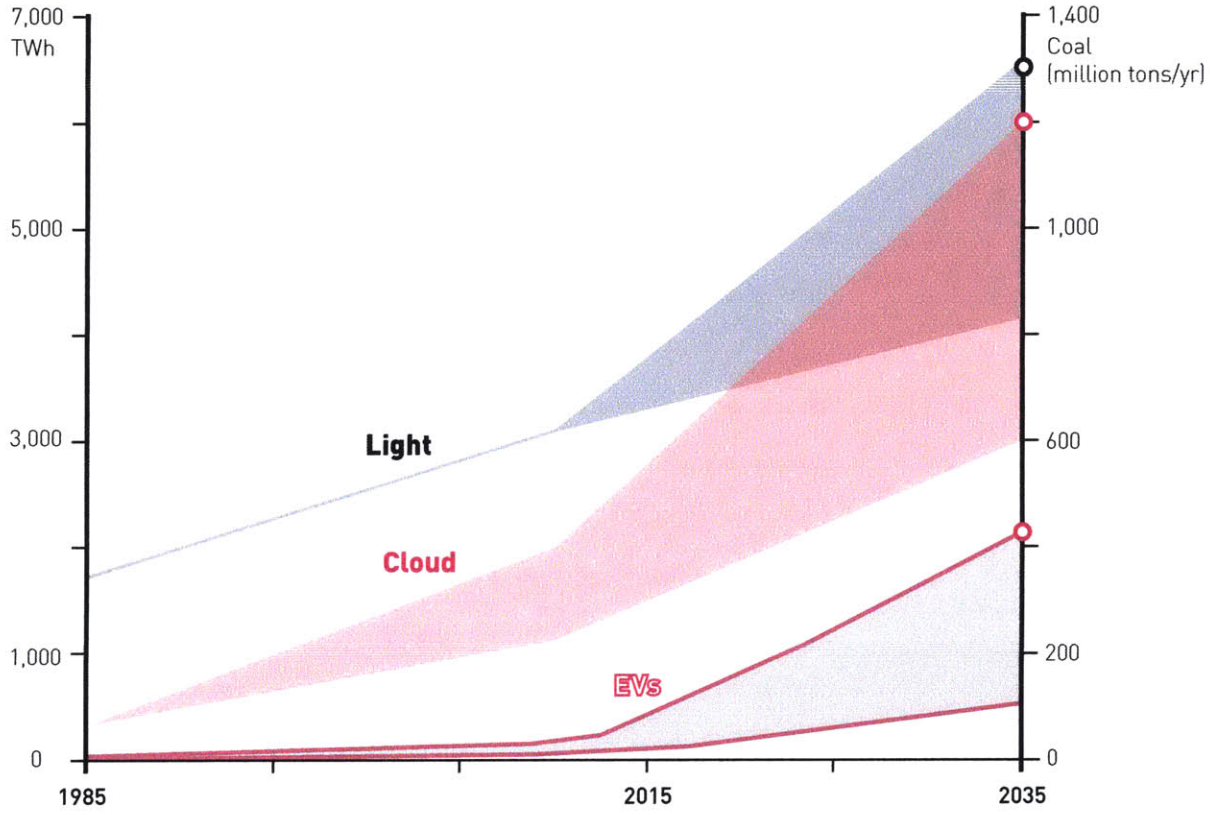


FIG 4-4

Electricity as Leverage

Global Electricity Demand: The Cloud and EVs

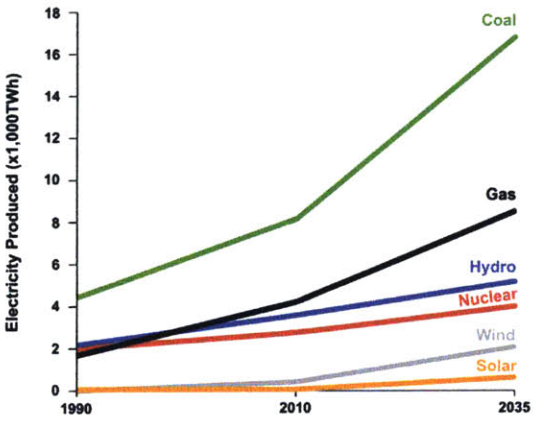


FIG 4-5

Annual Global Electricity Generated

enormous more employment than merely on-site employees. The usage of data centers to offer search, data storage, mail, computation and other services is the foundation of those high-tech and innovative industries. And now, more and more economists have asserted that each job in innovative industry creates more jobs than we usually imagine[7].

7
Moretti, Enrico. *The new geography of jobs*. Houghton Mifflin Harcourt, 2012.

The power of electric vehicles cannot be more obvious than ever since Elon Musk started Tesla Motors. Tesla Model S was released in June 2012, which has a top speed at 201 km/h and battery pack that could voyage up to 425 km[8]. Another potential breakthrough through electrical vehicles is Hyperloop, a conceptual high-speed transportation system which would be tested from Los Angeles and San Francisco Bay Area soon. Hyperloop, also forwarded by Elon Musk, was designed as a vacuum-tube transport network that intends to totally change long-distance travel experience. The amount of electricity needed in this emerging industry would make Ordos a promising destination, and corresponding research and technology supports are expected to come along.

8
"Tesla Model S." *Wikipedia, the Free Encyclopedia*. http://en.wikipedia.org/w/index.php?title=Tesla_Model_S&oldid=662895383.

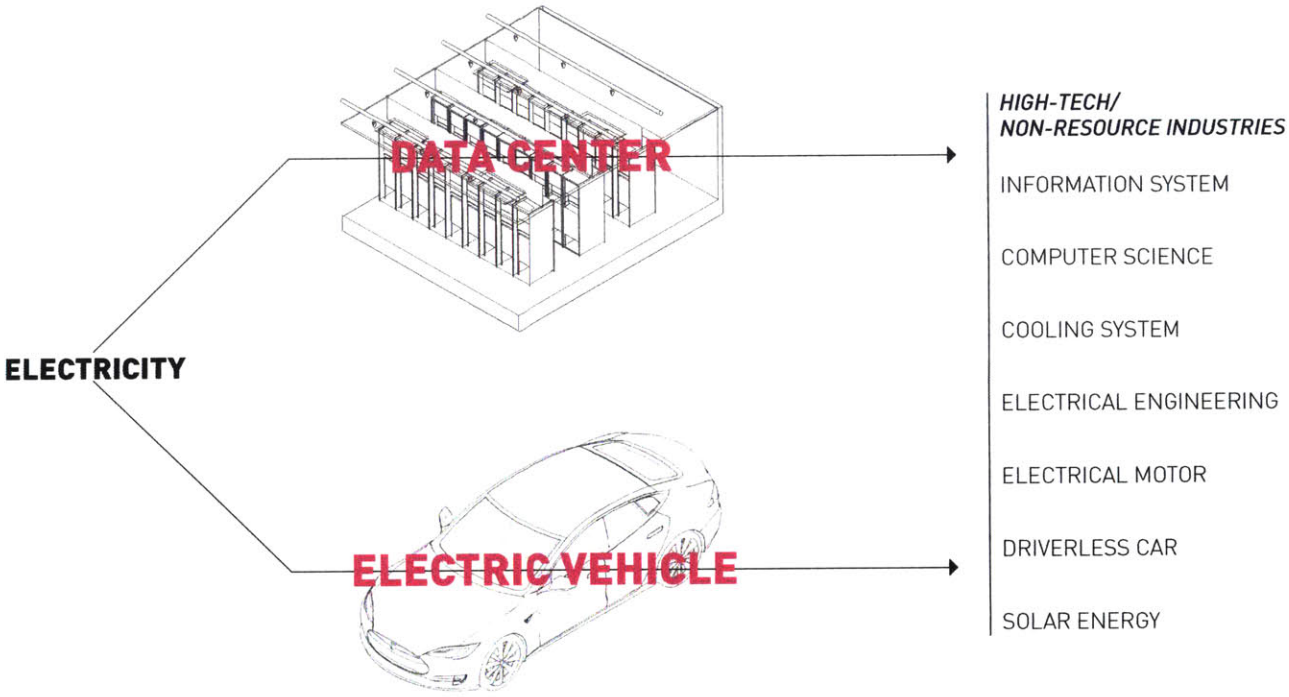


FIG 4-6

Interconnection

Linkage between Coal and High-tech Industries

FIG 4-7

Power Network

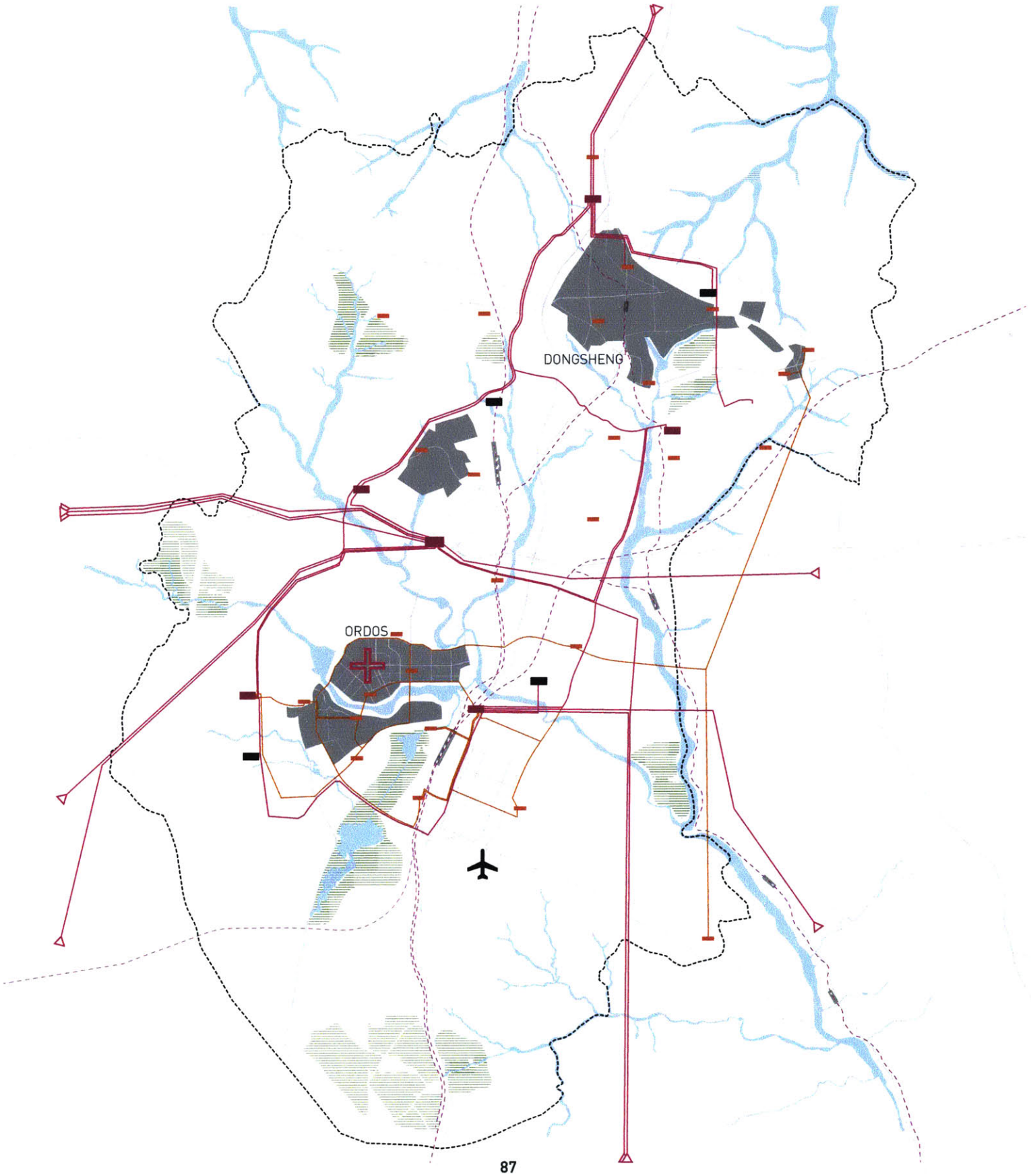

DONGSHENG
ORDOS

FIG 4-8

Gas Network

Gas Pipeline

Gas Station

Heat Plant

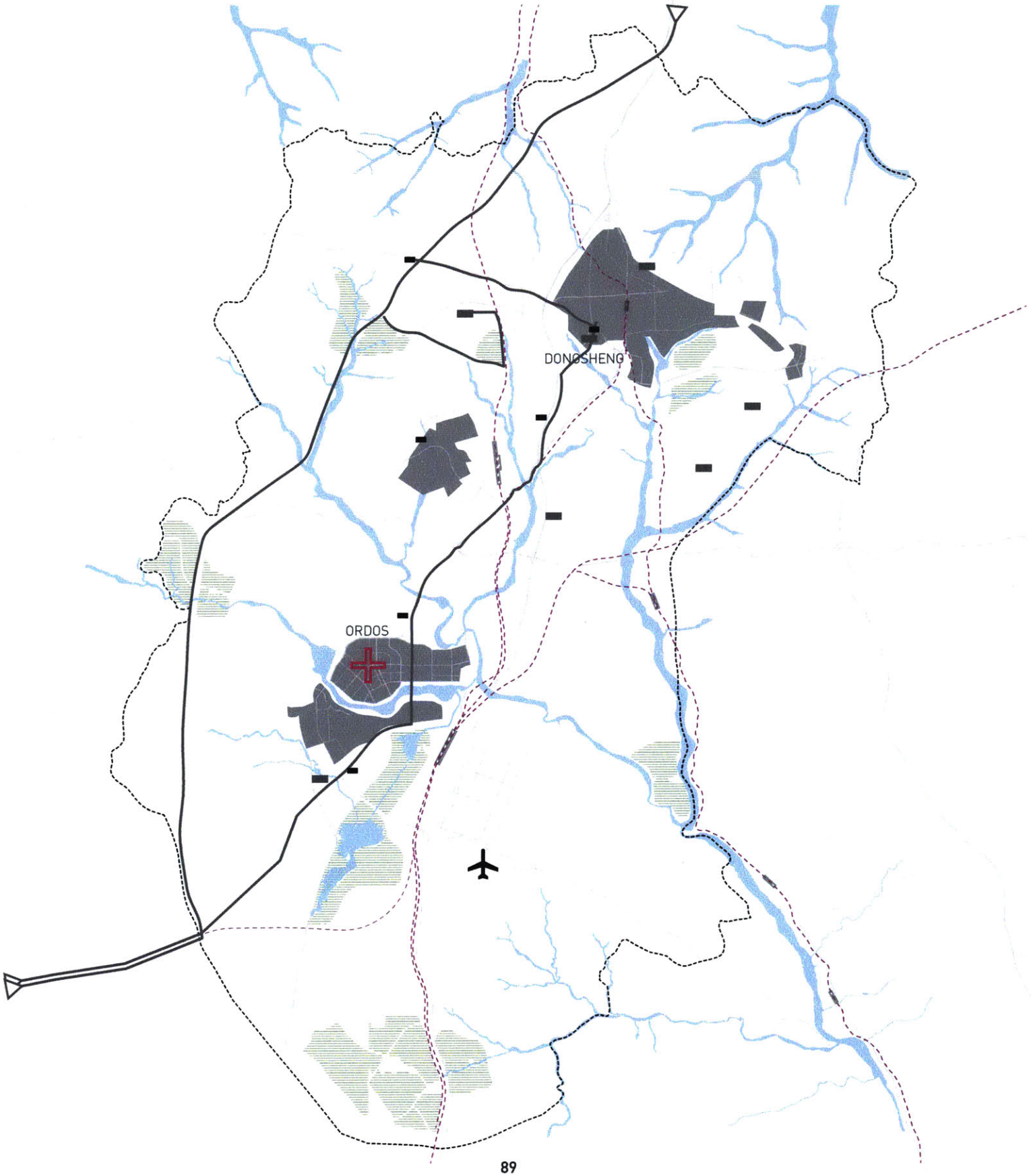
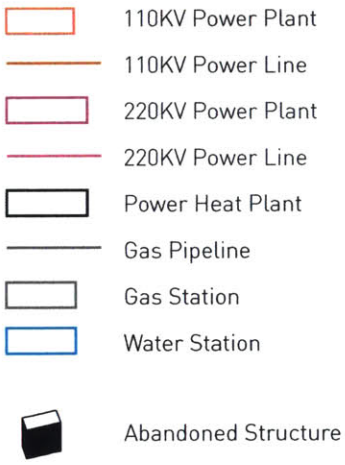
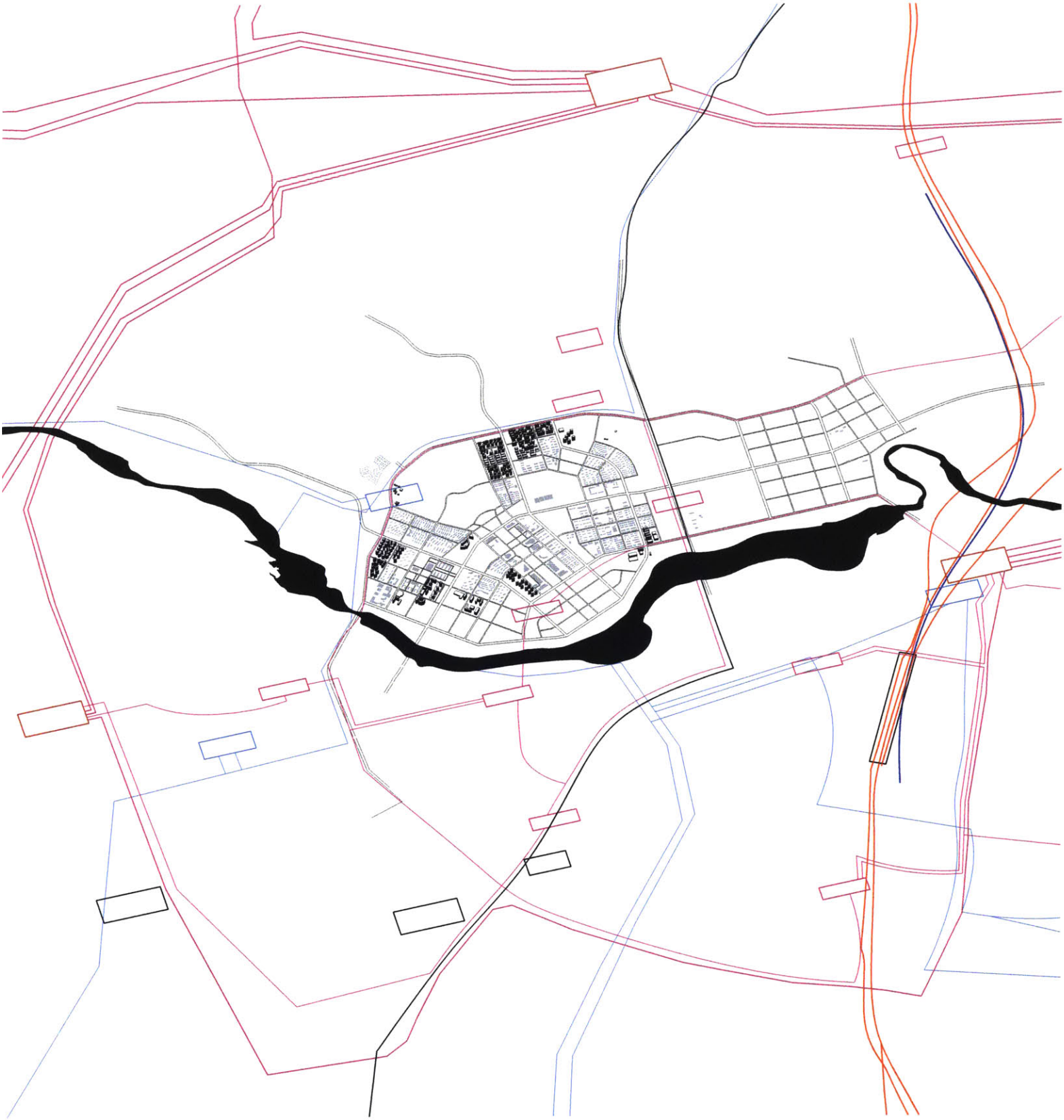
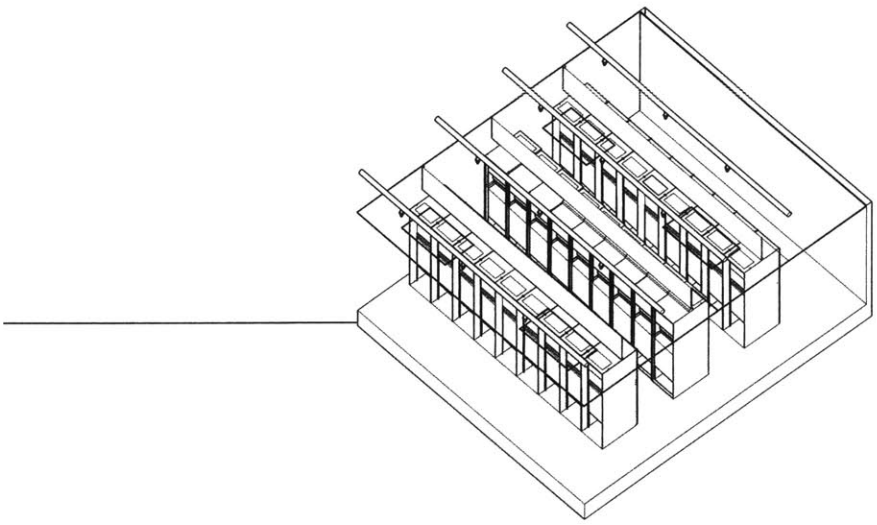

DONGSHENG
ORDOS

FIG 4-9

Infrastructure Network Around Ordos







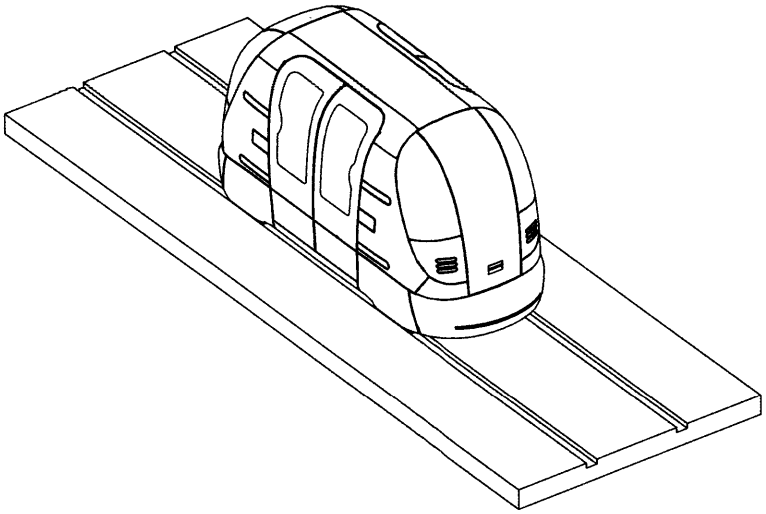
4.4 Opportunities of Reuse—Date Centers

Power lines, gas stations and water stations were sufficiently planned and constructed around Ordos. Reuse of abandoned structures was feasible without much additional investments.

Abandoned high-rises cannot qualify for civic use in terms of structural strength, making them appropriate container for infrastructure. A data center high-rise in downtown Manhattan has given the example. At 375 Pearl St, an old Verizon switching building was transformed into the world's largest high-rise data center in 2013[9]. The location was also determined by the power supply and connectivity to underground fiber. In this case, abandoned structures could be filled with telecommunication and storage facilities.

9
"World's Largest High-Rise Data Center Opens in Downtown New York City." *Wall Street & Technology*. http://www.wallstreetandtech.com/it-infrastructure/worlds-largest-high-rise-data-center-ope/240151399.


217



4.5 Personal Rapid Transit

Another fruit of the development of electric vehicles is a new transit system for the city—Personal Rapid Transit. This transit system operates on small automated vehicles on a network of guide ways. It is not hard to imagine because there have been continuous operations since 1975. London Heathrow Airport launched the Ultra PRT system to link terminal and business car park; Masdar City in UAE started to operate the PRT system since 2010; and since April 2014, South Korea officially opened a 40-vehicle system in Suncheon[10].

PRT system could fully operate via electricity, maximizing the benefits of newly introduced industries in Ordos. Traditional fossil

10
"Personal Rapid Transit." *Wikipedia, the Free Encyclopedia.* http://en.wikipedia.org/w/index.php?title=Personal_rapid_transit&oldid=662456213.

fuel automobiles will be replaced gradually and PRT will become the daily vehicles for commute.

A numbers of benefits should be listed:

- Electricity Driven

Electricity driven transportation not only utilizes the strength of Ordos' resources, but also optimizes the impact on environment.

