

TOD Urban Integration, Community and Value Creation Challenges and Opportunities in China

通过TOD实现天津城市一体化发展及社区和价值创造

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TOD urban integration and value creation leads to communities and better places for people to live and work TOD城市一体化和价值创造带来社区发展、为人们生活和工作提供更好的场所

King’s Cross Central in London 1000 m of canal side and 0.8 ha of natural parkland

London King’s Cross Central

TOD urban forms are dense, accessible, mixed use and adaptive
TOD城市形态：较高密度、可达、土地混合使用和灵活性强

Articulated density相互关联的密度

- Residential density matches with job density
- Human density matches with transit infrastructure capacity
- High gross built density
- High density of amenities

Accessibility and proximity可达性和接近度

- Each part of the city is easily accessible
- Easy access to public transit infrastructures
- Seamlessly interconnected transit infrastructures
- Daily amenities accessible by foot (shops, health, education, culture, sport)
- Intense street network (high number of intersections per km^2)

Mixed use and adaptive土地混合利用和灵活性

- Jobs, housing and retail are mixed on the city, district, community and building scale
- Land use is highly flexible

TOD Checklist of Essential Features

TOD基本特征对照表

- Medium to high densities中到高密度
- Fine-grained mix of land uses细密的土地利用
- Short to medium-length blocks到中等大小街区距离短
- Transit routes every 800 meters or closer每隔800米或更近距离就有捷运路线
- Two to four-lane streets (with rare exceptions)街道两至四车道（少有例外）
- Continuous sidewalk appropriately scaled人行道连续、比例适当
- Safe crossings交叉口安全
- Appropriate buffering from traffic与行驶车辆间有适当缓冲
- Street-oriented buildings街道主导的建筑
- Comfortable and safe places to wait 有舒适、安全的等待区

TOD Checklist

of Highly Desirable Features

TOD高满意度特征

- Landmarks地标
- Supportive commercial uses支持性商业开发
- Grid-like street networks网格状街道
- Traffic calming交通静化
- Closely spaced shade trees密树成荫
- - Little dead space少有死角
- Nearby parks and other public spaces附近有公园及其它公共场地

- Small-scale buildings (or articulated larger ones)小规模建筑群（或相互关联的大型建筑群）
- Pedestrian scale lighting步行标度照明
- Attractive transit facilities有吸引力的公交设施

TOD Checklist of Worthwhile Additions
TOD值得增加的特征

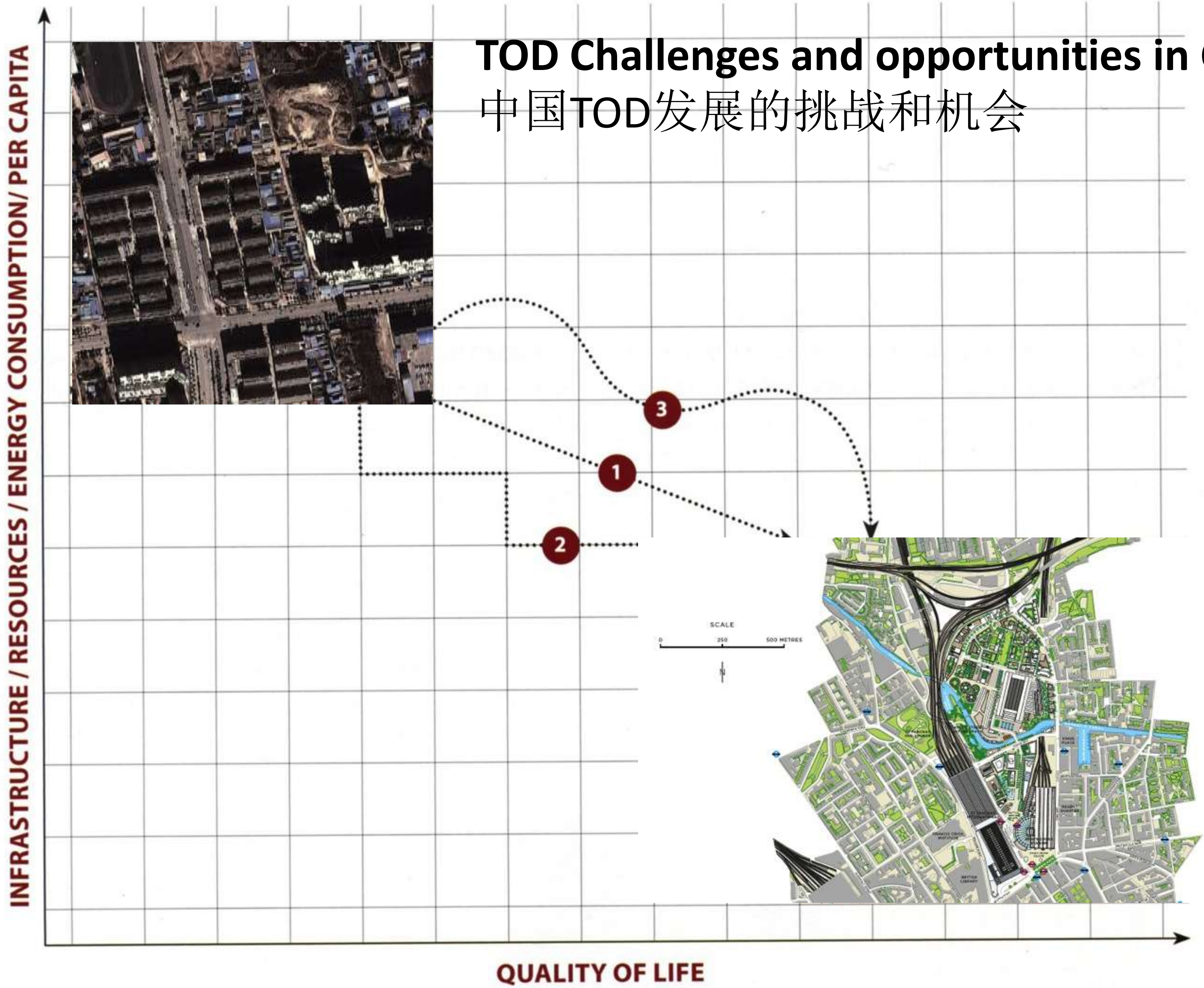
- Street walls街墙
- Functional street furniture街道功能设施
- Coherent small-scale signage 连续一致的小型标识
- Special pavement别致的人行道
- Public Art公共艺术
- Water features水景设计
- Outdoor dining户外进餐
- Underground utilities地下设施