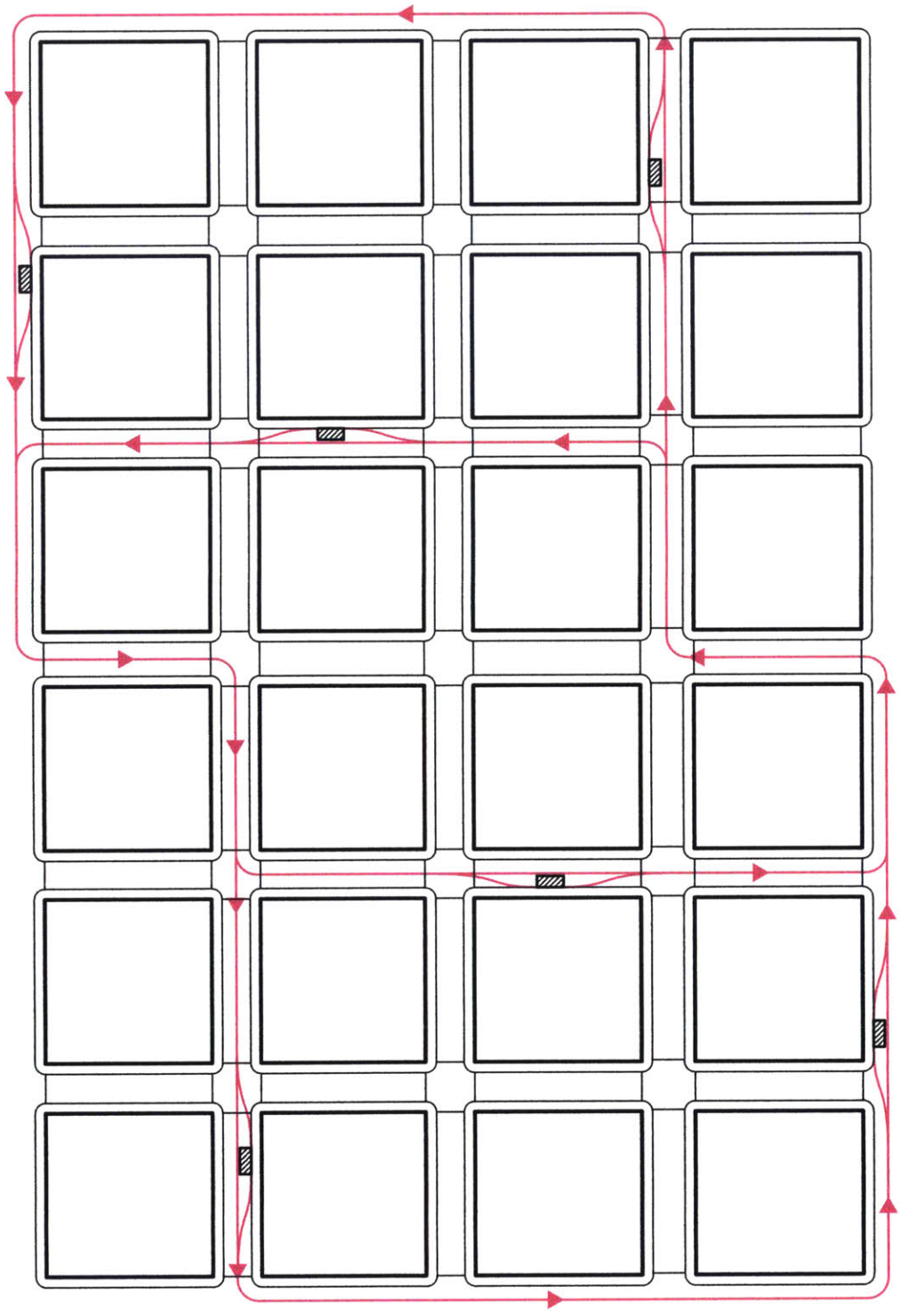
- Routes can be coordinated, not fixed

Although tracks are to be fixed, routes are flexible and subject to demands. Each car can carry four people. The system is pretty much like UbersPool service—people aiming for most similar routes will be picked up to maximize efficiency and occupancy.

- Lighter Infrastructure

Now tracks seem inevitable. However, driverless cars are being intensely developed by Google, Uber and other companies who look forward to overturn the transportation system of the world. Tracks, at that time would have been an ancient-time thing.

FIG 4-10 (right)
PRT network
within Walkable Distance



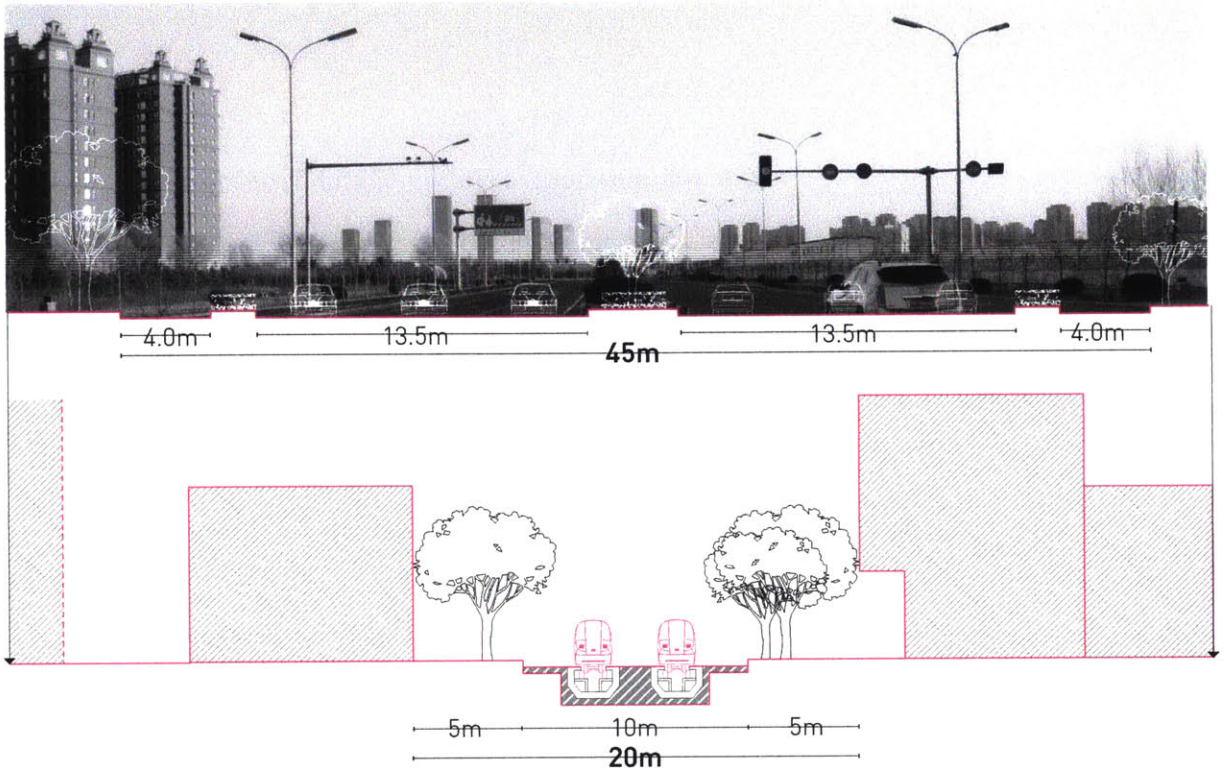
- Narrower Streets

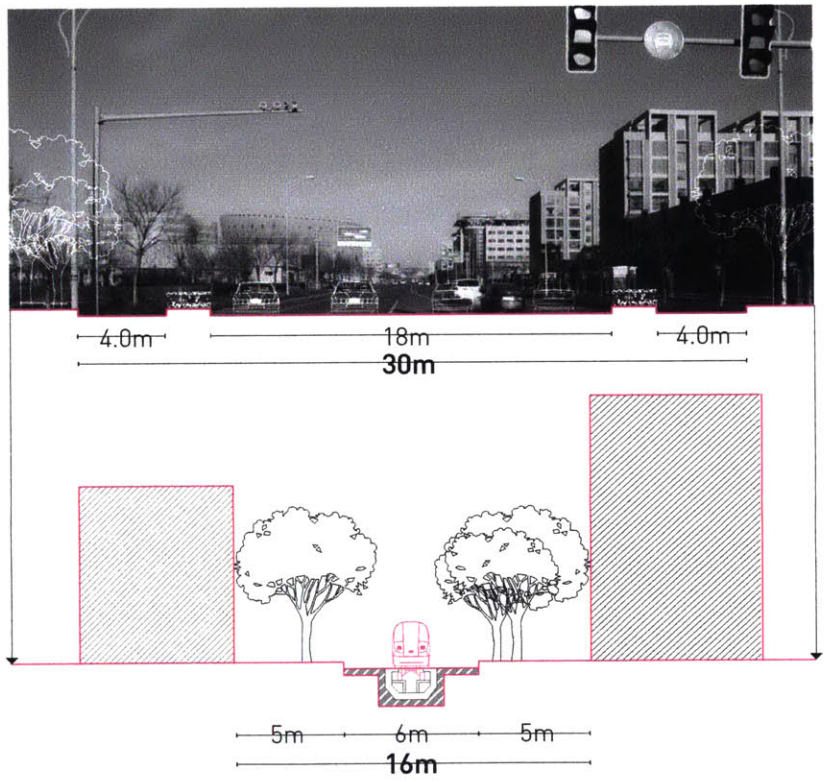
For a city with superblocks and immense streets, PRT is able to totally shrink the scale. As the operation system is processed automatically, two lanes of tracks would be sufficient and some low-hierarchy roads need only one lane. Road width would be narrowed down to 10m (two lanes) or 6m (one lane), while currently roads are 30m or 40m wide.

- No prompt parking space needed

Prompt parking space is no longer needed because all PRT cars are public owned and are functioning all the time. Spared cars will park themselves into parking garages at the periphery of the city.

FIG 4-11 (right)
Narrowed Street


4.0m
13.5m
13.5m
4.0m
45m
5m
10m
5m
20m


4.0m
18m
4.0m
30m
5m
6m
5m
16m

4.6 Infrastructure Network and Typologies

As infrastructure is proximate to community, their excessive energy can be reused by surrounding neighborhoods. For instance, data centers can redirect excessive heat from servers into nearby offices, homes, swimming pools or green houses. Water is usually the medium to redirect waste heat.

To cover the whole city, a network needs to be established.

1-Abandoned structures at the periphery

Land with abandoned structures would be transformed into infrastructure farms and fully function as energy generator and infrastructure facilities.

2-Abandoned structures in communities

These structures would also function as infrastructure but combine with public services such as community park at ground level. If warehouse or ground-level space is needed for certain facilities, the community park could be raised up one level.

3-Newly added energy node

In some communities that do not have abandoned structures, new energy facilities would be added. In this typology, open space will be dominating.

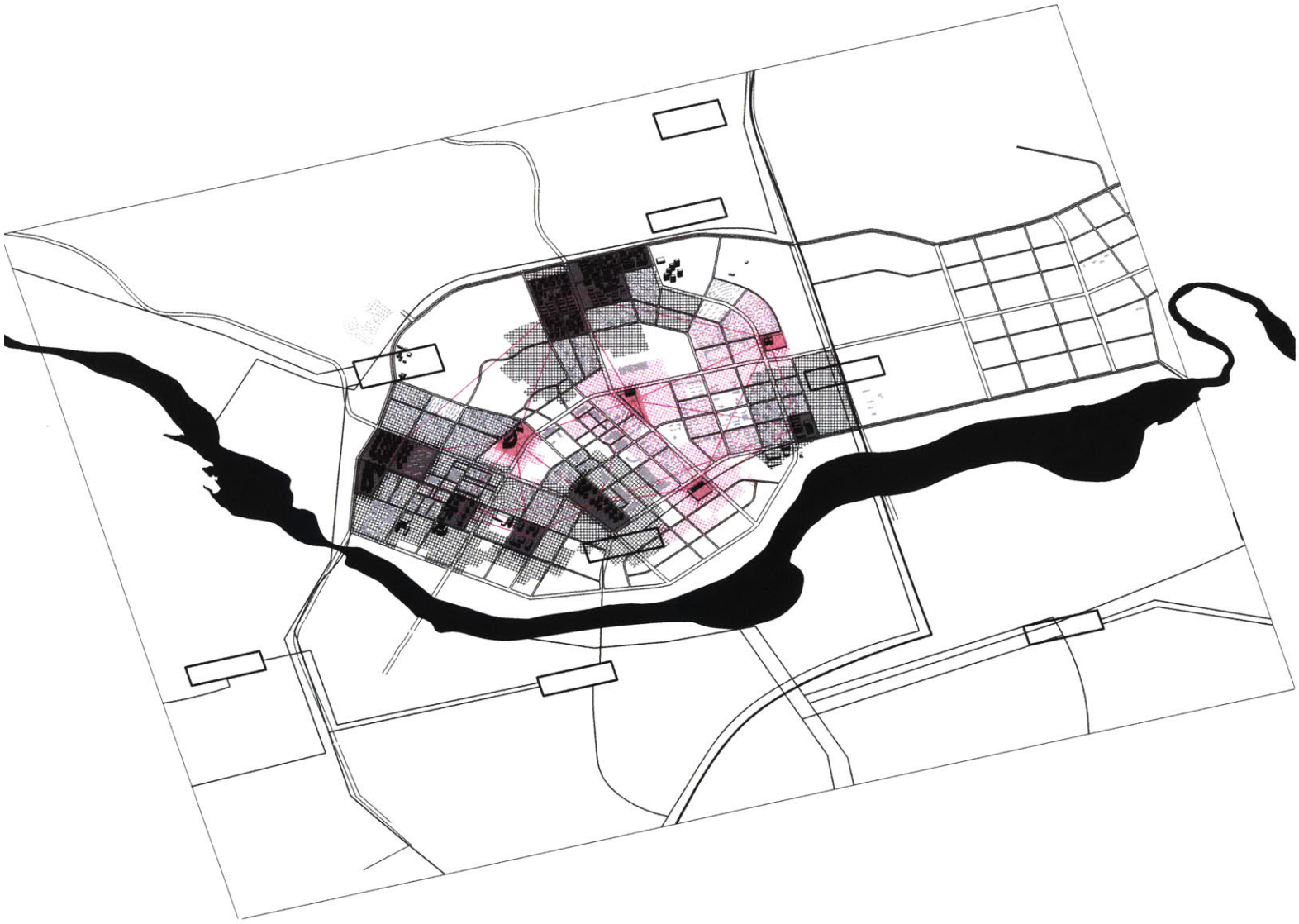


FIG 4-12

Infrastructure Network

Existing Abandoned Structure

Newly Add Energy Node

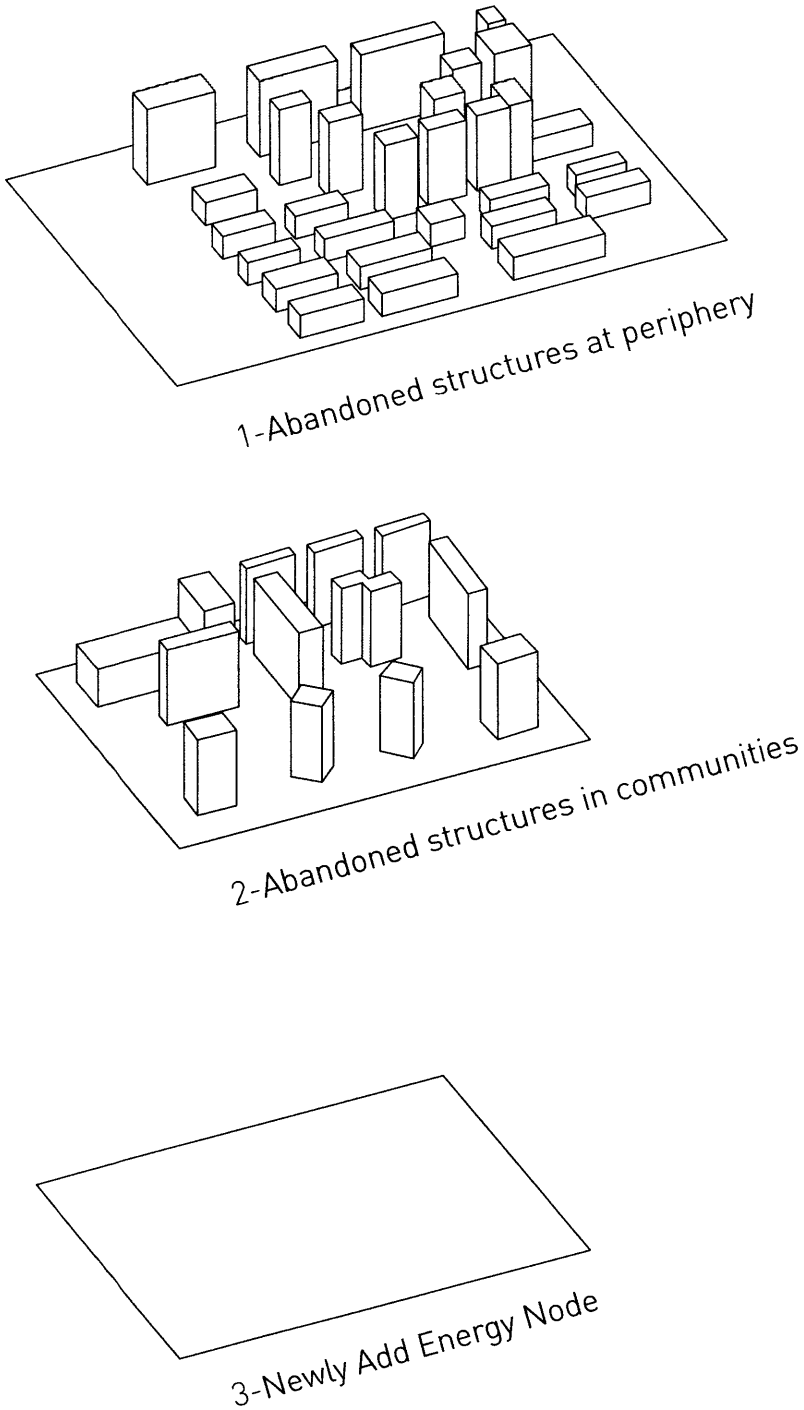
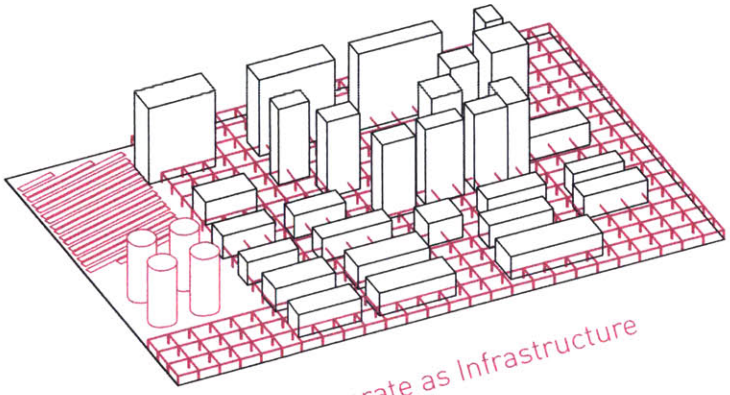
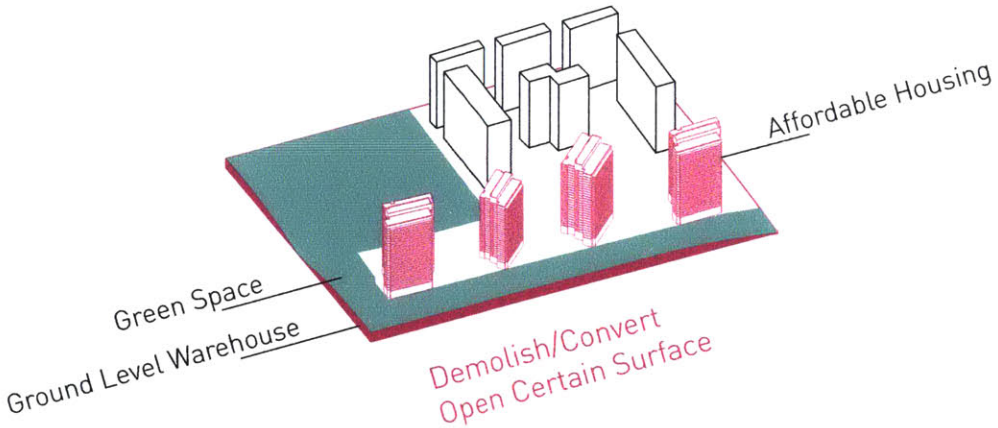


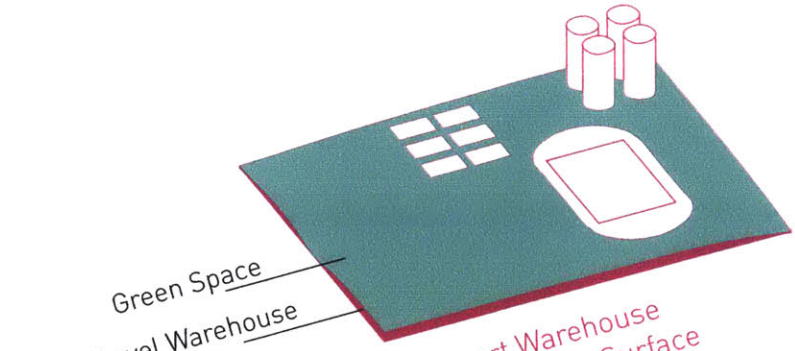
FIG 4-13
Infrastructure Typologies
Reused and Inserted



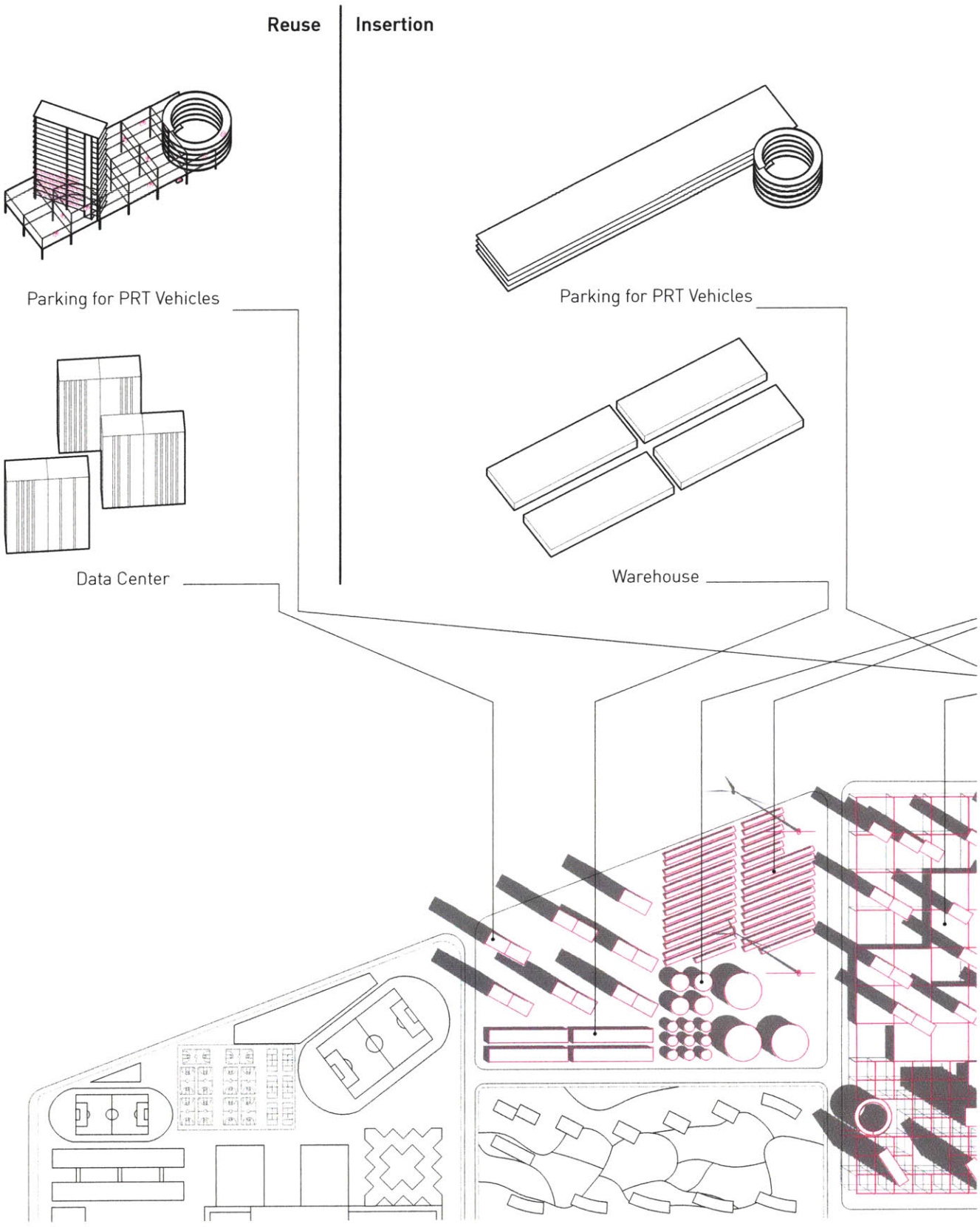
Fully Operate as Infrastructure



Demolish/Convert
Open Certain Surface



Insert Warehouse
Entire Open Surface


Reuse
Insertion
Parking for PRT Vehicles
Parking for PRT Vehicles
Data Center
Warehouse

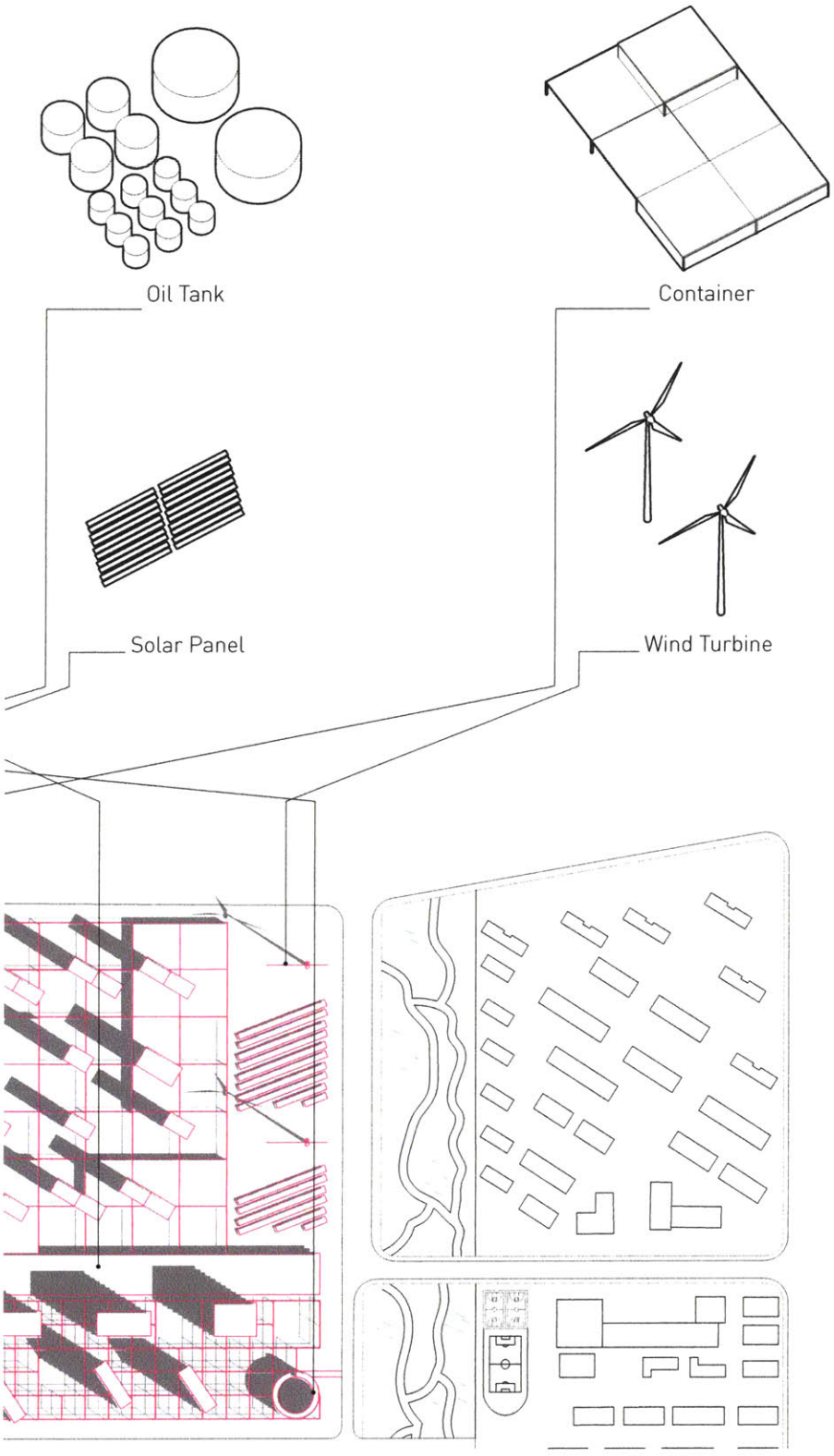


FIG 4-14

Infrastructure Components

Existing abandoned structures will be transformed mostly into data centers and parking garages. Parking garages are mainly for PRT cars and equipped with automatic parking system. New components will also be inserted, including warehouses, solar panels, wind turbines, etc.

4.7 Necessities

Necessity 1-A Research Institute

Of course, all these new industries and companies need skilled specialists and candidates. A new university, a research institute, needs to be established. I would propose to also call it MIT, which is short for Mongolia institute of Technology. One example is the Singapore University of Technology and Design (SUTD), which opened its door in April 2012 and since then has been in multi-face collaboration with the Massachusetts Institute of Technology (MIT). It was a successful mode of establishing a new university.

Necessity 2-A High-speed Railway Station

High-speed train would be an option for commute. Currently there is no civic railway station in Kangbashi, and the one in Dongsheng is not accessed by high-speed trains. High-speed train in China has been proved a real success. In the Yangtze River Delta, certain proportions of people live in Suzhou or Wuxi and take high-speed rails as daily commute to work in Shanghai

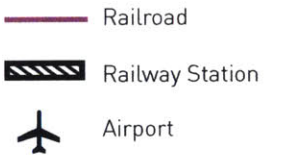
Currently China is extending the high-speed railroad network into Inner Mongolia. A high-speed railroad to Baotou is already under construction. Baotou is 150 km away from Ordos, and an extension of the railroad is not a dream.

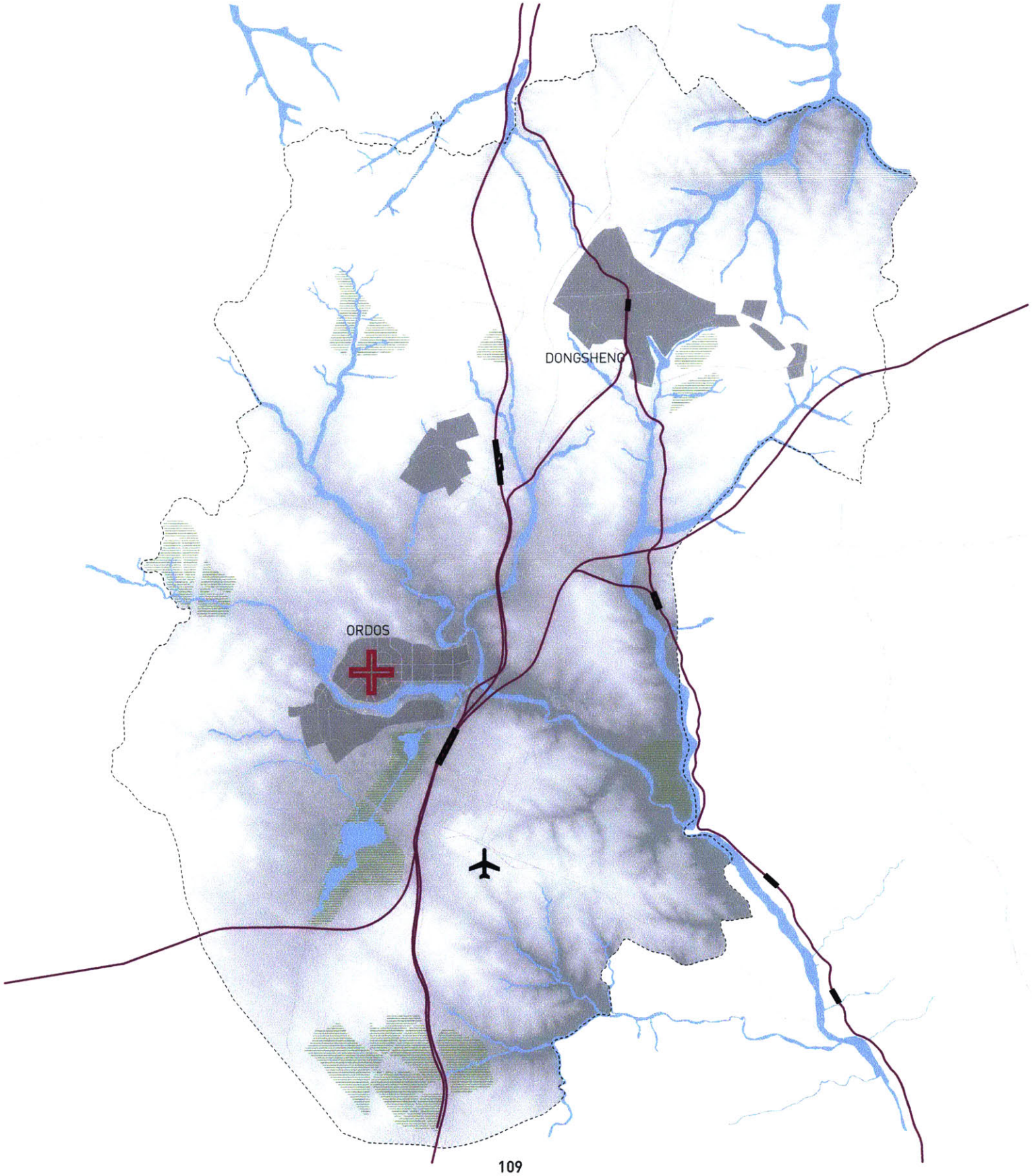
MIT
Mongolia Institute of Technology

FIG 4-15
A Research Institute
Collaboration with Massachusetts Institute of Technology

FIG 4-16

Transportation Netwok




DONGSHENG
ORDOS

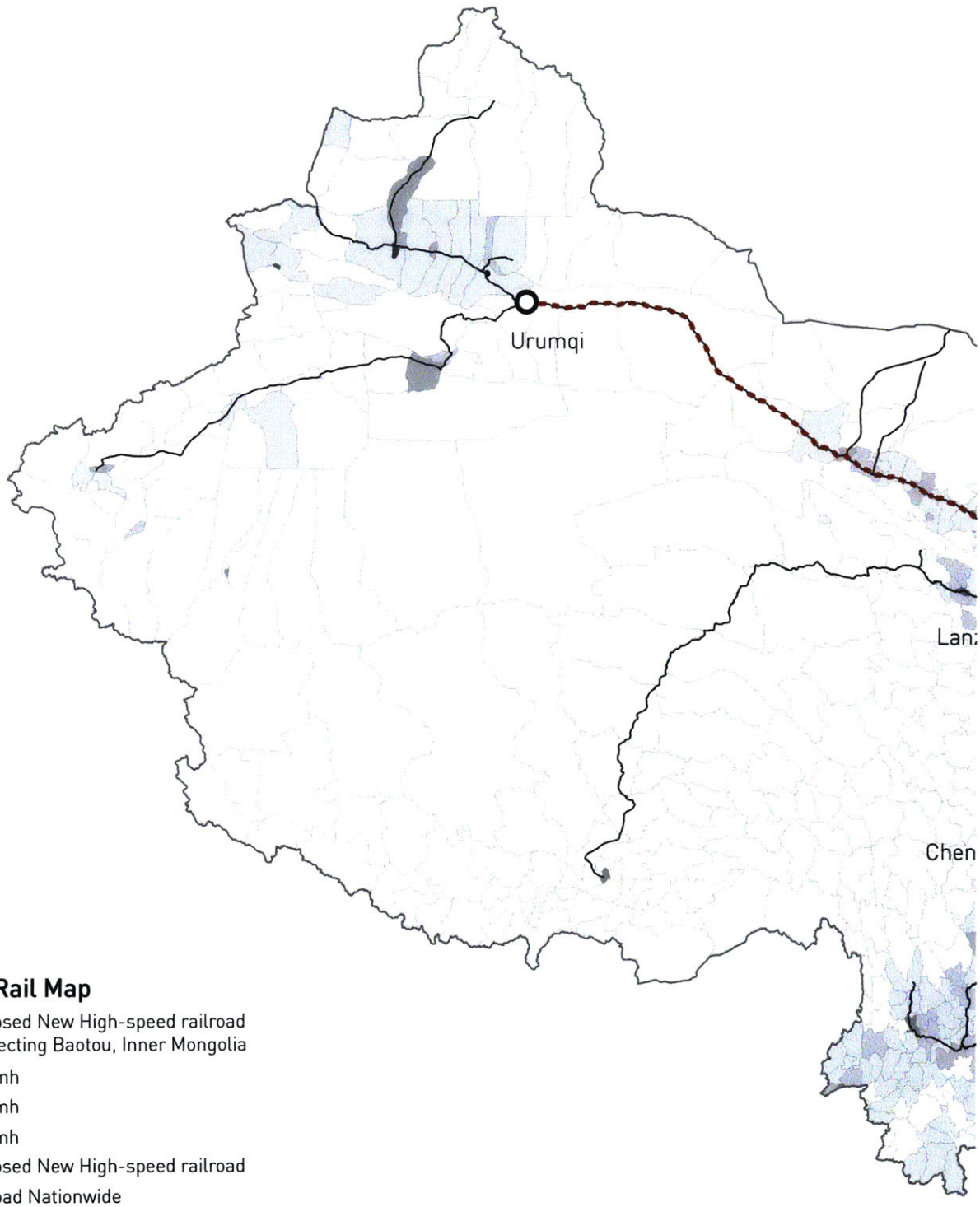


FIG 4-17

High-speed Rail Map

- Proposed New High-speed railroad Connecting Baotou, Inner Mongolia
- 300kmh
- 250kmh
- 200kmh
- Proposed New High-speed railroad
- Railroad Nationwide
- Railway Transportation Nodes
- High-speed Railway Stations

Data Source: Harvard China Map

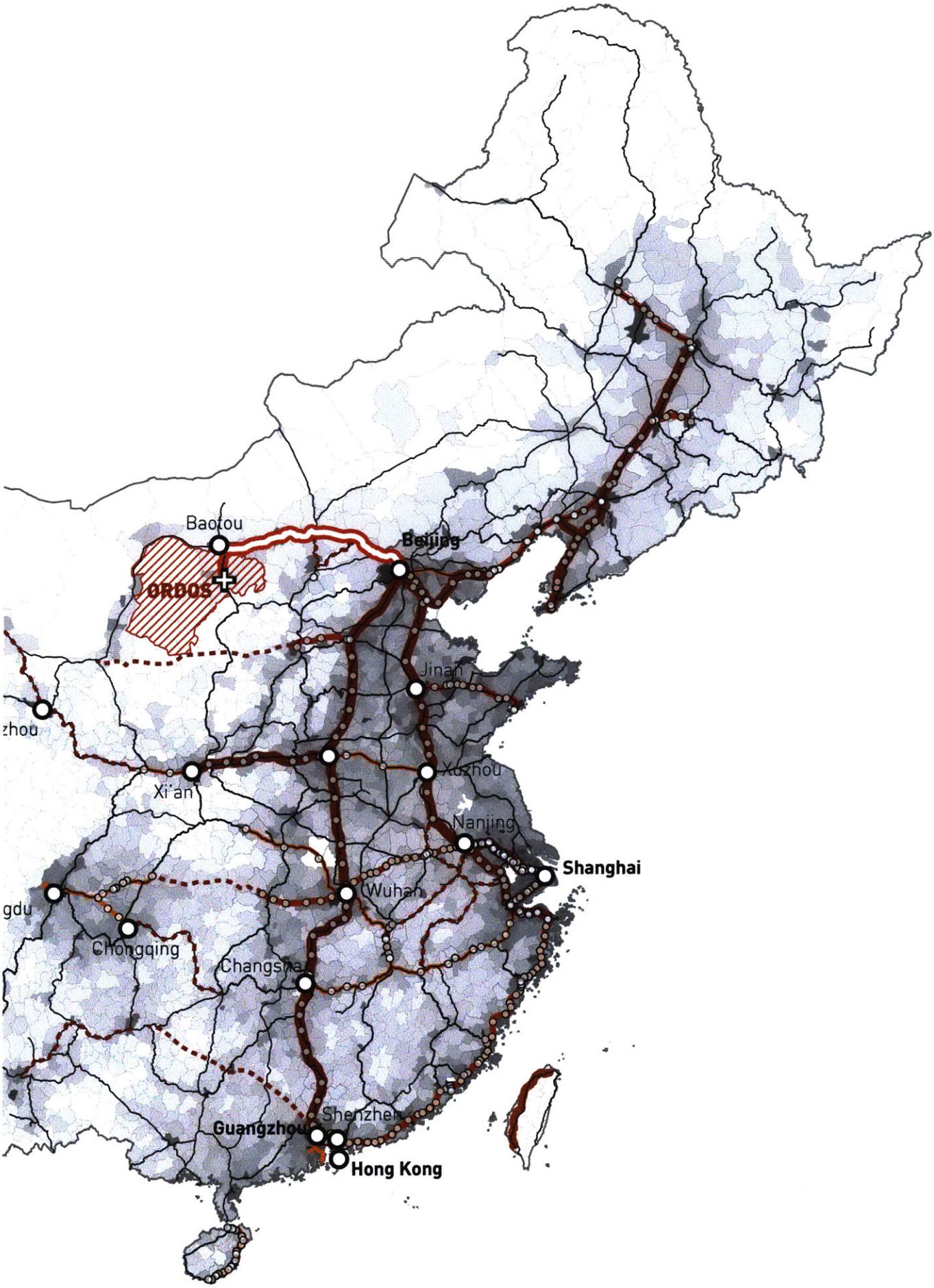
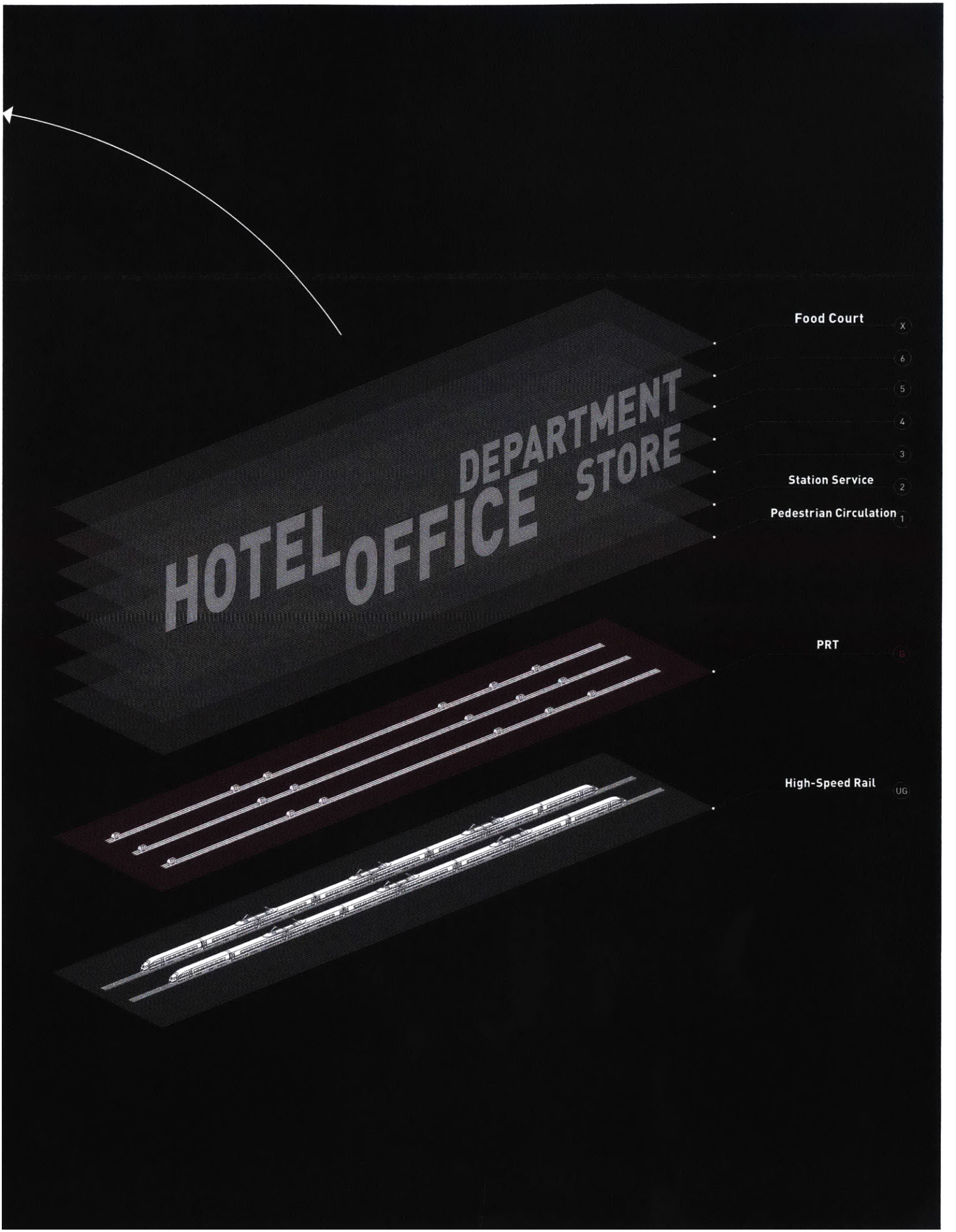
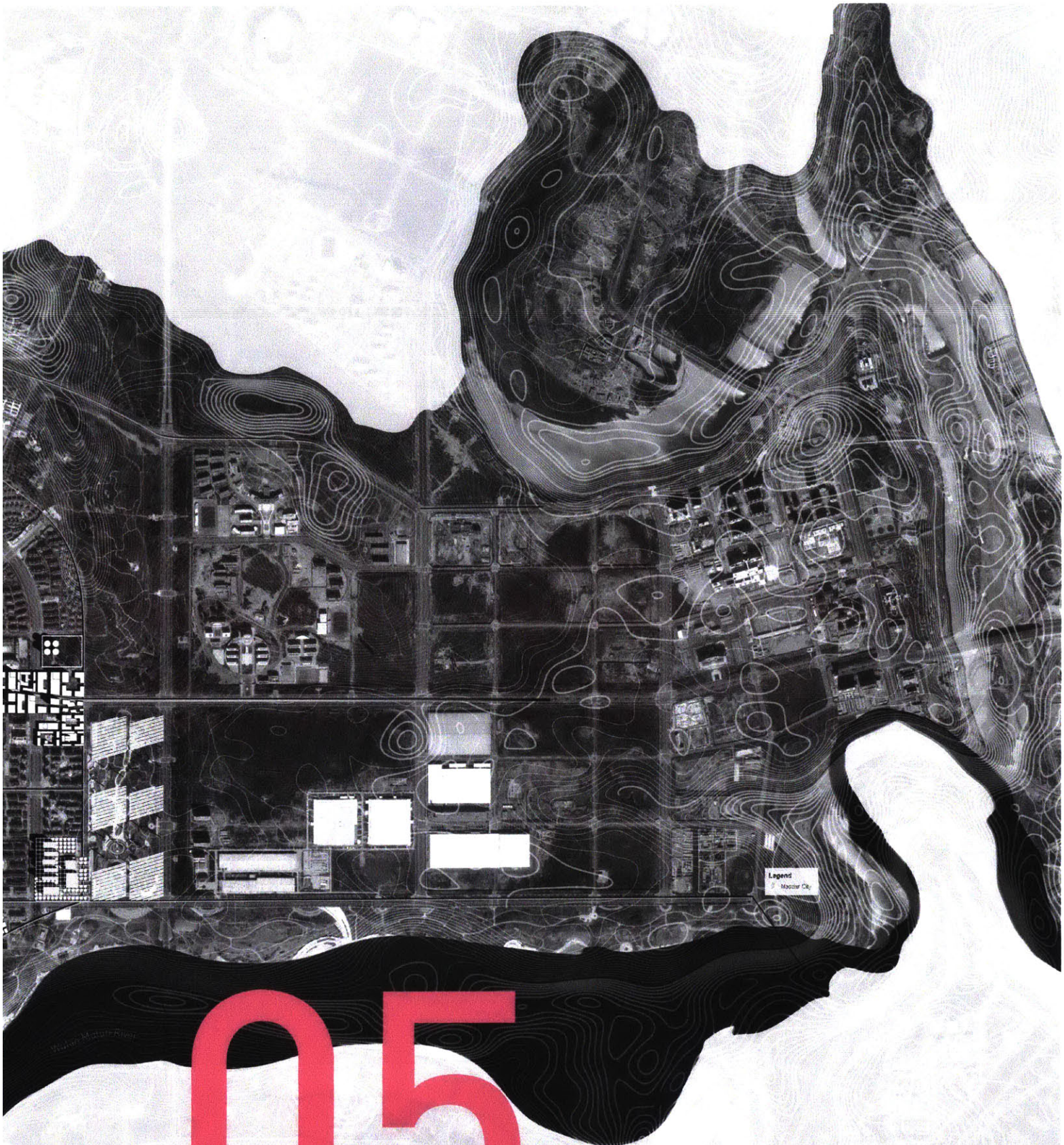

Baotou
Beijing
ORDOS
Jinan
Xi'an
Xuzhou
Nanjing
Shanghai
Wuhan
Chongqing
Changsha
Shenzhen
Guangzhou
Hong Kong

FIG 4-18
A Railway Station
High-speed Railway Station


HOTEL
OFFICE
DEPARTMENT STORE
Food Court
X
6
5
4
3
Station Service
2
Pedestrian Circulation
1
PRT
G
High-Speed Rail
UG



05

NEW URBAN PATTERN

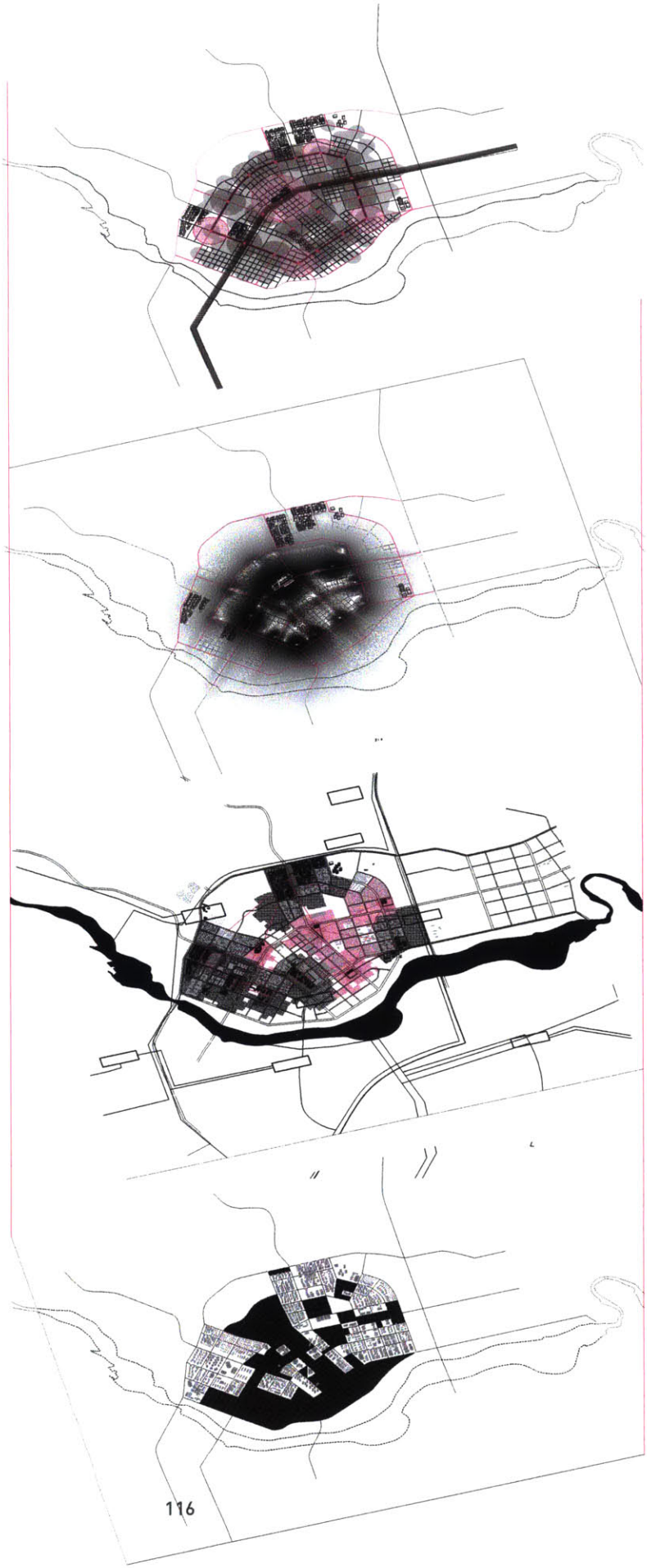


FIG 5-1
Principals

Framework

-Reuse/Demolish Excessiveness

-Reprogram Reused Structures

-Insertion of New Infrastructure

Urban Pattern

-Shared Economy/Transportation

-Muti-centers

-Reinvent from Traditional Blocks

-Compact City Form

-Hybrid/Mix-use

-Transit Oriented Density

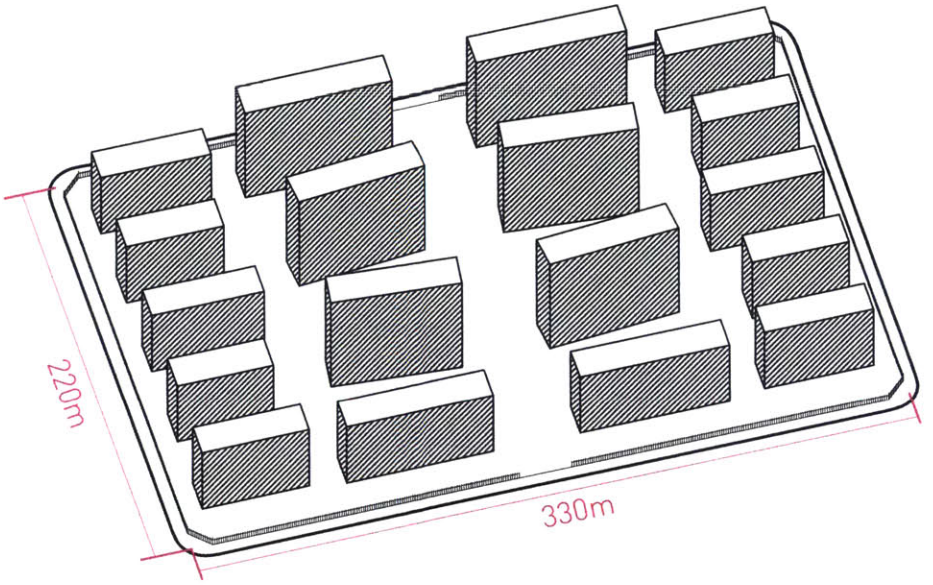
-Walking Distance to Public Transit

5.1 Block Subdivision

To reconcile the current inhumane scale, blocks need to be subdivided to create a compact urban fabric. The frequency of PRT pick-up stations also requires rather small blocks to allow accessibility within walkable distance. Well-functioning neighborhoods will be preserved, and the rest empty or abandoned parcels will be subdivided. Most existing blocks in the northeast and southeast of the city have certain numbers of residents because schools and hospitals are nearby.

A block size of 100 by 100 meters (subject to slight difference), close to Barcelona grid, will be adopted in Ordos. There will not be new land but all from existing developed parcels (roads have been built).

FIG 5-2 (right)
Block Subdivision


220m
330m

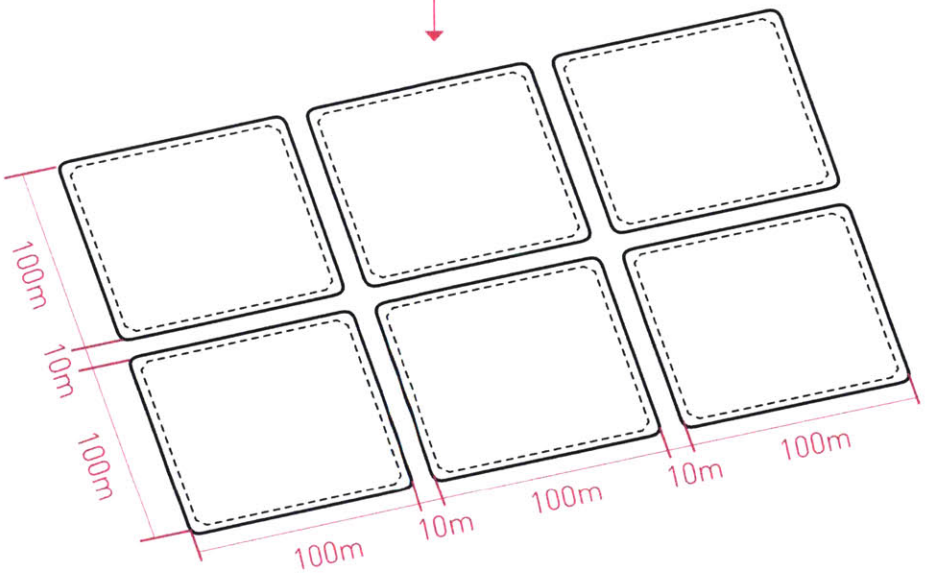
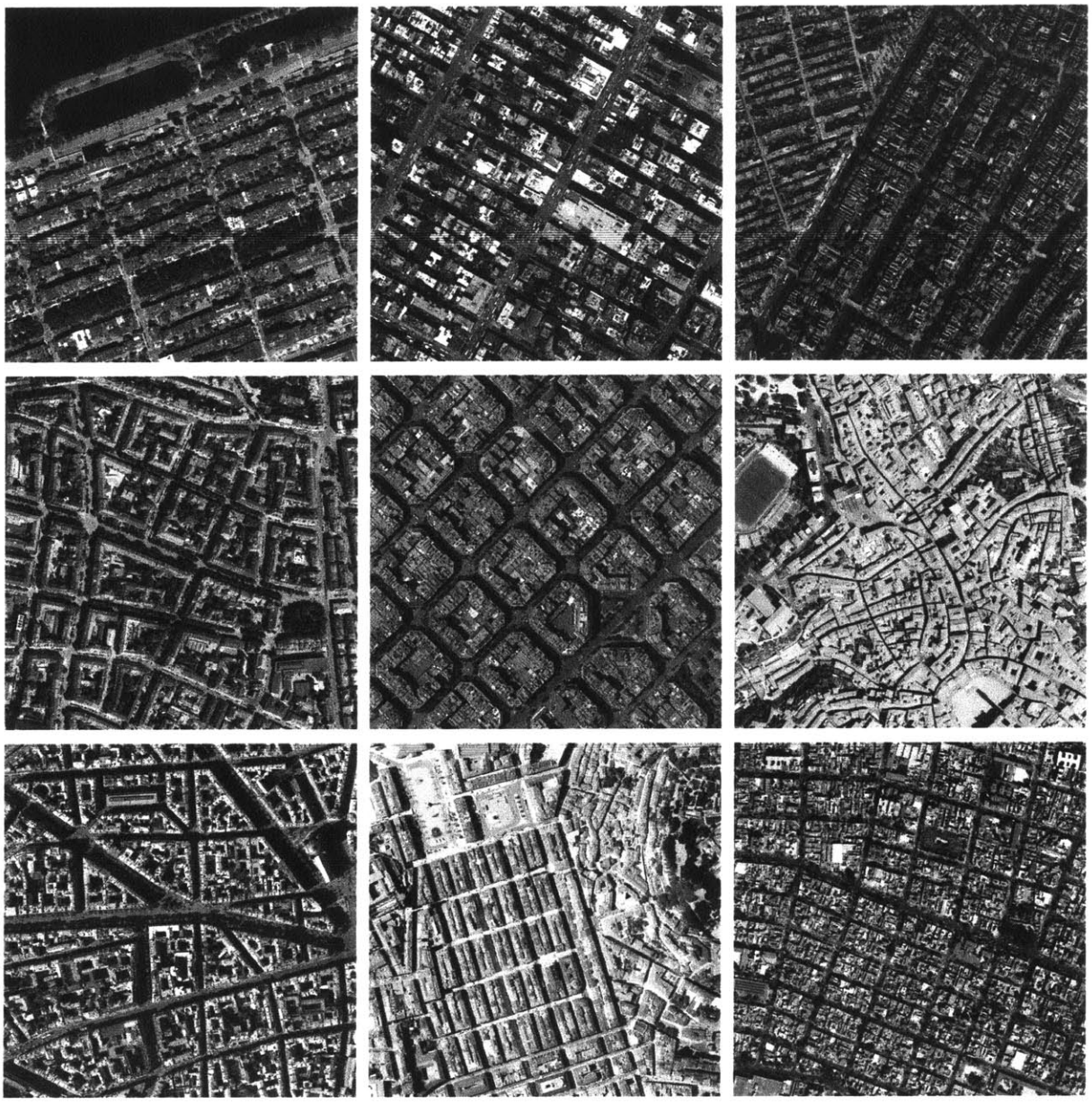

100m
10m
100m
100m
10m
100m
10m
100m

FIG 5-3

Subdivision

Empty and Abandoned Parcels

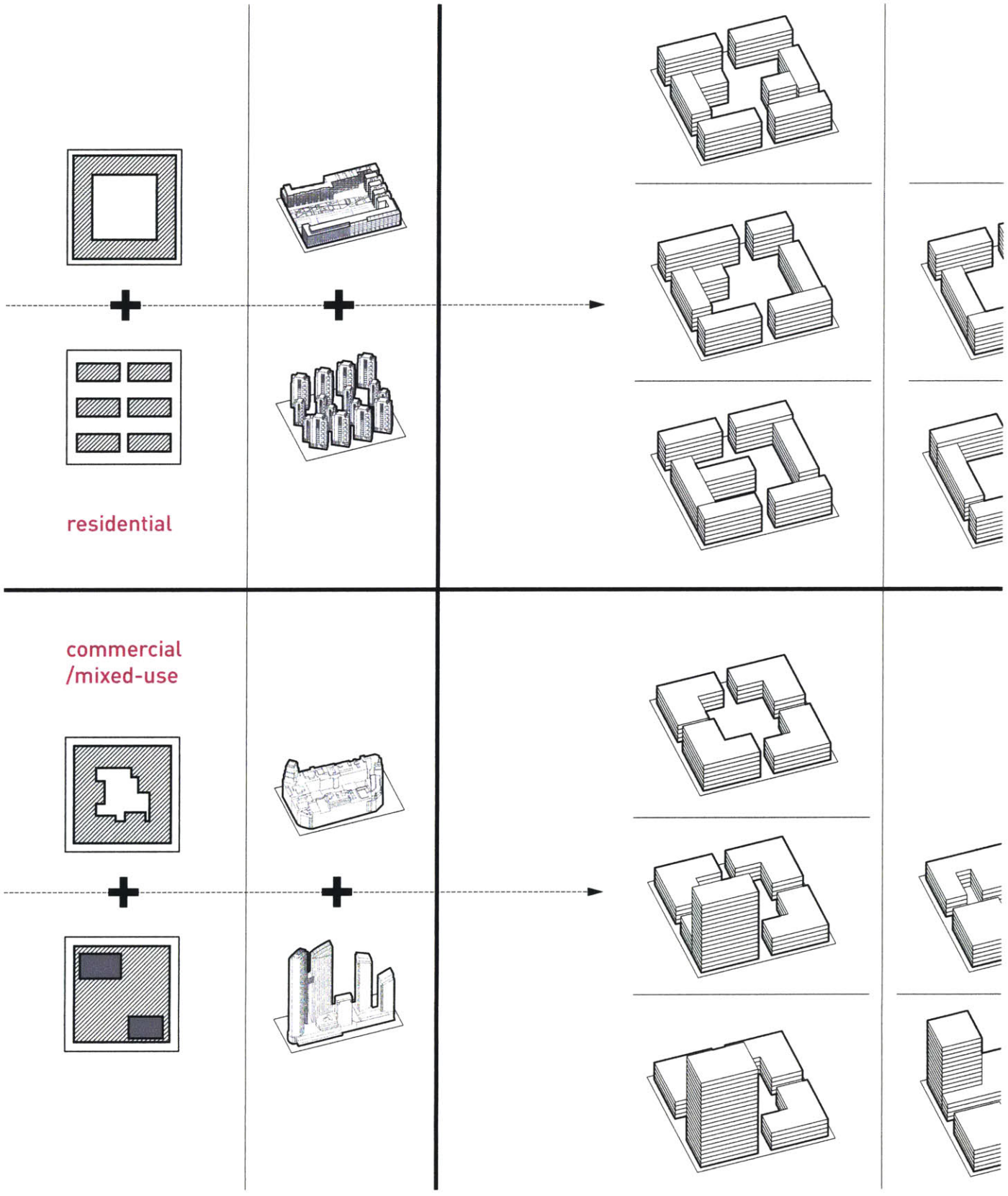


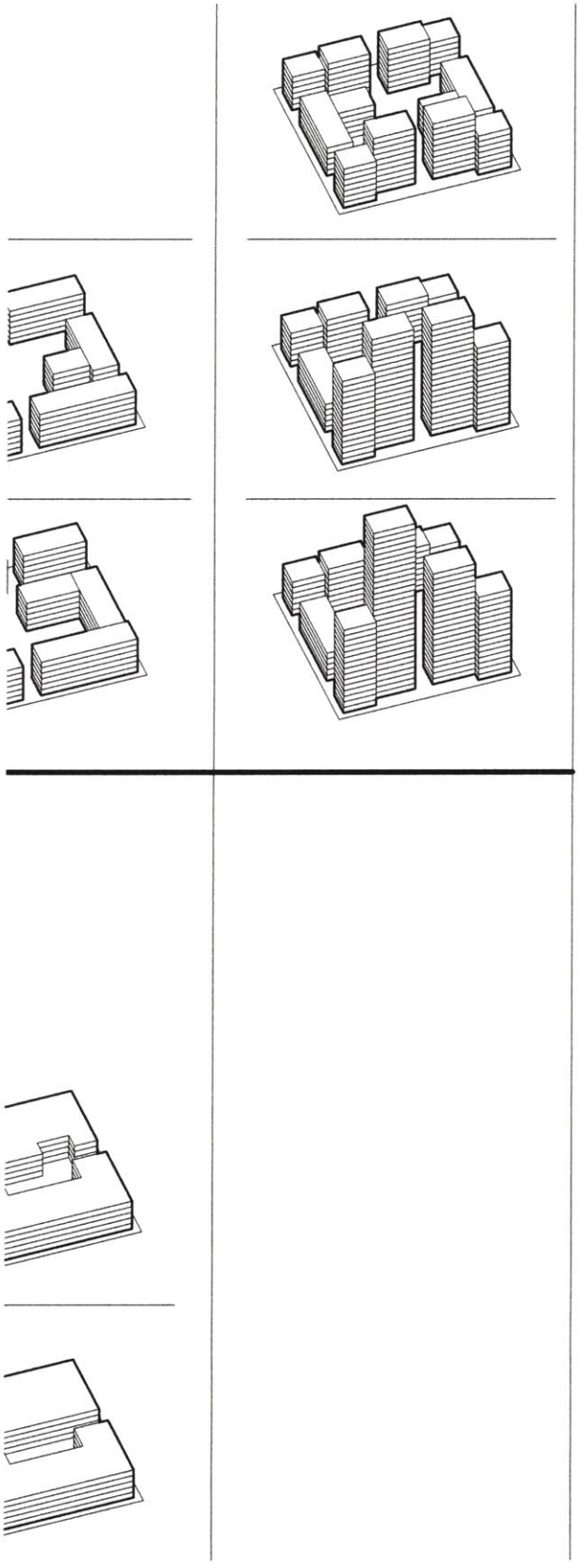
Privacy
Street
Retail
Compact
Mix-use

Noisy
Dark

Sunlight
Safe
Height

No Street Life
Isolate
Monotonous


residential
commercial
/mixed-use



5.2 Block Typologies

The fundamental principle to reinvent and reinterpret from traditional Chinese blocks is to combine with enclosed and courtyard types. On the one hand, it could maximize street interface and revive street life and retail; on the other hand, it should maintain the tradition of maximizing sunlight with the row-type slab housings.

Four types of blocks will be developed:

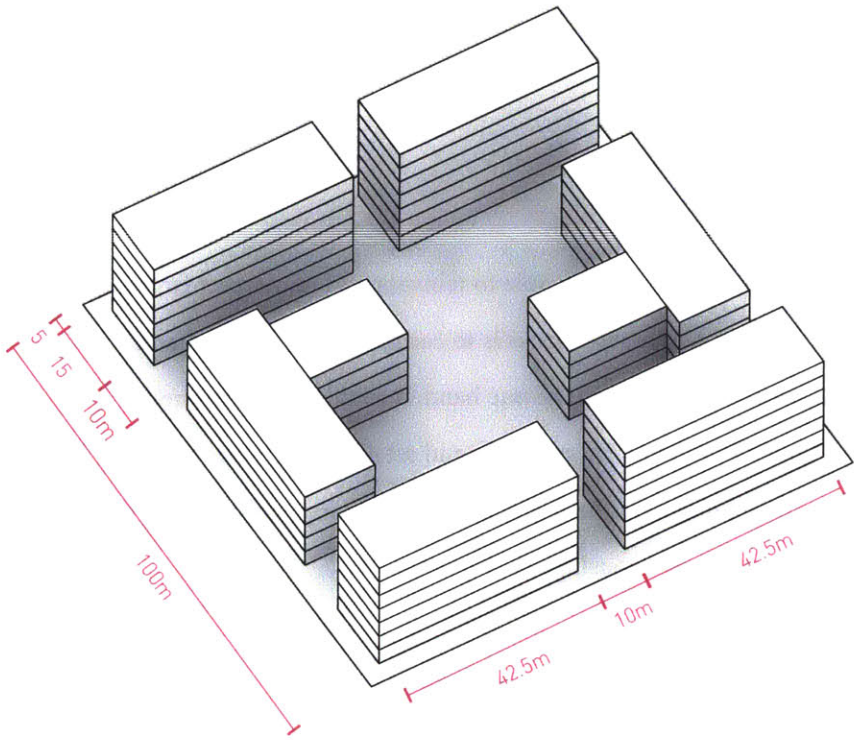
-Residential

-Commercial/Mix-use

-Cultural/Institutional

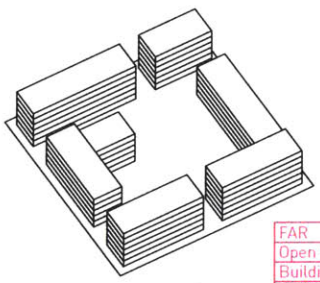
-Innovative Industry

FIG 5-4
Residential and Mix-use Blocks
Reference: Energy Foundation

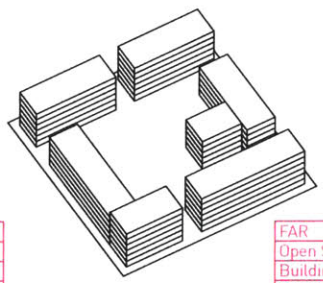


RESIDENTIAL

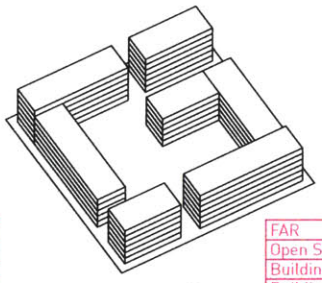
FAR	2.5
Open Space	30%
Building Coverage	40%
Building Height	7 storeys
UNITS	**180**



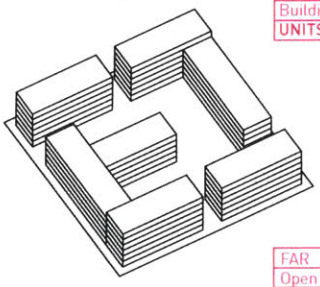
FAR	2.5
Open Space	30%
Building Coverage	40%
Building Height	7
UNITS	**190**



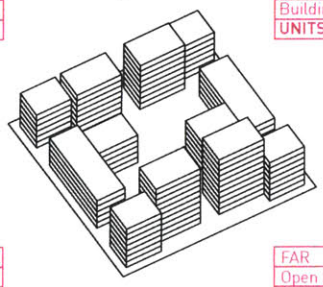
FAR	2.5
Open Space	30%
Building Coverage	40%
Building Height	7
UNITS	**190**



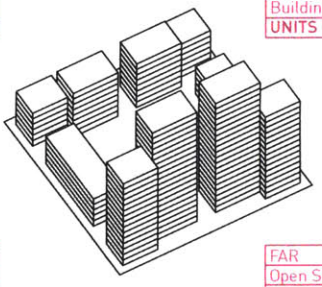
FAR	2.5
Open Space	30%
Building Coverage	40%
Building Height	7
UNITS	**195**



FAR	2.5
Open Space	30%
Building Coverage	40%
Building Height	7
UNITS	**200**



FAR	2.7
Open Space	30%
Building Coverage	40%
Building Height	10
UNITS	**250**



FAR	3.5
Open Space	30%
Building Coverage	40%
Building Height	20
UNITS	**320**

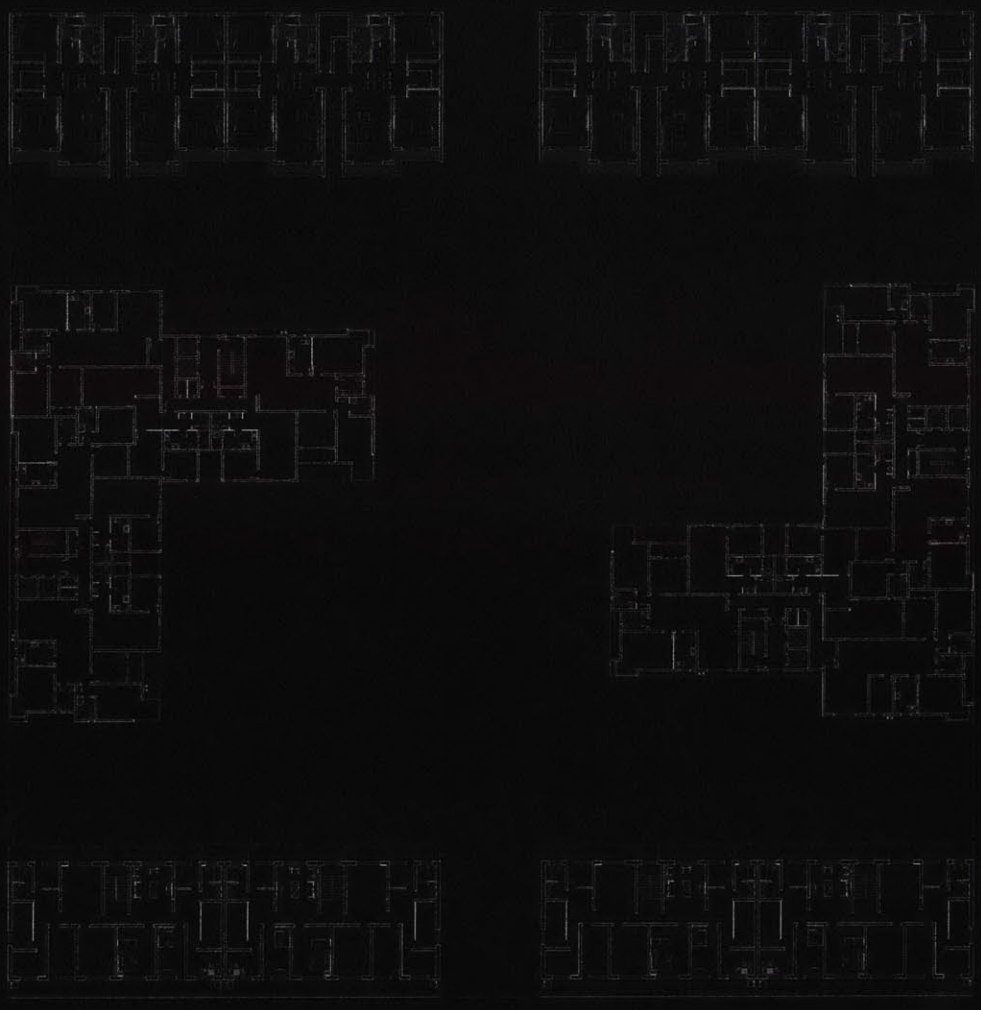
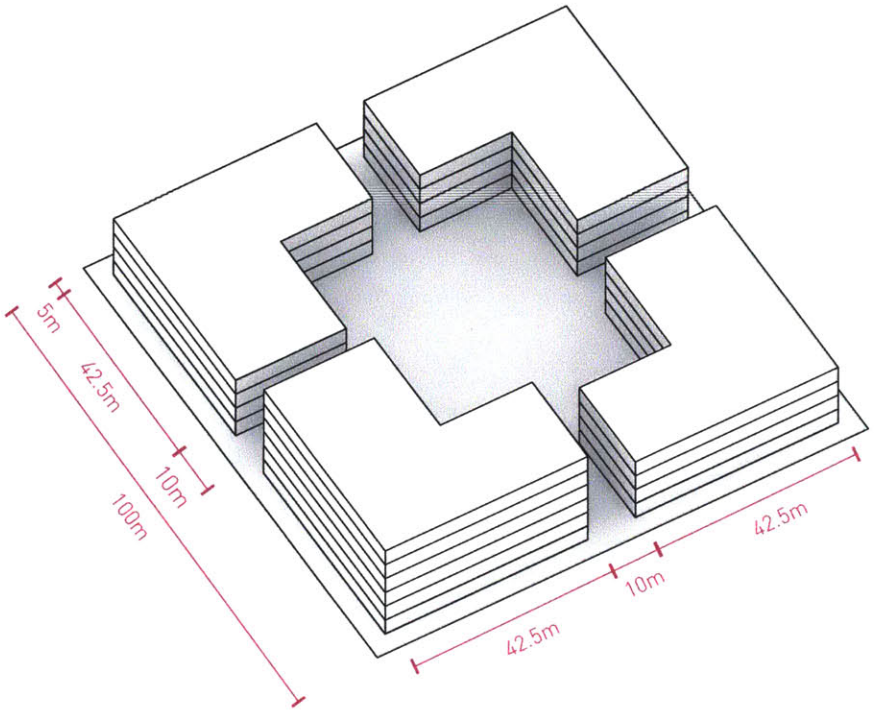
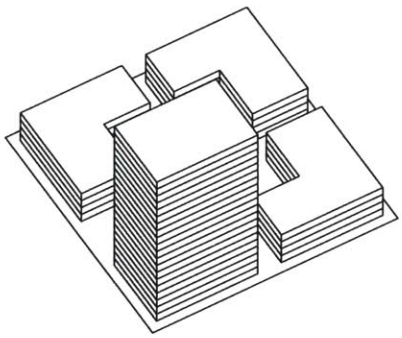


FIG 5-5
Residential Block
Typical Floor Plan

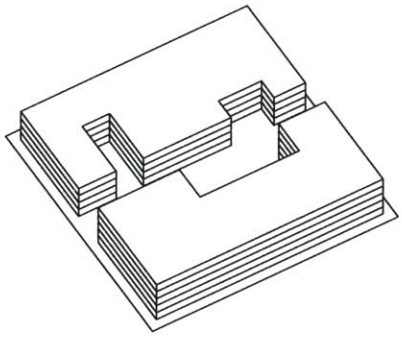


COMMERCIAL/MIX-USE

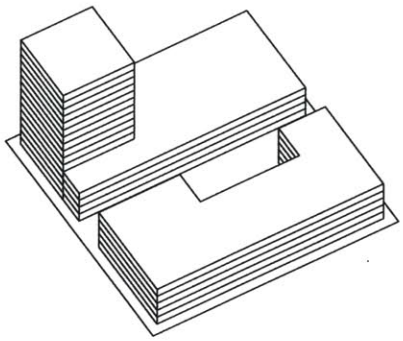
FAR	2.5
Open Space	20%
Building Coverage	65%
Building Height	6 storeys



FAR	4.0
Open Space	20%
Building Coverage	65%
Building Height	16 storeys



FAR	3.0
Building Coverage	80%
Building Height	5 storeys



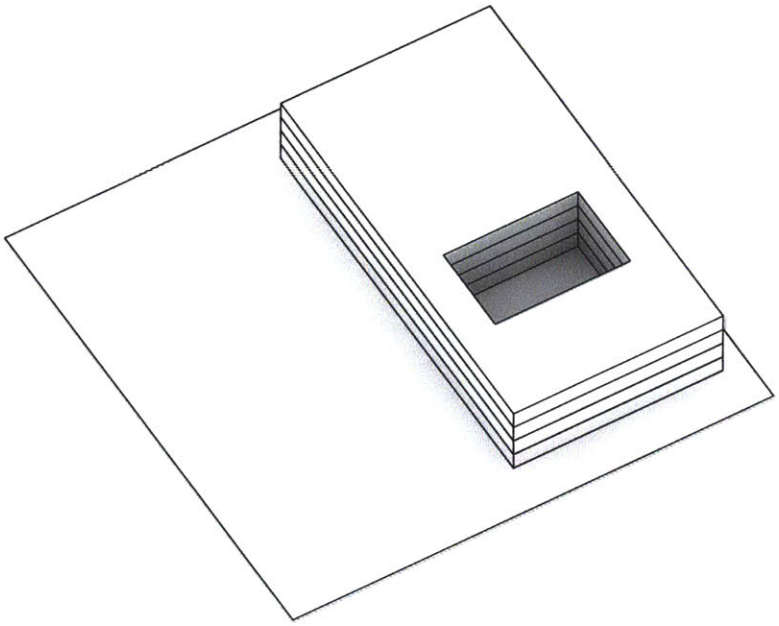
MIXED-USE

FAR	4.0
Building Coverage	80%
Building Height	15 storeys
UNITS	**135**

FIG 5-6

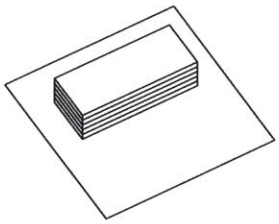
Commercial/Mix-use Block

Typical Floor Plan

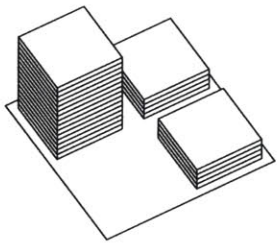


CULTURE / OFFICE

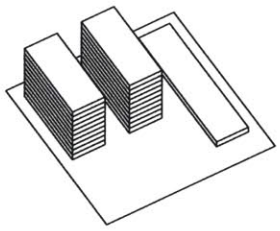
FAR	0.8
Open Space	80%



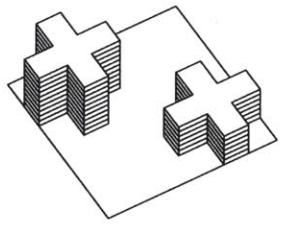
FAR	1.2
Open Space	68%



FAR	3.7
Open Space	52%



FAR	2.7
Open Space	65%



FAR	2.5
Open Space	75%

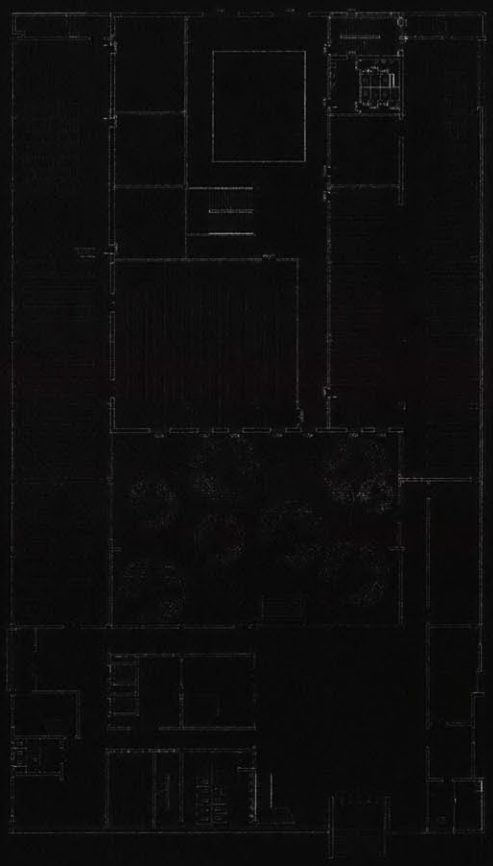


FIG 5-7

Cultural/Institutional Block

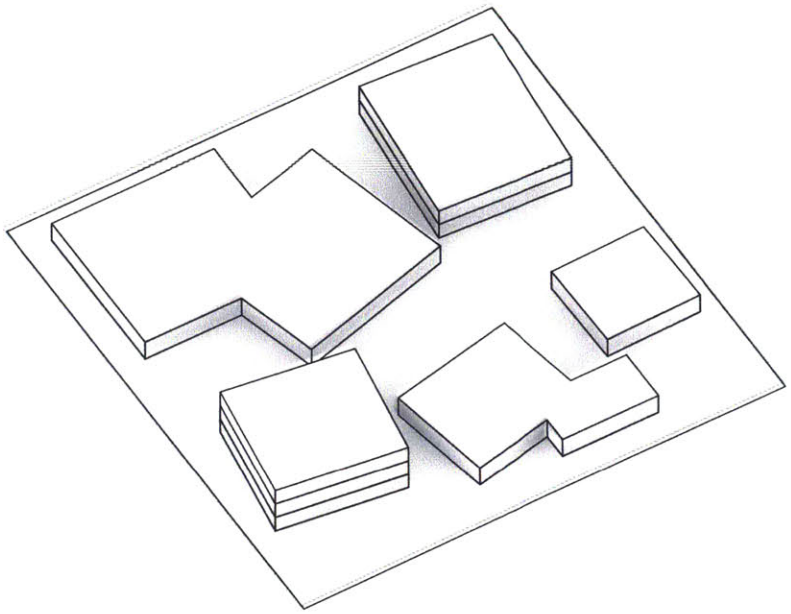
Typical Floor Plan

Innovative Industry

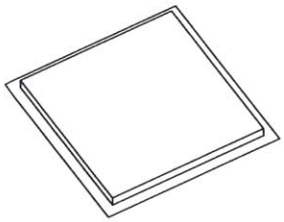
Innovative industries would come to Ordos after the development of cloud computing and electric vehicles. The plan on the left is the new Facebook headquarters designed by Frank Gehry. It has claimed the largest open floor plan in the world. The incoming Google new headquarters would use the same notion with large open floor layout and free circulation.

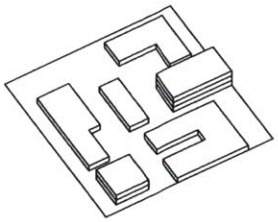
The shift from traditional private office to open floor plan has three primary reasons. First is the more flexible project team member composition. Employees often have to involve in different projects and hence team locations, and open plan could accommodate this fluctuation. Second, working devices are shifting from desktops to laptops and even tablets. As people could work anywhere on their laps, flexible, customizable and interesting space are more welcome. Last, cost-effectiveness is another concern because open floor plan can accommodate multiple renters.

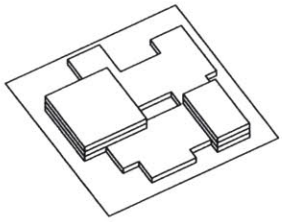
FIG 5-8 **(left)**
Open Floor Plan
New Facebook Headquarters by Frank Gehry



INNOVATIVE INDUSTRY







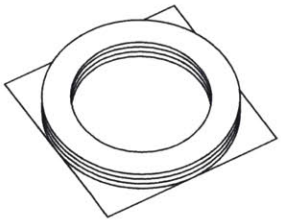
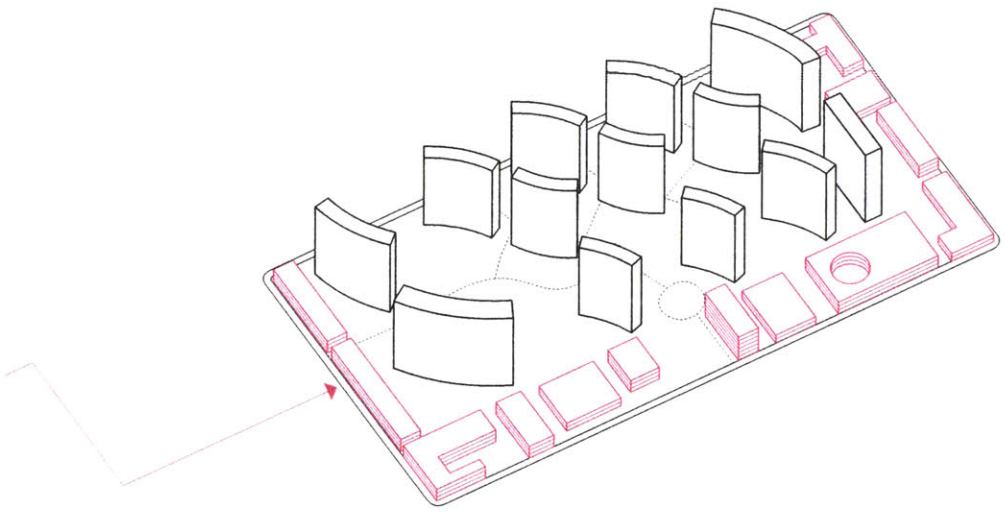


FIG 5-9

Innovative Industry

Typical Floor Plan



Transformation from existing blocks

As roads are narrowed and parking lots are no longer needed, existing mega-blocks would be spared with large amount of space. Average depth of the space is around 15 meters, which is quite appropriate for low-rise retail and service programs. These infill programs would significantly revive the preserved neighborhoods.

5.3 Density

Transit Oriented Development (TOD) is a reference for distributing density. Like Japan and Singapore, mix-use and hybrid programs are centered around transit nodes with higher density, and lower density development are spread outward from the center. The city will have multiple centers that trigger development. Although most typologies are flat and mid-rise, the new train station is going to attract the highest density development, and main corridors and the ring system would also be surrounded by higher density.

Top population density around transportation nodes would be around 500 people per hectare, approaching the density of Manhattan. 300 people per hectare would be the average density, creating an urban and pleasant environment. The density is calculated from the units of residential typologies.

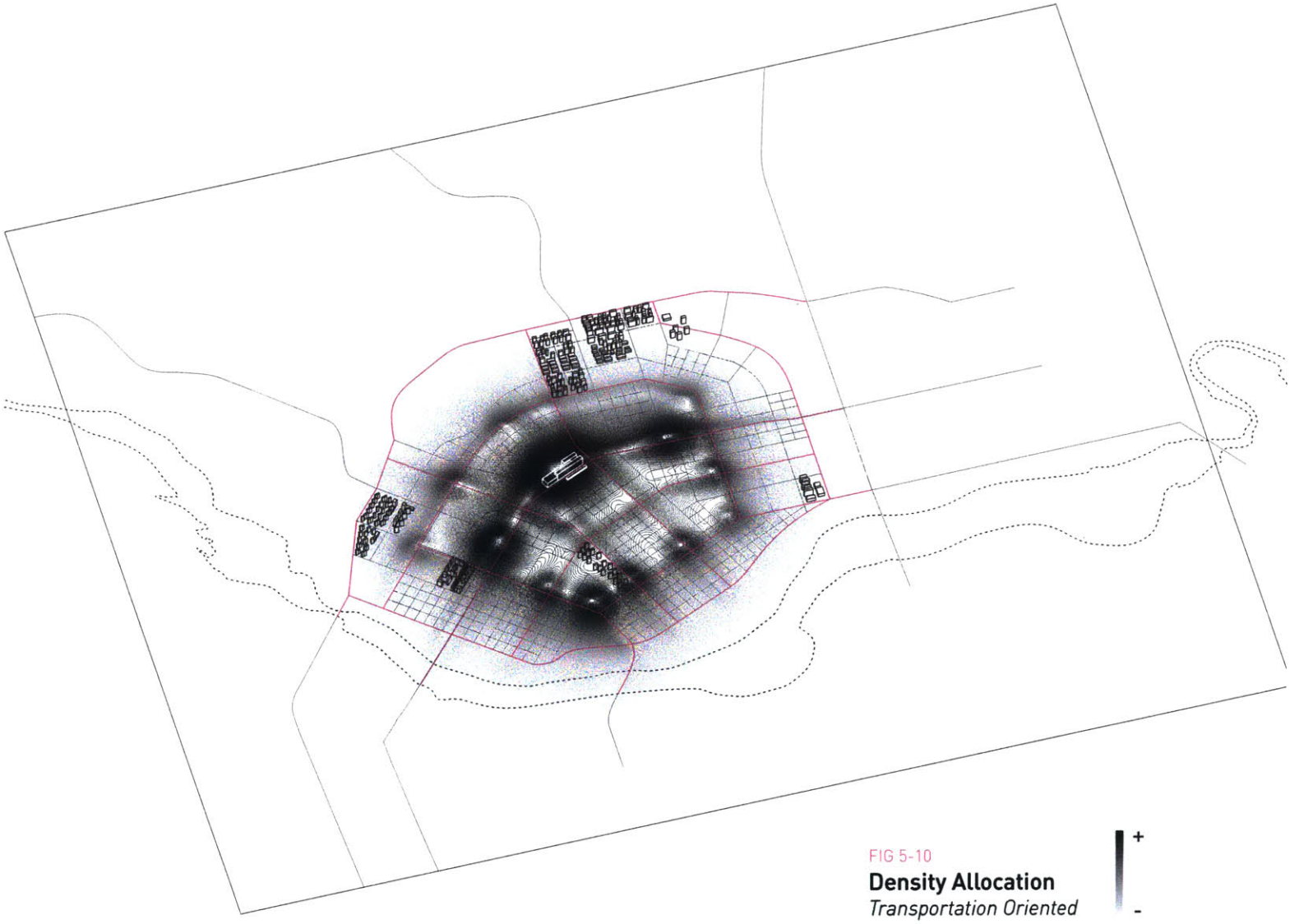


FIG 5-10
Density Allocation
Transportation Oriented

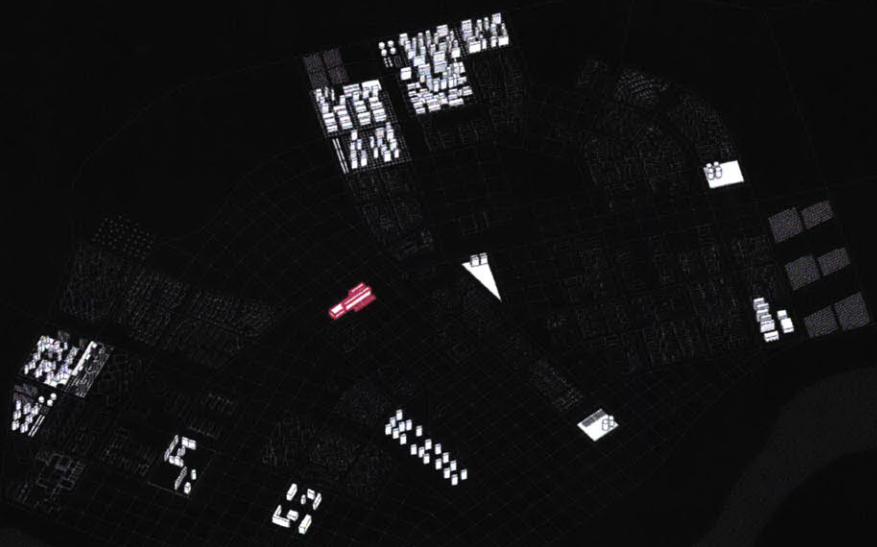
FIG 5-11
Existing Plan


500m
0.5 mi

FIG 5-12

Revised Master-plan

PHASE 0
Preserved Fabric



PHASE 1
Intrastructure
Framework

PHASE 2

Growth from
Existing Neighborhood

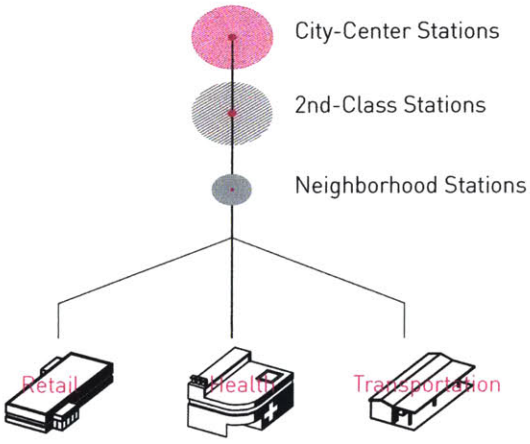
PHASE 3

PHASE 4

FINAL PHASE

5.4 Transportation

The city would first nail the infrastructure framework for industry growth. New city fabric would generate from existing neighborhoods. When the city reaches certain capacity, different hierarchies of road network are to be established. A ring system can serve as first-class rapid passage for PRT system. Generally, PRT stations are distributed into neighborhood scale, and distance between every station is within 200-400 meters. All commercial, health centers and other service will cluster around these transportation nodes.



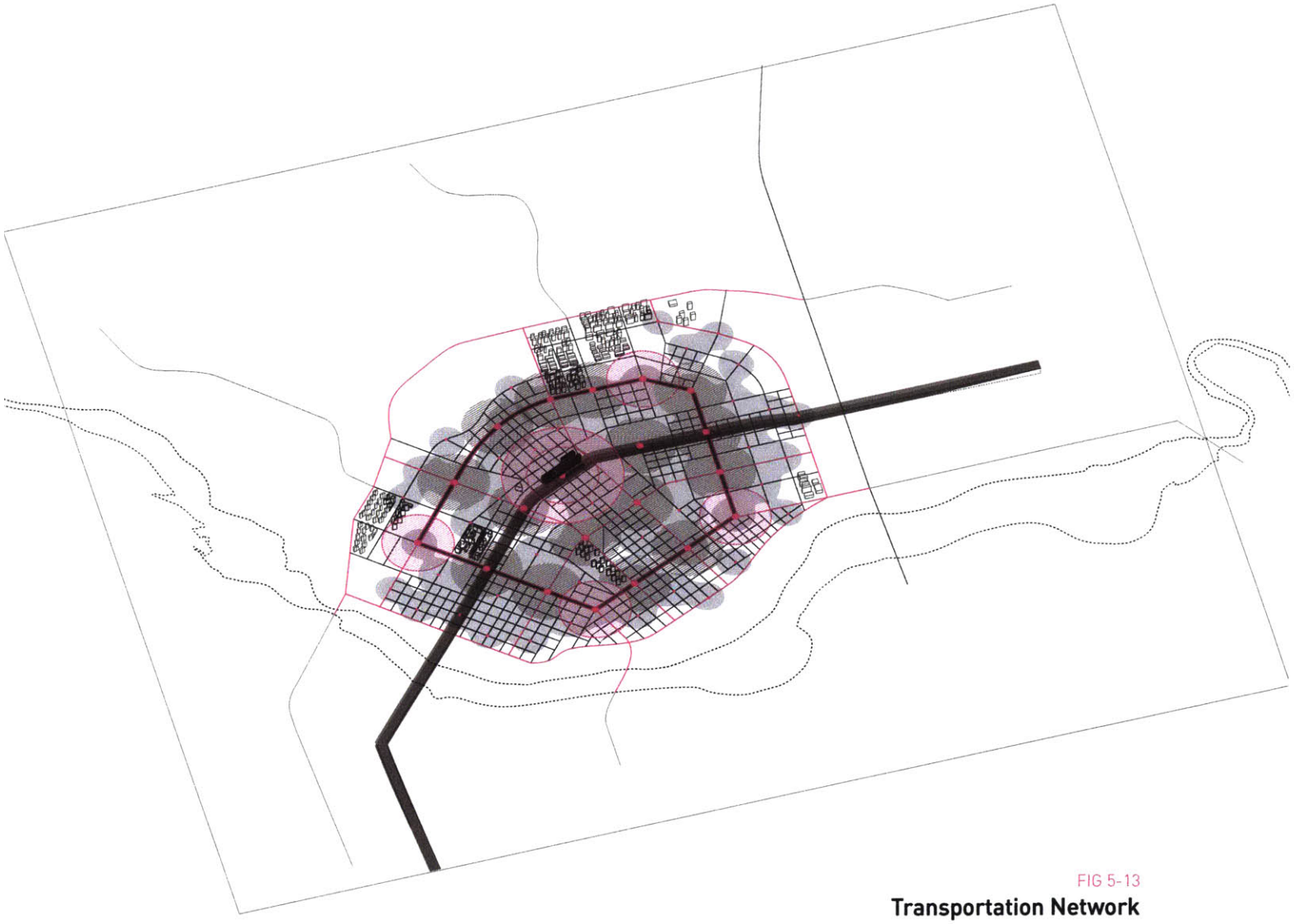
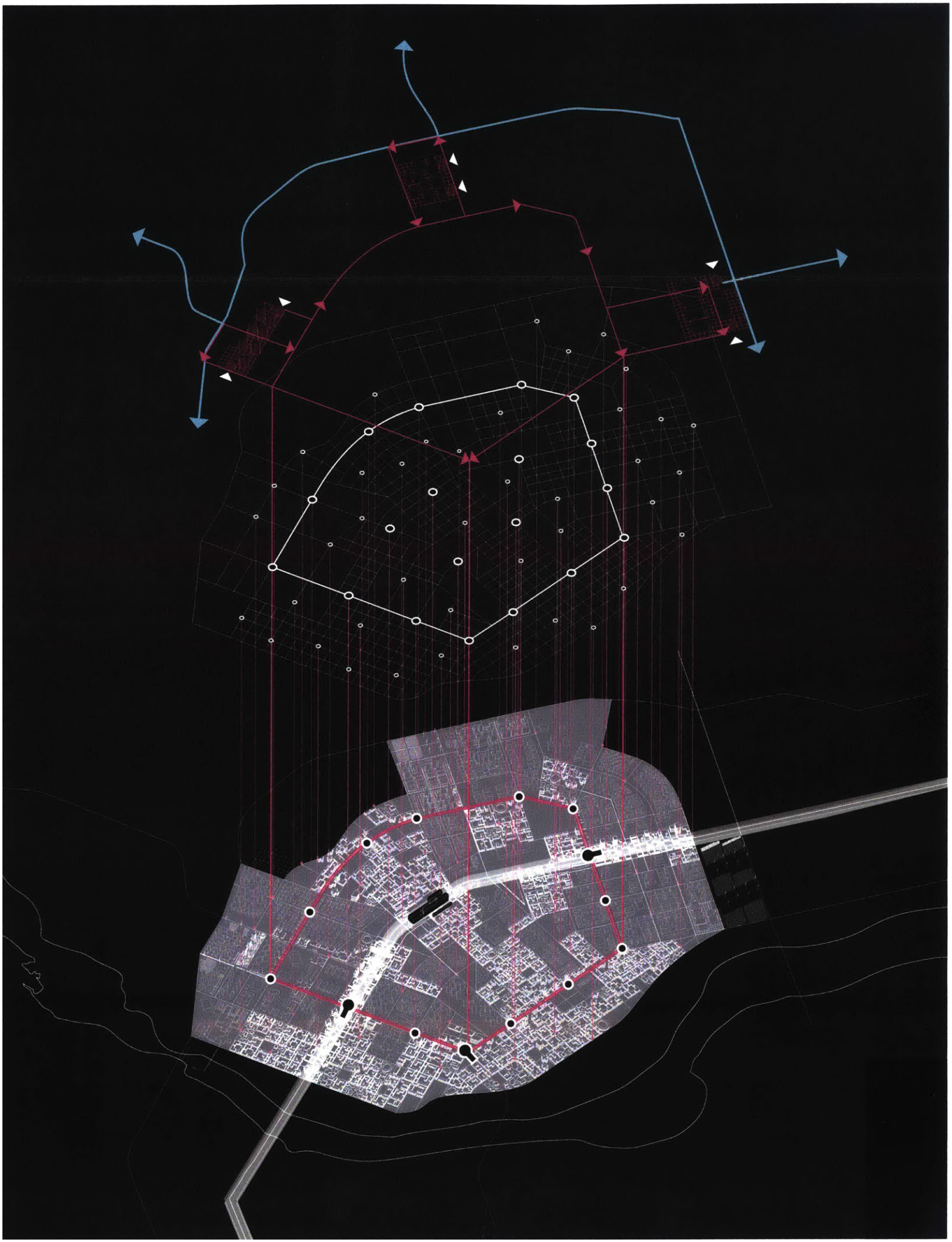


FIG 5-13
Transportation Network



Parking lots for PRT system would be located in the infrastructure farms at the periphery. Traditional fossil fuel vehicles would not be totally banned. If people would like to travel out of the city, a Zipcar-like system can provide traditional automobiles; when there are visitors from other cities, their cars can also be parked in the parking lot and enter Ordos via PRT system.

FIG 5-14

Transit System

Rapid Ring System

Transfer Station

2nd Class Station

Neighborhood Station

PRT Logistics Line

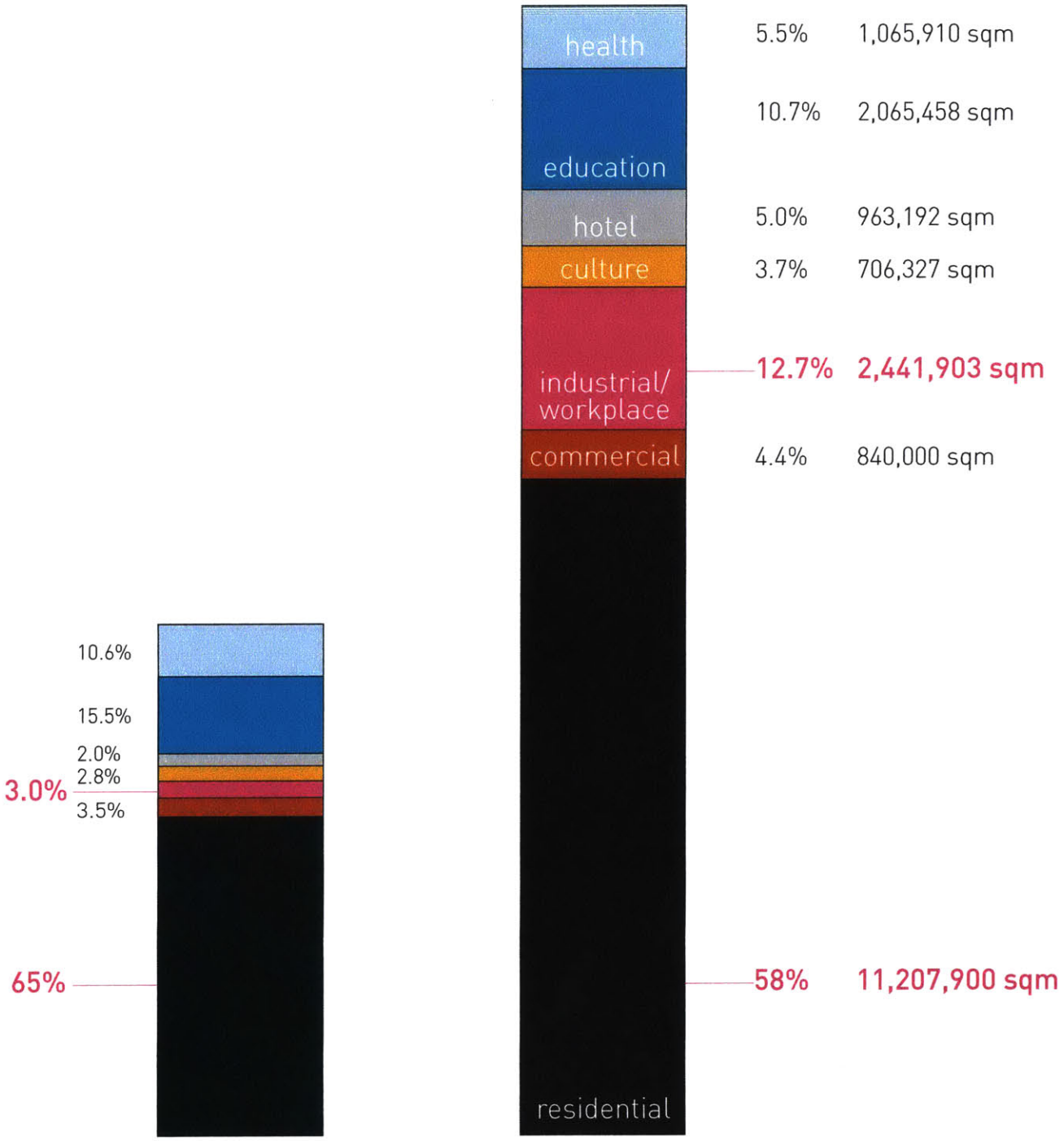
PRT Parking Cluster

Traditional Automobile Line

5.5 Program Index

The major increased programs are residential, commercial, and industrial workplace. Residential proportion remains steady at around 60 percentages, with 11million square meters and will accommodate 500,000 people. As new block types applied, street level will significantly increase commercial space, reaching 4.4% of entire city. Innovative industries would occupy 12.7% of the city, and will be distributed into typical blocks or mix-use office space.

FIG 5-15 (right)
Program Index


health
education
hotel
culture
industrial/
workplace
commercial
residential
5.5%
1,065,910 sqm
10.7%
2,065,458 sqm
5.0%
963,192 sqm
3.7%
706,327 sqm
12.7%
2,441,903 sqm
4.4%
840,000 sqm
58%
11,207,900 sqm
10.6%
15.5%
2.0%
2.8%
3.0%
3.5%
65%

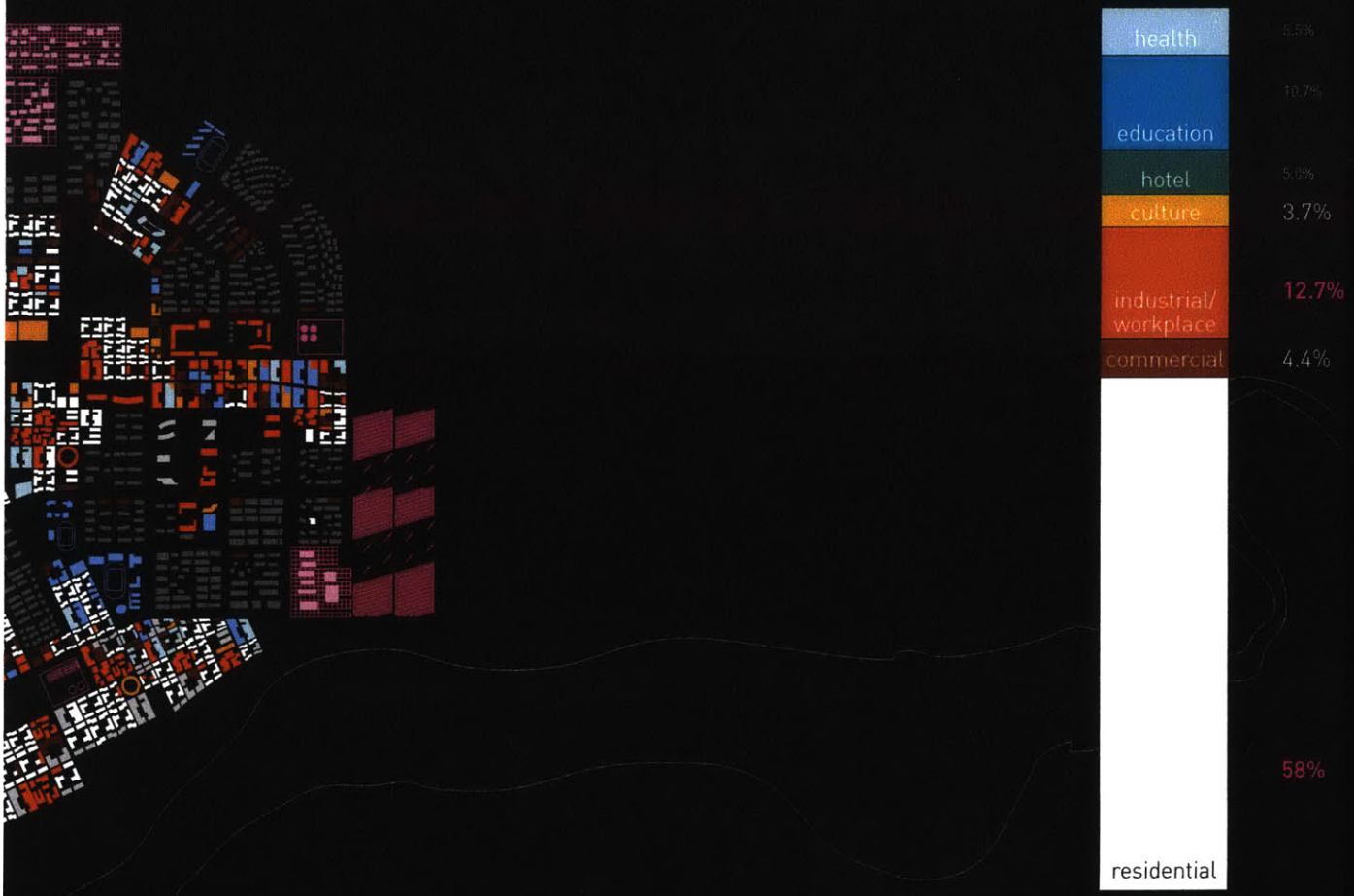
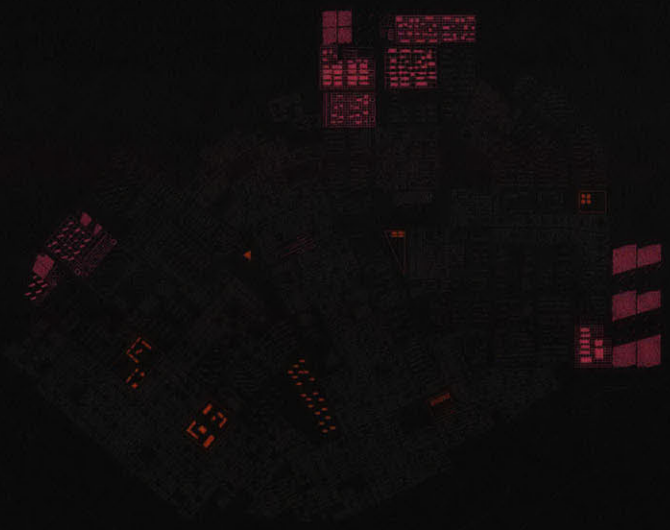


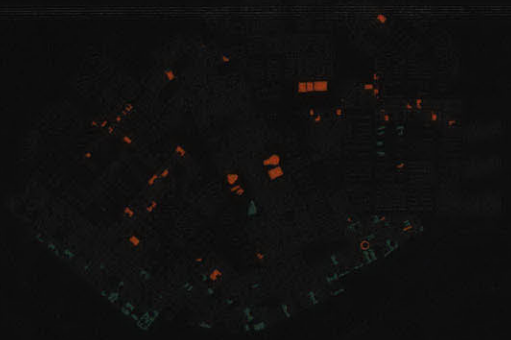
FIG 5-16

Program Composite

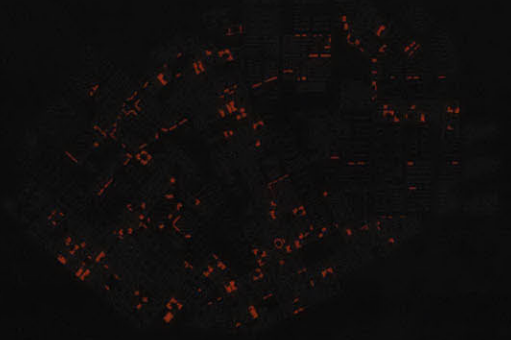
Residential



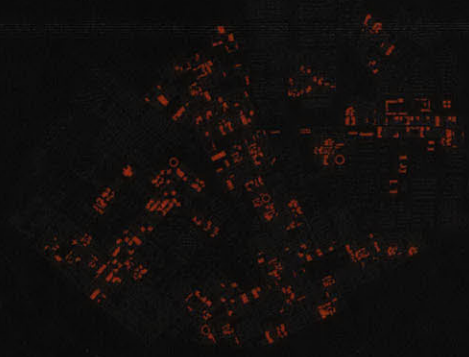
Infrastructure/
Energy Node



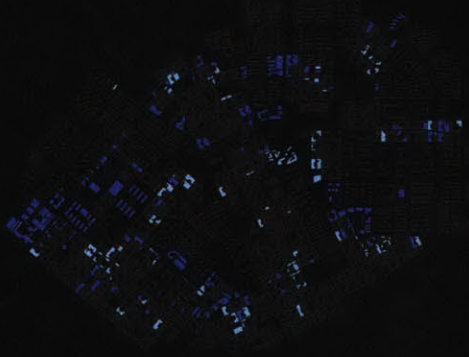
Culture/
Hotel



Commercial

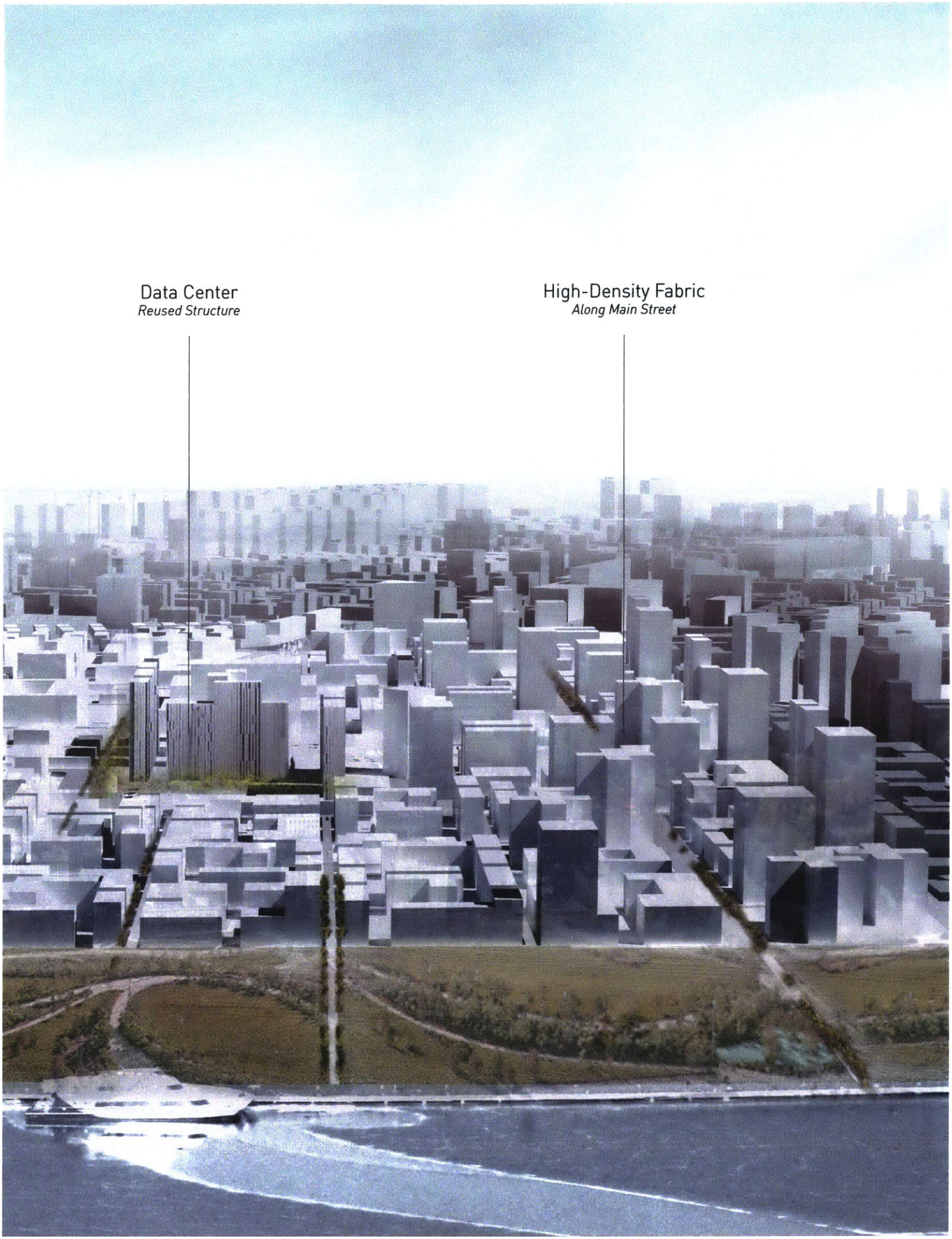


Office/
Workspace



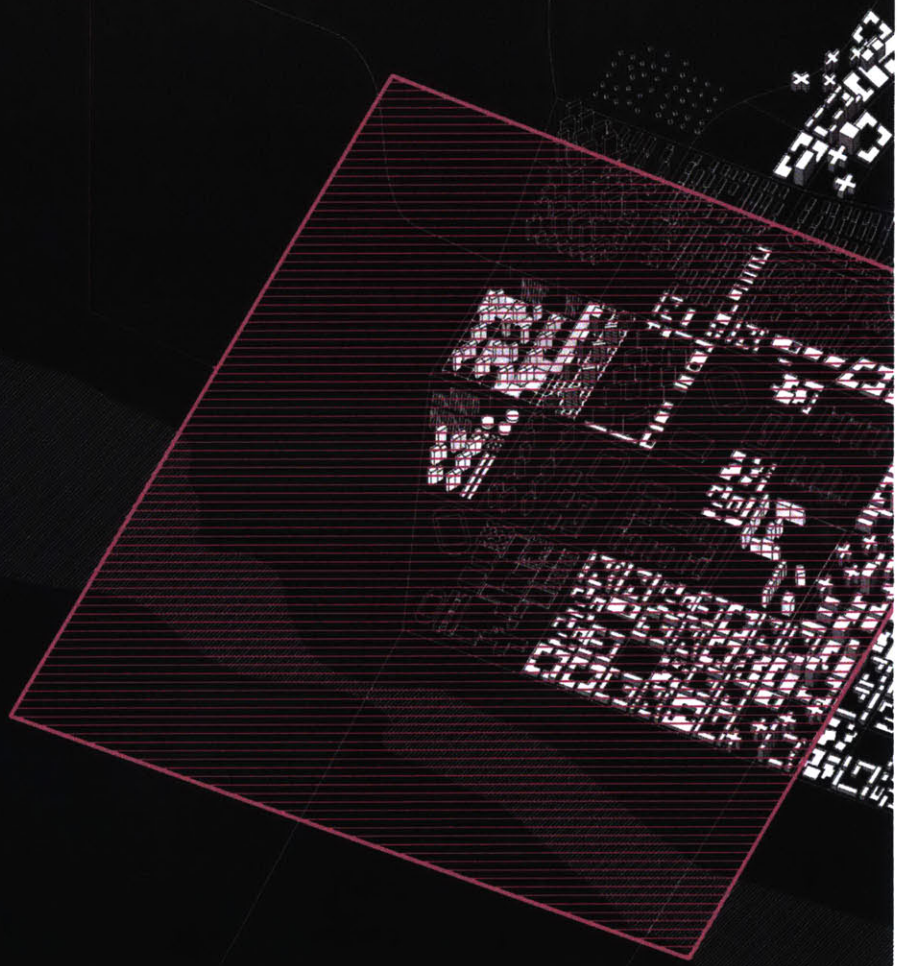
Education/
Health

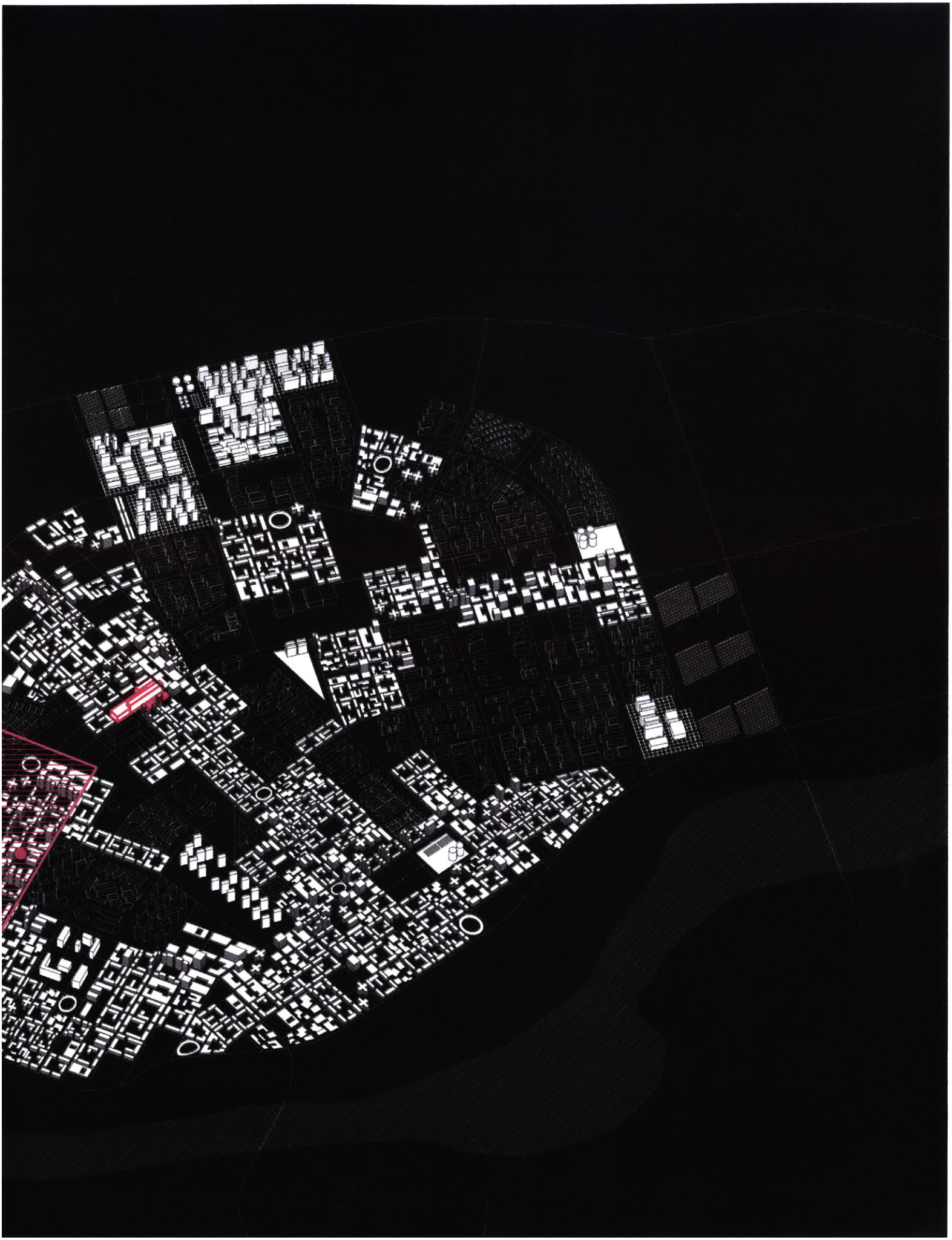
FIG 3.17
Variety of the City


Data Center
Reused Structure
High-Density Fabric
Along Main Street

06

PILOT AREA

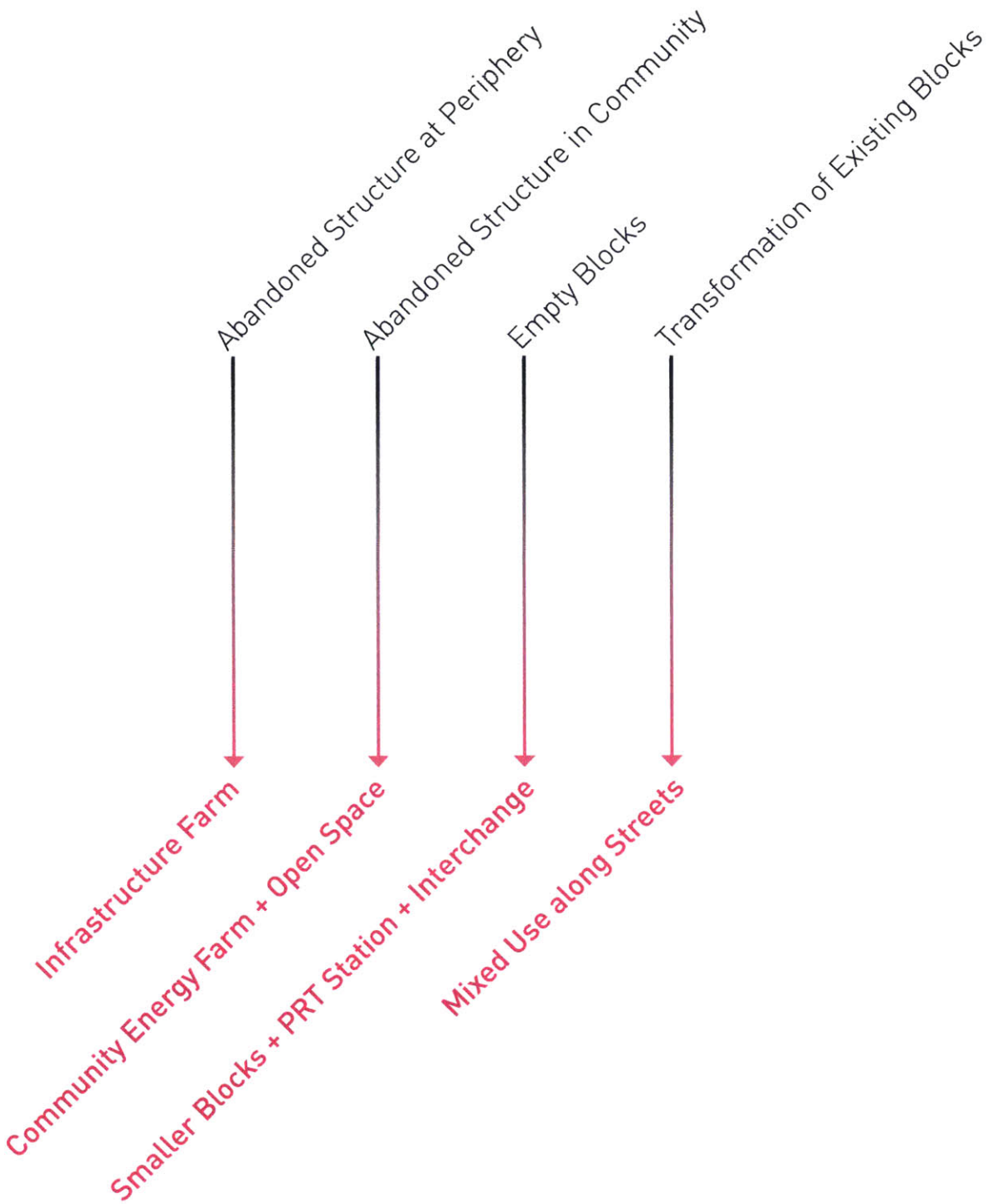




Pilot Area Elements

The pilot trunk consists of all typologies and principles mentioned in previous chapters. Five residential communities will be preserved; four blocks of structures will be transformed into infrastructure farm; and one middle school and one high school are to remain functioning. As for open space, two more community level parks will be opened. One rapid transportation corridor would pass in the south of this trunk, surrounded by higher-density developments.

FIG 6-1 (right)
Elements


Abandoned Structure at Periphery
Abandoned Structure in Community
Empty Blocks
Transformation of Existing Blocks
Infrastructure Farm
Community Energy Farm + Open Space
Smaller Blocks + PRT Station + Interchange
Mixed Use along Streets

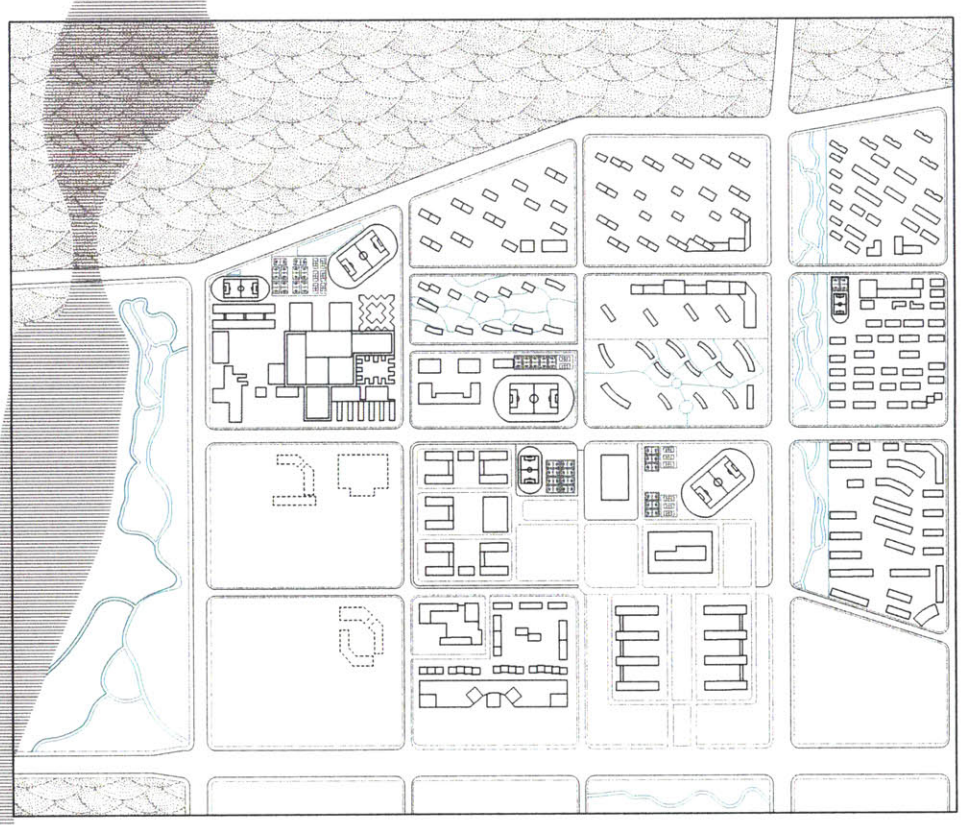


FIG 6-2
Exisiting Plan

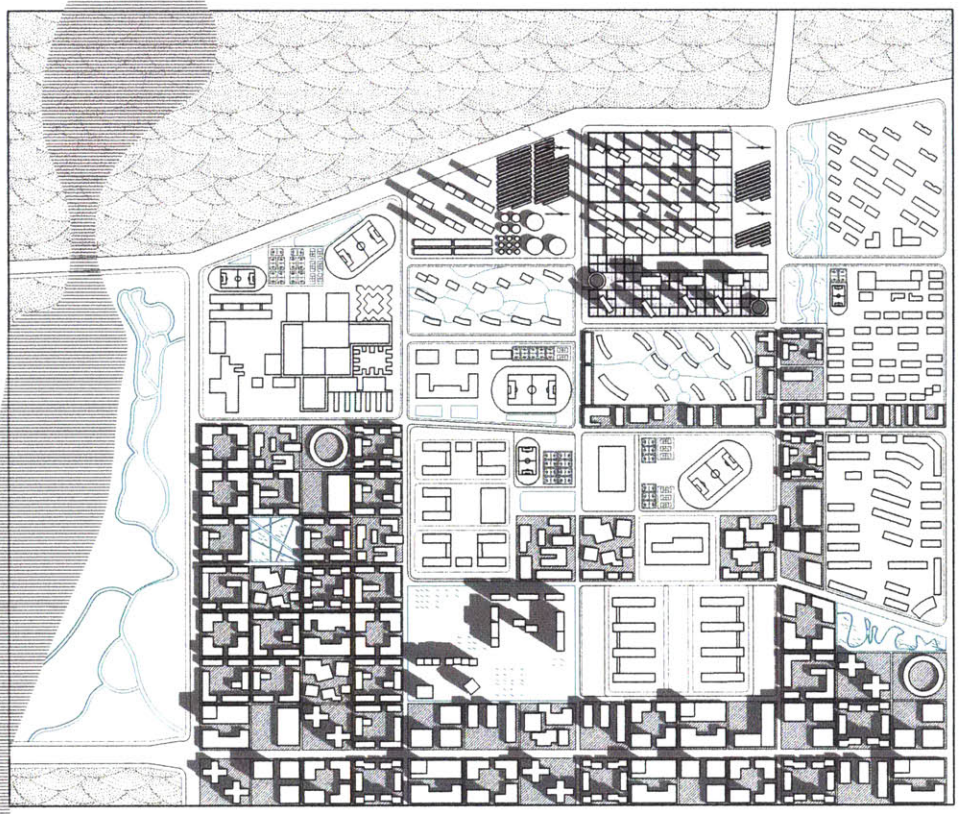


FIG 6-3
Proposed Plan

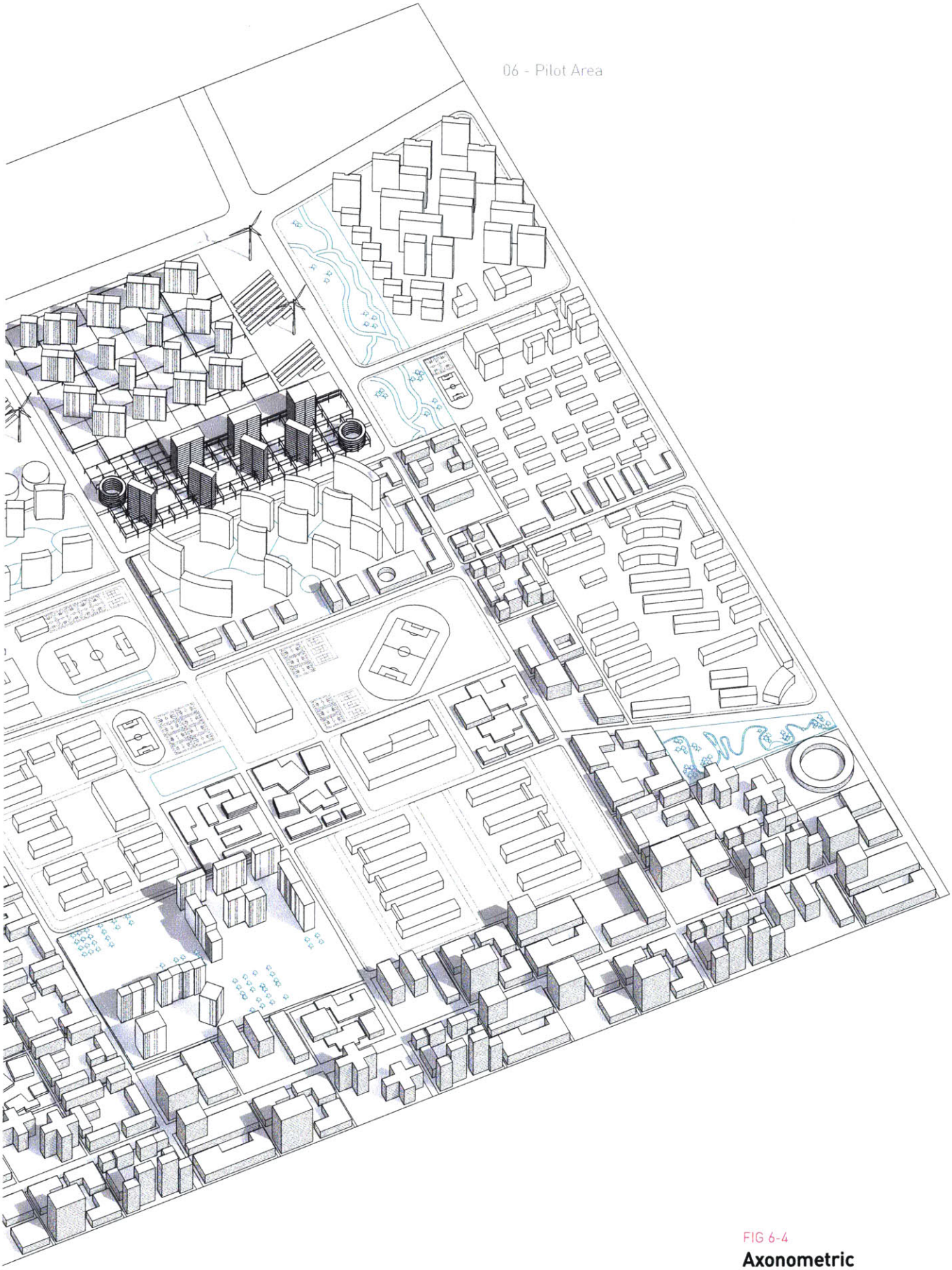
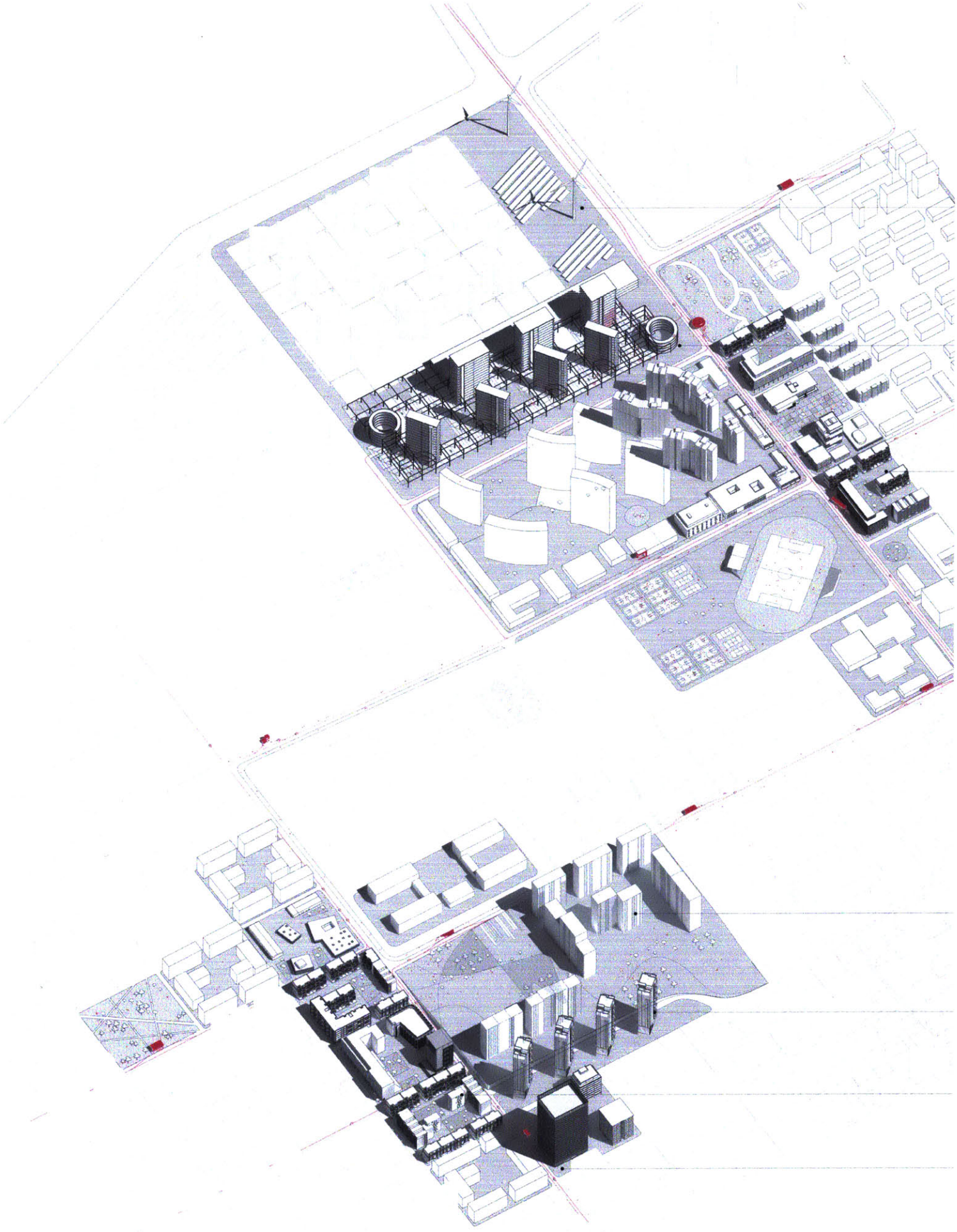
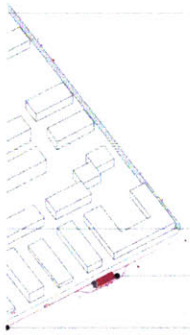


FIG 6-4
Axonometric





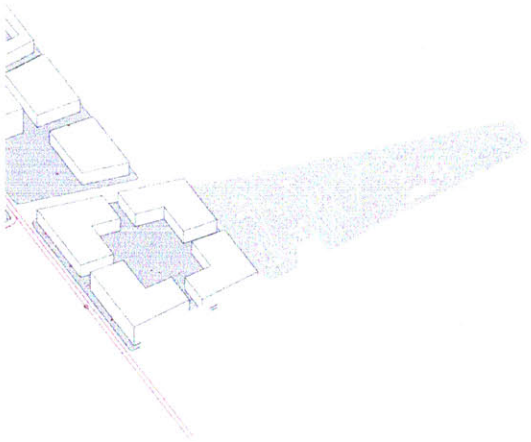
Infrastructure/Energy Farm

PRT/Automobile Parking Lot

PRT Station

PRT Route

Infill Programs



Community Energy Node
/Community Park

Affordable Housing

Residential Block

Office/Mix-use Block

FIG 6-5
Scenario

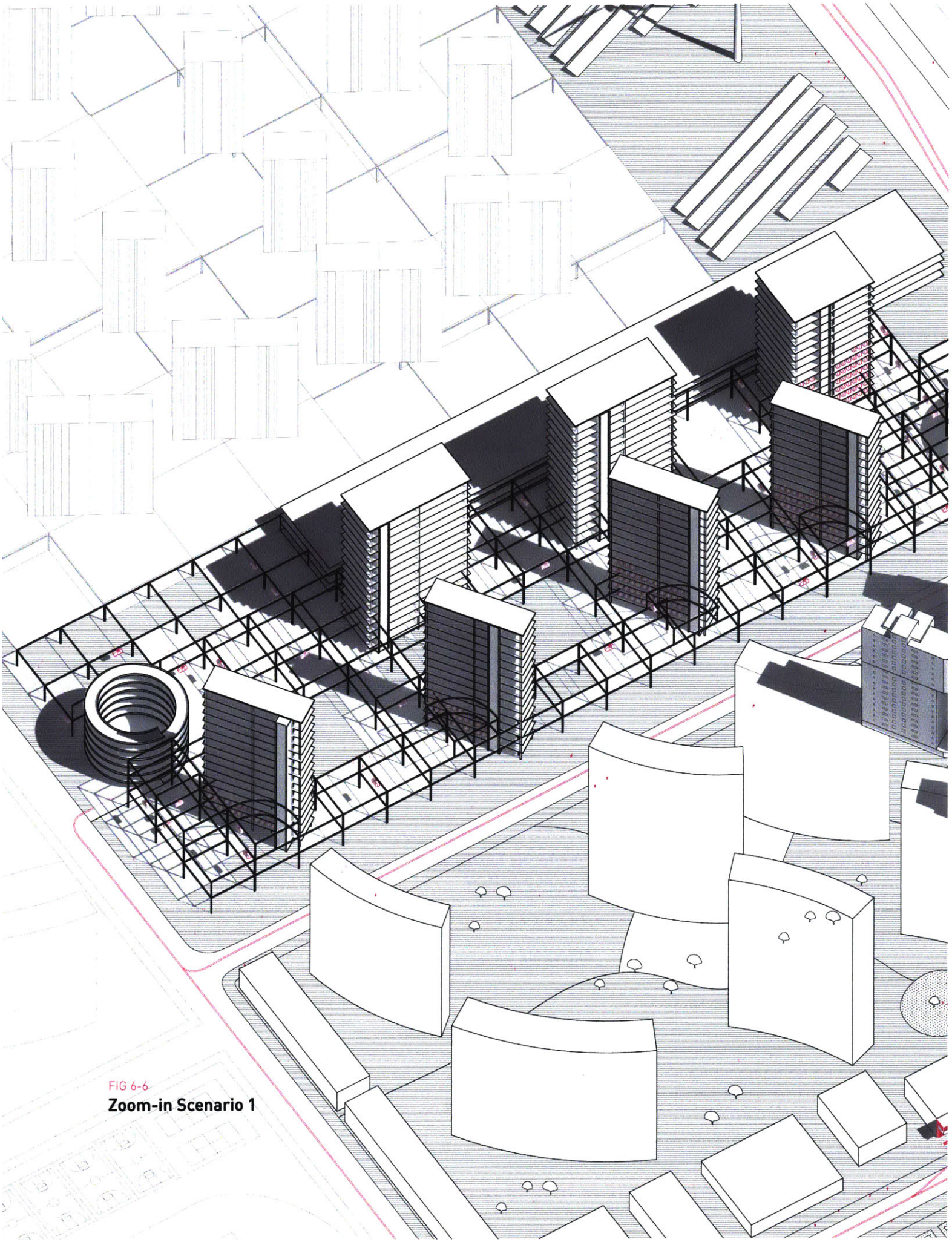
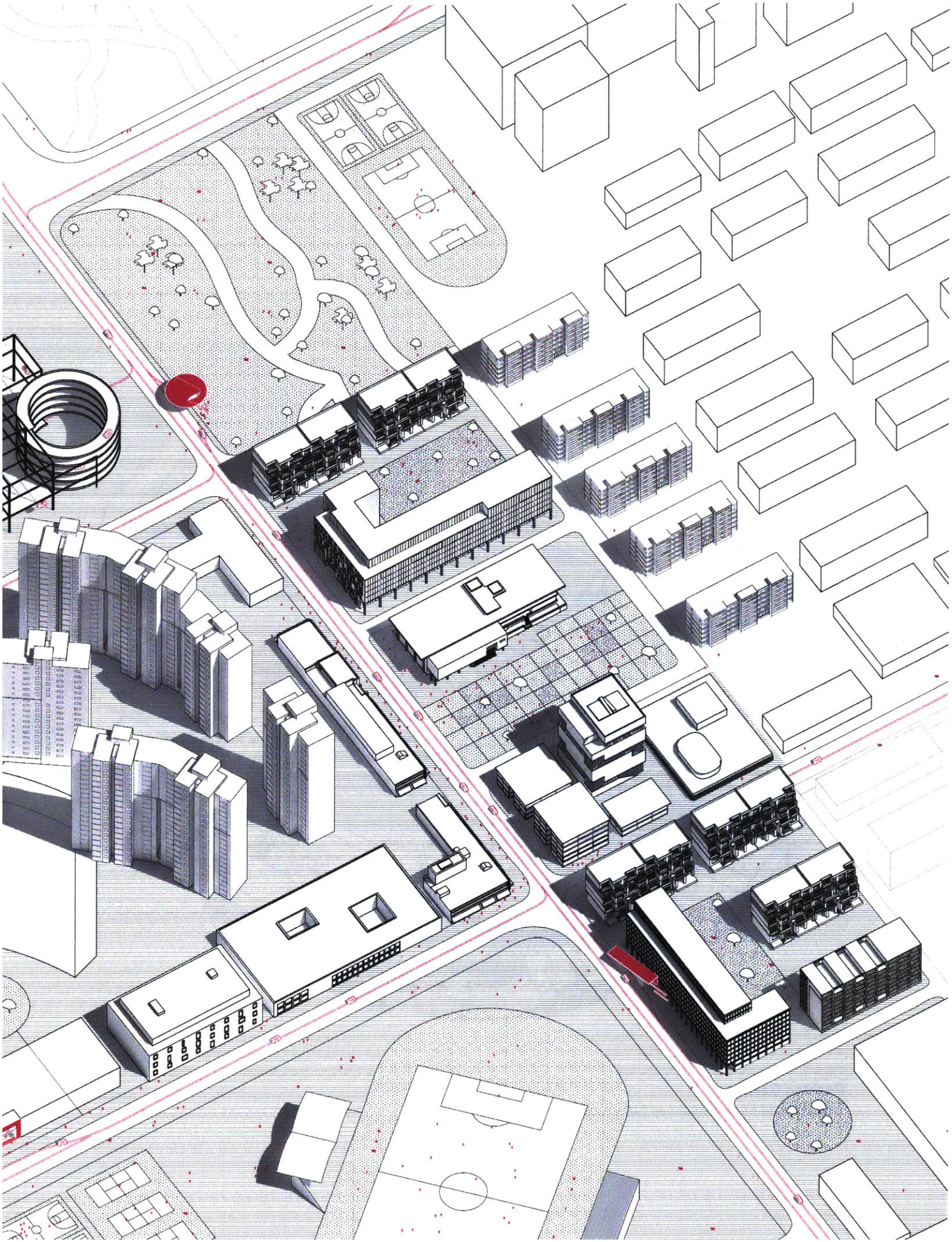


FIG 6-6
Zoom-in Scenario 1



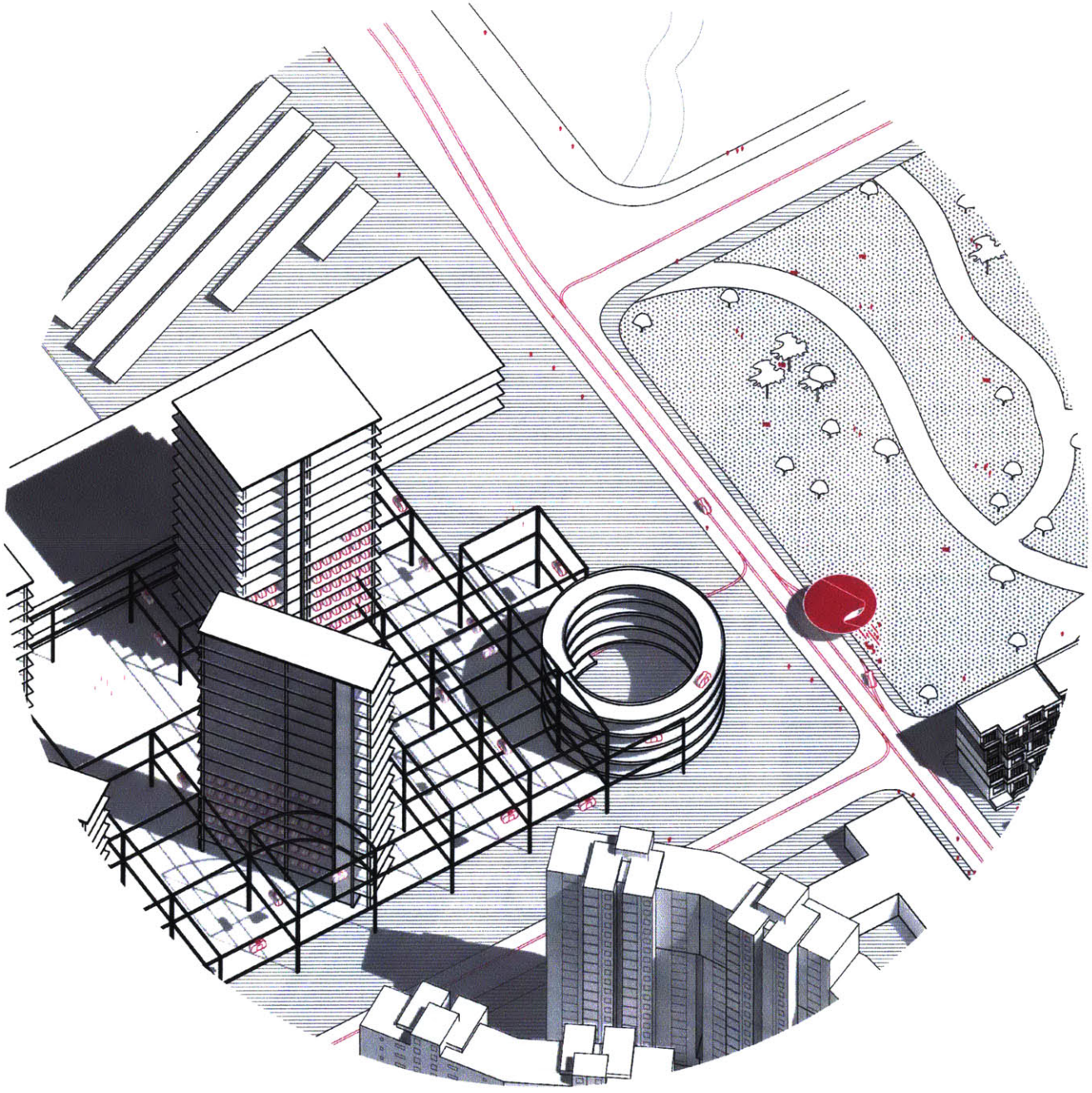


FIG 6-7

Parking Garage

Transformed from Abandoned Structures

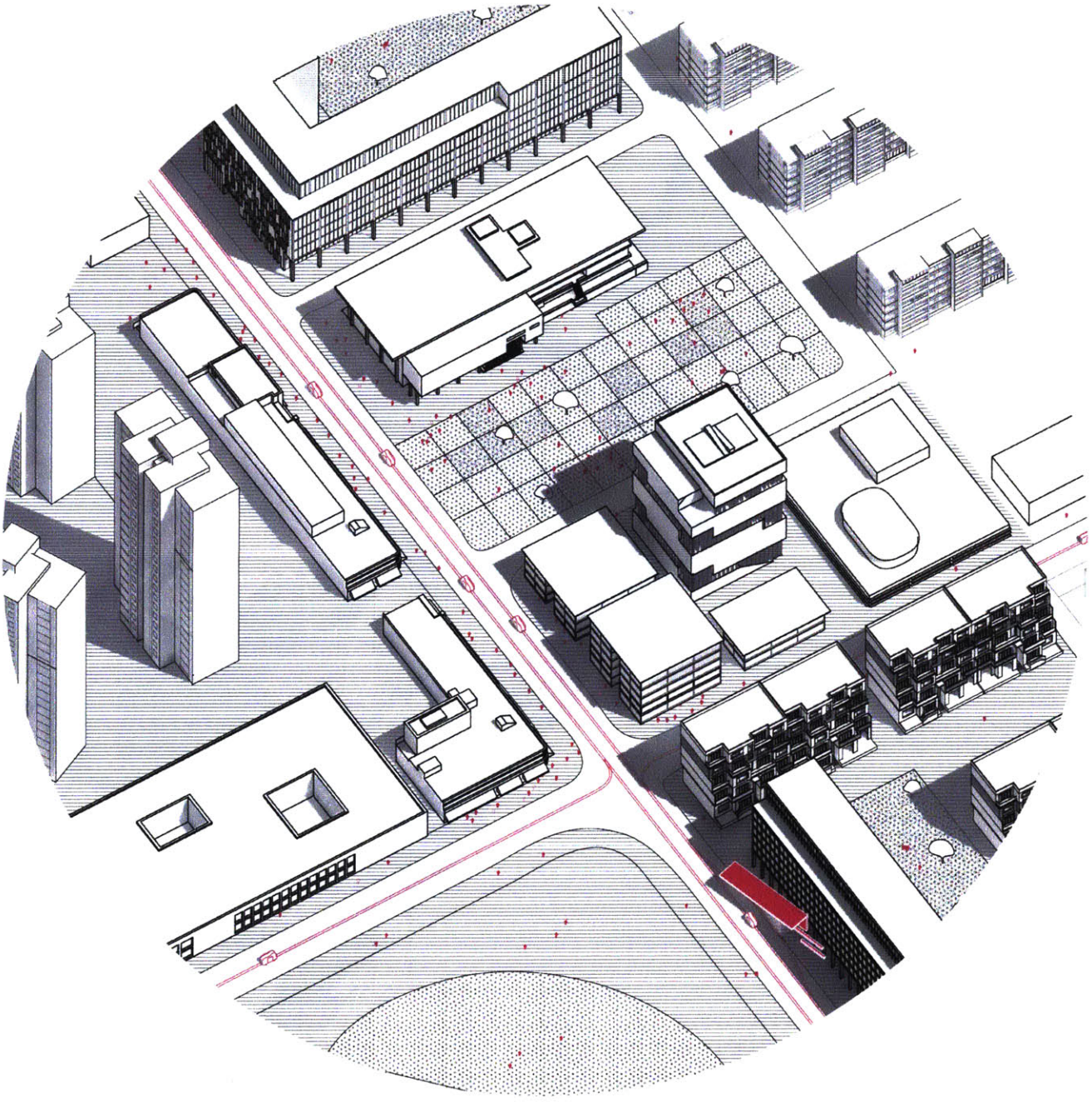


FIG 6-8

Mixed Programs

Infill Retail, Cultural, Office, Residential

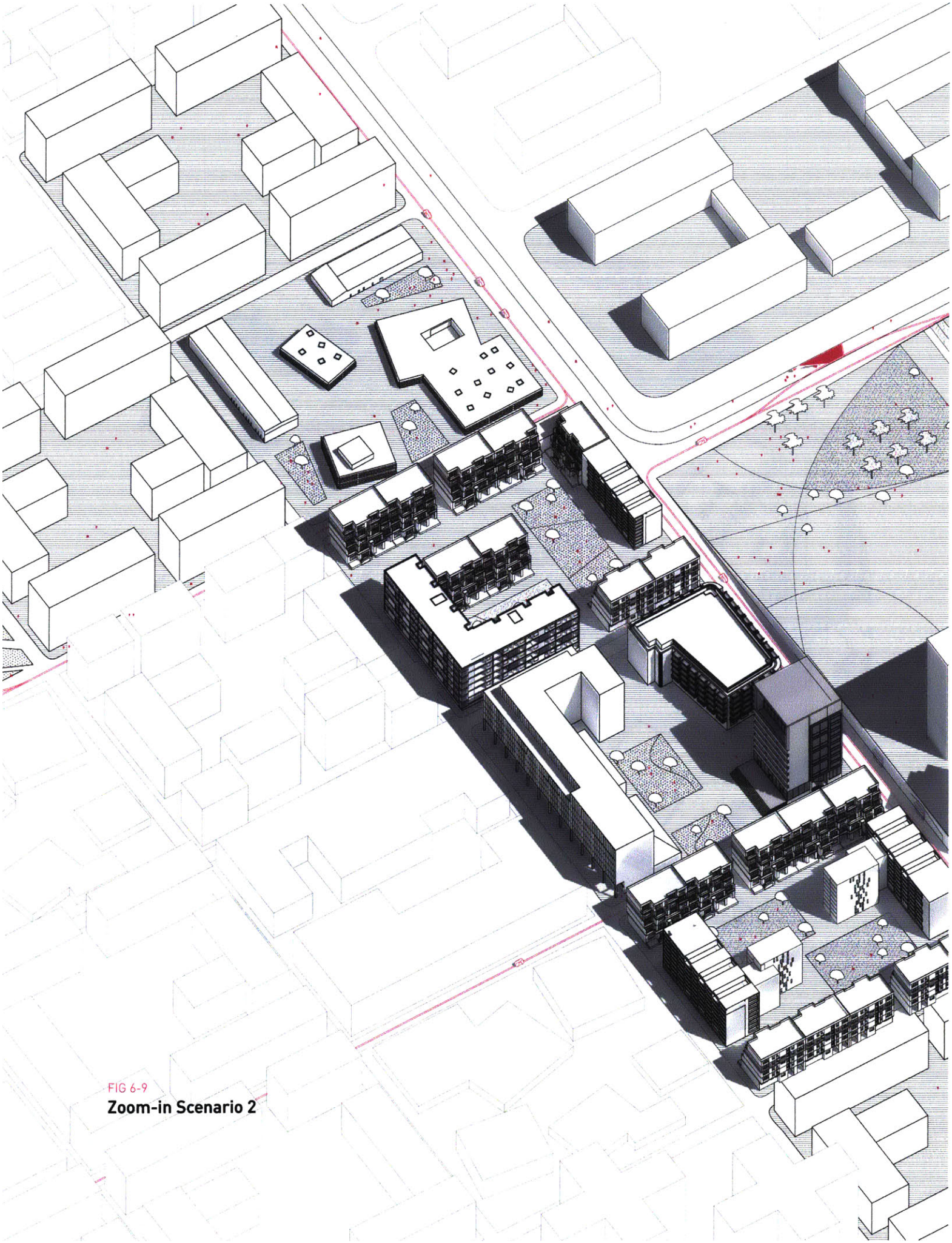
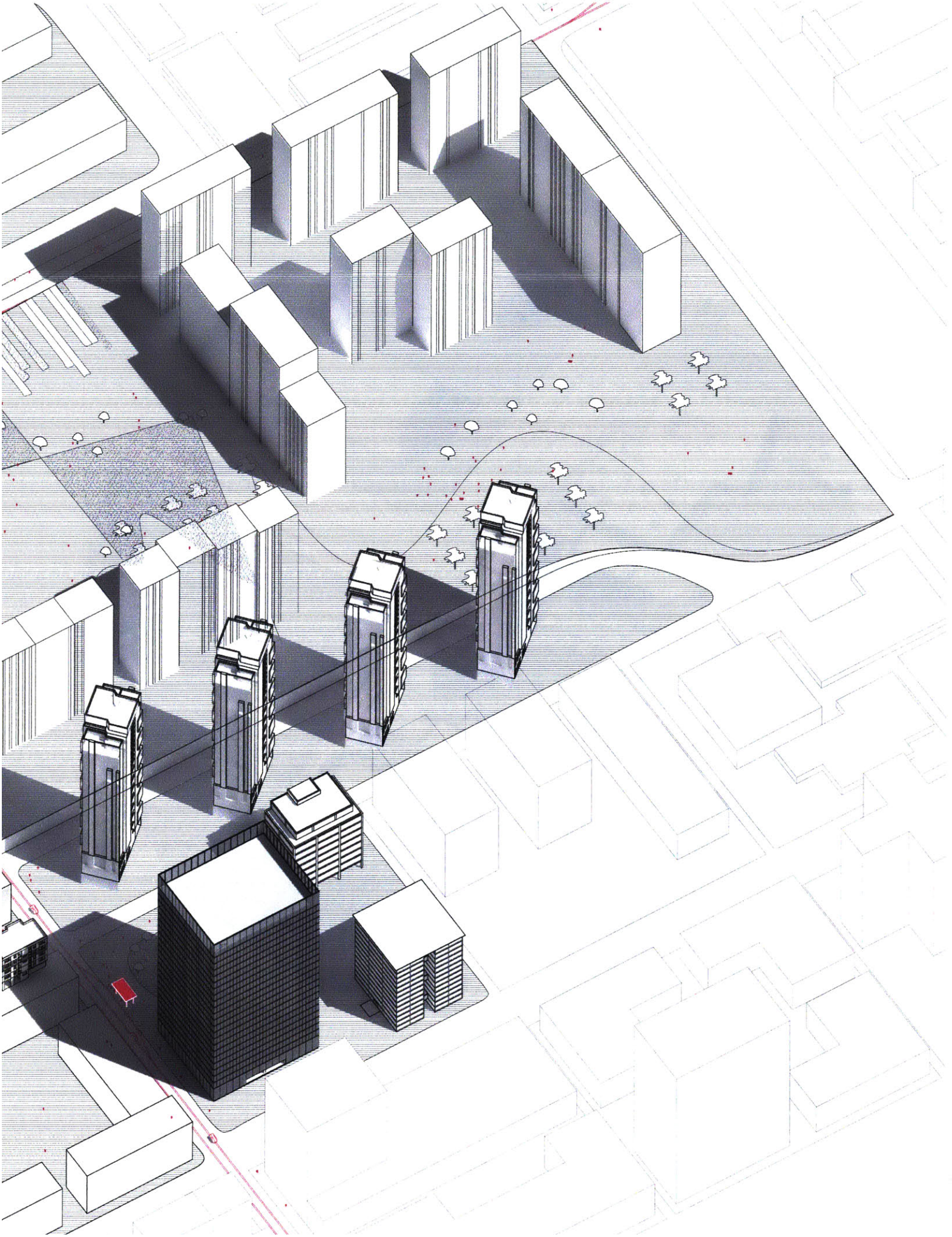


FIG 6-9
Zoom-in Scenario 2



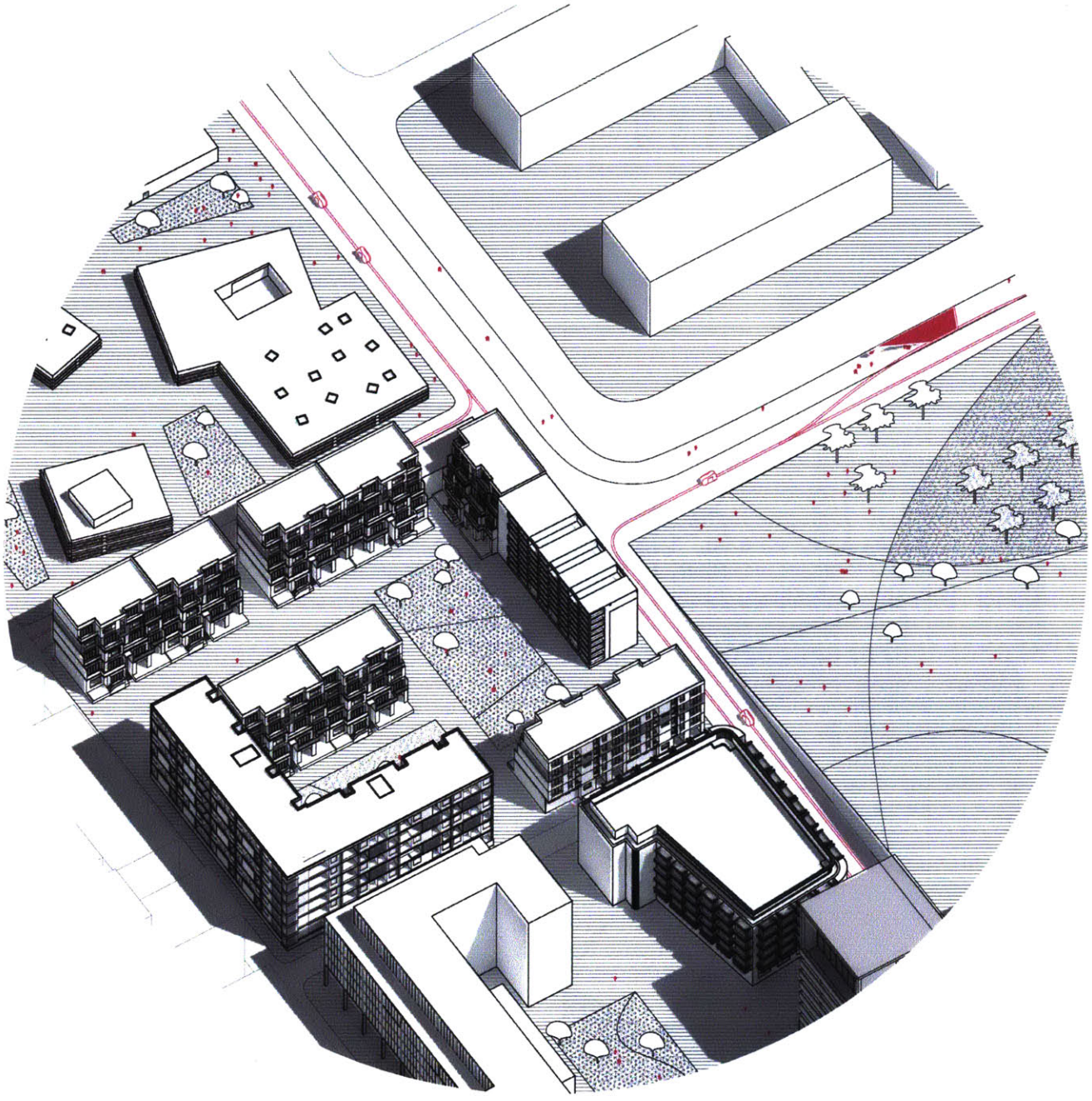


FIG 6-10

Community and Open Space

Innovative Industry, Residential, Mix-use, Community Park

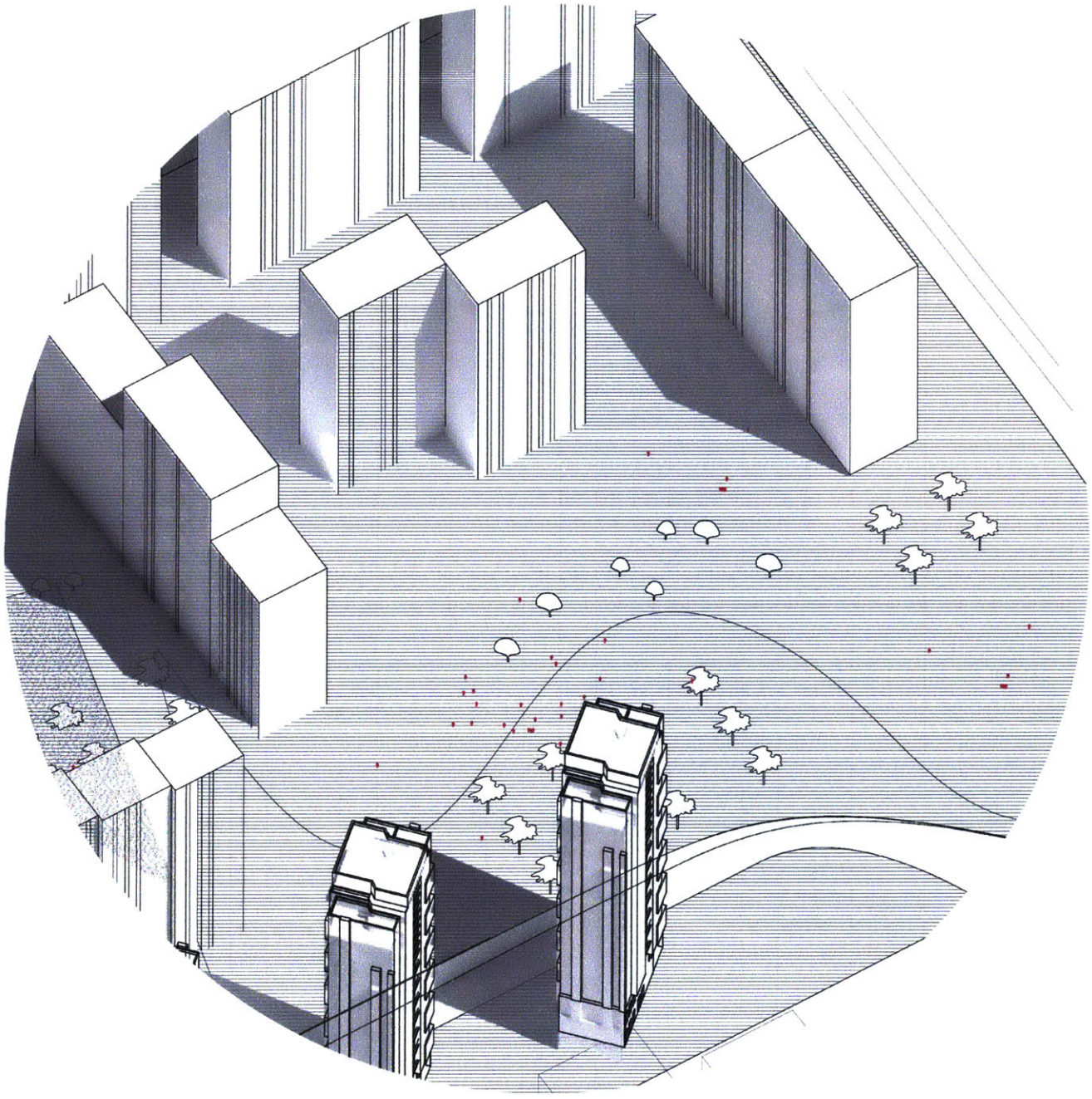


FIG 6-11

Data Centers and Affordable Housing

Adjacency

FIG 6-12
Current Street Condition


COACH

FIG 6-14
Transformed Street Scenario

Current Street Condition

FIG 6-15
Transformed Street Scenario

07 IMPLICATION

The thesis seeks a new paradigm for revitalizing not only current ghost cities but also cities undergoing economic shrinkage. Contemporary master-plan principles in China are space and form driven, which would work with sufficient economic support. However, as the acceleration of growth has cooled down, many cities will face similar situations that ghost cities are facing now.

Some argue that the rapid construction of cities is just some points of a broader scale experiments. These cities are allowed to fail, and the failures are necessary and do not need immediate salvage. However, maintaining this type of experiments has enormous political importance. In America, when cities failed, people are more likely to just move away, like Detroit. But China is not a neo-liberal country, and a geopolitical strategy is going on intensely trying to develop the interior regions and relieve over-population. And indeed, Ordos has not stopped investing on new industries, trying to save the fruit.

In order to address this problem, the thesis starts from the reform

of economy, industry, and infrastructure, and then utilizes the opportunities to transform current city form and to revise the initial planning. As an urban designer and planner, this thesis focuses more on the physical framework under the social, political and economic rationale. China is continuously transforming itself on those political and social issues, but the spatial and physical strategies and planning yet need a new model for current slow-down situation. This new model of urbanism and the reversal of form-based planning principles are expected to guide the next generation of master-plans or master-plan revisions for Chinese cities.

APPENDIX
ILLUSTRATION CREDITS

TITLE PAGE: Photo by Author

00 RISE OF GHOST CITIES

COVER : Photo by Feng Shen
FIG 0-1: Drawn by Author, Data Source: Beijing City Lab
FIG 0-2: Drawn by Author, Data Source: The Chinese Real Estate Information Corporatio
FIG 0-3: Source: The Chinese Real Estate Information Corporation
FIG 0-4: Source: The New York Times, CNN, The Wall Street Journal, Reuters
FIG 0-5: Drawn by Author, Source: Google Earth
FIG 0-6: "Chasing Ghosts: Where Is China's next Wave of Empty 'New Towns'?" South China Morning Post. http://multimedia.scmp.com/china-ghost-towns/.

01 THE FAILED UTOPIA

COVER: http://www.panoramio.com/photo/90405617;
FIG 1-1: Drawn by Author, Source: Google Earth
FIG 1-2: Drawn by Author, Data Source: Ordos Yearbook
FIG 1-3: Photo by Author
FIG 1-4: Drawn by Author, Data Source: US Geological Survey
FIG 1-5: Drawn by Author, Data Source: Yearbook of Shanghai and Ordos
FIG 1-6~8: Photo by Author
FIG 1-9: 1,2-http://hhht.house.sina.com.cn/zhuanti/hhhtjtx52/; 3-Photo by Author
FIG 1-10: Photo by Author
FIG 1-11: http://movingcities.org/wordpress/wp-content/photos/arch_public/090101-PP09-ORDOS100_09-10.jpg
FIG 1-12: Photo by Author

02 AN ECONOMIC PERSPECTIVE

COVER: http://fabiusmaximus.com/2013/03/17/china-real-estate-bubble-49461/
FIG 2-1: Drawn by Author
FIG 2-2: Source: http://www.voxeu.org/article/china-s-housing-bubble-new-evidence

FIG 2-3: Drawn by Author, Source: Li Xiuting and others (2014); CEIC; Nomura International Economic Research Department
FIG 2-4: Source: Catalogtree
FIG 2-5: http://www.tuwenba.com/content/MDE5MTI1M1zAx.html
FIG 2-6: Source: Peterson Institute for International Economics
FIG 2-7: Graphic by Bloomberg Business Week, Data Source: New York Mercantile Exchange, Intercontinentalexchange
FIG 2-8: www. Economicshelp.org, Data Source: World Bank
FIG 2-9: Drawn by Author

03 A MASTER-PLANNED CITY

COVER: Ordos Planning Bureau, http://www.ordosgh.gov.cn/ghzss/ztgh/201005/t20100525_186923.html
FIG3-1~3: Drawn by Author
FIG3-4: Drawn by Author, Source: Google Earth
FIG3-5: Drawn by Author, Data Source: henan.sina.com.cn
FIG3-6: Drawn by Author
FIG3-7: Drawn by Author

04 REVITALIZATION STRATEGIES

COVER: http://www.ciber.com.br/en/noticias-y-eventos/press-releases/press_release_5141.html
FIG4-1: Drawn by Author, Data Source: http://www.ordostj.gov.cn/
FIG4-2: Drawn by Author, Source: 邬娜，傅泽强，沈鹏，高宝，and 谢园园. “煤炭资源富集区循环经济发展模式探讨——以内蒙古鄂尔多斯市为例.” 2012 中国环境科学学会学术年会论文集 (第一卷) (2012).
FIG4-3: Drawn by Author
FIG4-4: Source: Digital Power Group
FIG4-5: Source: Mills, Mark P. “The Cloud Begins With Coal.” (2013).
FIG4-6: Drawn by Author
FIG4-7: Drawn by Author, Source: Tongji Urban Planning and Design Institute
FIG4-8: Drawn by Author, Source: Tongji Urban Planning and

Design Institute
FIG4-9~14: Drawn by Author
FIG4-15: Designed by Author
FIG4-16: Drawn by Author, Source: Tongji Urban Planning and Design Institute
FIG4-17: Drawn by Author, Data Source: Harvard China Map
FIG4-18: Drawn by Author

05 NEW CITY FORMS

COVER: Drawn by Author
FIG5-1~4: Drawn by Author
FIG5-5~7: Drawn by Author, thanks to Qiuying Sun
FIG5-8: http://opinionator.blogs.nytimes.com/2012/08/31/facebook-plays-it-safe/?_r=0
FIG5-9: Drawn by Author, thanks to Qiuying Sun
FIG5-10: Drawn by Author
FIG5-11: Drawn by Author, Source: Google Earth
FIG5-12~16: Drawn by Author
FIG5-17: Drawn by Author, thanks to Xuanyi Nie and Yinjia Gong

06 PILOT AREA

COVER: Drawn by Author
FIG6-1~4: Drawn by Author
FIG6-5: Drawn by Author, thanks to Jie Zhang
FIG6-6~11: Drawn by Author
FIG6-12: Source: Baidu Map
FIG6-13: Drawn by Author, thanks to Tengjia Liu
FIG6-14: Source: Baidu Map
FIG6-15: Drawn by Author, thanks to Tengjia Liu

APPENDIX
BIBLIOGRAPHY

Ai, Weiwei. *Ordos 100*. Documentary, 2012.

Aureli, Pier Vittorio. *The possibility of an absolute architecture*. MIT press, 2011.

Berghauser Pont, Meta, and Per Haupt. "*Spacematrix: Space, density and urban form*." Rotterdam: Nai Publishers (2010).

Bhatia, Neeraj, and Mary Casper. *The Petropolis of Tomorrow*. Actar, 2013.

Busquets, Joan, and Felipe Correa. *Catalunya Continental: Rail Infrastructure as the Backbone of Development*. Harvard University, Graduate School of Design, 2008.

Correa, Felipe, and Carlos Garciavelez Alfaro. *Mexico City: Between Geometry and Geography = Entre Geometría Y Geografía*. First edition. Novato, CA: Applied Research and Design Publishing, 2014.

Farr, Douglas. *Sustainable urbanism: urban design with nature*. John Wiley & Sons, 2012.

Heckmann, Oliver, and Friederike Schneider, eds. *Floor Plan Manual Housing*. 4th, rev. and expanded ed: Birkhauser, 2011.

Internationale, Bauausstellung Emscher Park GmbH. *International Building Exhibition Emscher Park: The Projects 10*

Years Later. Edited by Angela Uttke. Essen: Klartext, 2008.

Kapp, Paul Hardin, and Paul J. Armstrong, eds. *SynergiCity: Reinventing the postindustrial city.* University of Illinois Press, 2012.

Li, Si-ming. "China's Housing Reform and Outcomes." *Housing Studies 27*, no. 8 (2012): 1213-1214.

Li, Haifeng. "Energizing Strategy In New City Urban Design: Jiading Case" *Planners 28*, no. z1 (2012).

Liu, Yuyang. "East Village Dialogues-Re-conceptualizing and Strategizing the New Town Model" *Time+Architecture*, no. 5 (2011)

Moretti, Enrico. *The new geography of jobs*. Houghton Mifflin Harcourt, 2012.

MING, BEN SHE YI. *2013 Statistical Yearbook of Ordos(Chinese Edition) : 2013 E ER DUO SI TONG JI NIAN JIAN.*

Ryan, Brent D. "Incomplete and incremental plan implementation in Downtown Providence, Rhode Island, 1960-2000." *Journal of Planning History 5*, no. 1 (2006): 35-64.

Ryan, Brent D. *Design after decline: how America rebuilds shrinking cities*. University of Pennsylvania Press, 2012.

Ryan, Brent D. "Rightsizing Shrinking Cities: The Urban Design Dimension."*The City After Abandonment* (2012): 268-88.

Schenk, Leonhard, and David Koralek. *Designing cities: basics, principles, projects*. Birkhäuser, 2013.

Smith, Adam, and Ting Song. *The Land of Many Palaces*. Documentary, 2015.

Van der Ryn, Sim, and Peter Calthorpe. *Sustainable Communities a New Design Synthesis for Cities, Suburbs and Towns*. San Francisco : Sierra Club Books, 1986.

Wang, Zhijun. *Research on the Spatial Structures and Morphological Types of Shanghai's "one City and Nine Towns"*, 2007

Xue, Charlie QL, Ying Wang, and Luther Tsai. "Building new towns in China–A case study of Zhengdong New District." *Cities 30* (2013)

WEBSITES

"How Dirty Is Your Data?" Greenpeace International. Accessed December 8, 2014. http://www.greenpeace.org/international/en/publications/reports/How-dirty-is-your-data/

"How to Bring China's Ghost Towns Back to Life." ArchDaily. http://www.archdaily.com/425651/how-to-bring-china-s-ghost-towns-back-to-life/.

Wikipedia, the Free Encyclopedia, https://www.wikipedia.org/