TOD Challenges and Opportunies in China
中国TOD发展的挑战和机会

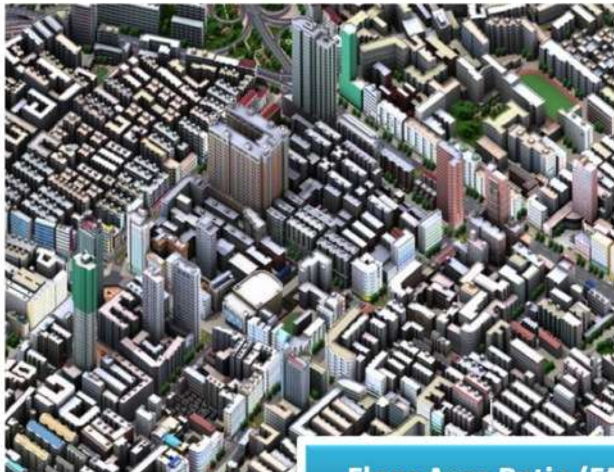
Reducing Infrastructure, Resources, Energy Consumption per Capita, while enhancing Quality of Life and Creating Communities在提高生活质量和建设社区的同时，减少基础设施、水资源、能源的人均消耗

1. Increase Densities around Transit Hubs增加公交枢纽周围的密度
2. Shift from Superblocks to Small Blocks从大型街区向小型街区转变
3. Develop Finer, More Connected and Longer Street Networks开发更细致、联通性更好、更长的街道网络
4. Increase Walkable Accessibility提高步行可达性
5. Increase Mixed use, Variety and Flexibility提高土地混合使用程度、多样性和灵活性
6. Develop Integrated Synergy Planning

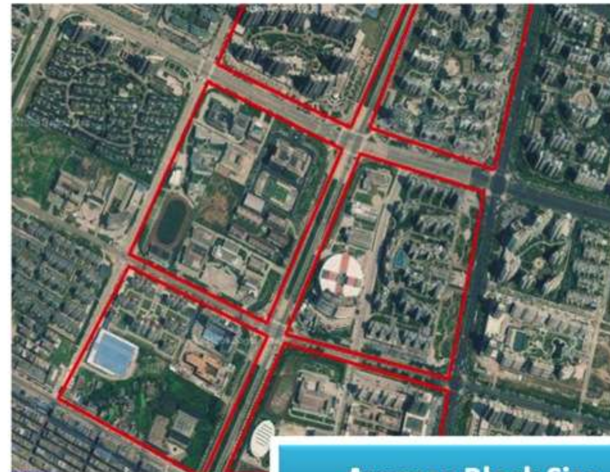
TOD Challenges and opportunities in China
中国TOD发展的挑战和机会



Resetting index values 重新设定指标值



Floor Area Ratio (FAR)



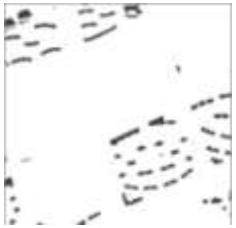
Average Block Size

Road Network Density

Traffic Signal Cycle

1.Increase Densities along transit lines
提高沿公交线路的密度

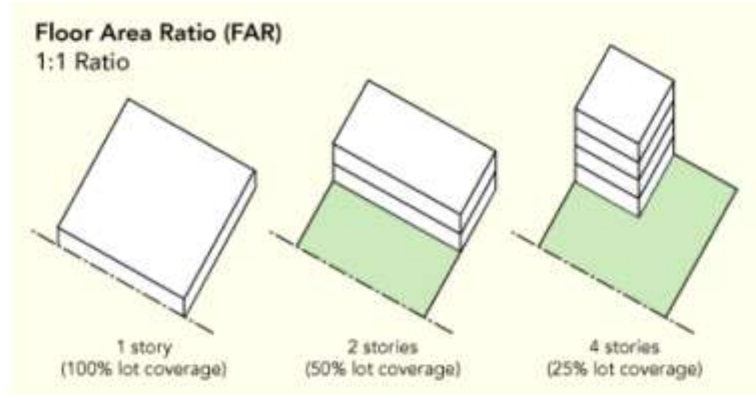
When seeing at 800mx800m scale in Pudong, huge non built-up areas appear, because of the large scale infrastructures associated with the large scale buildings: highways, large setbacks, parking space. The building footprint falls to 14% of the area, and gross urban density is only 1.2, compared to the gross urban density of 1.9 in Puxi where low-rise housing dominates.

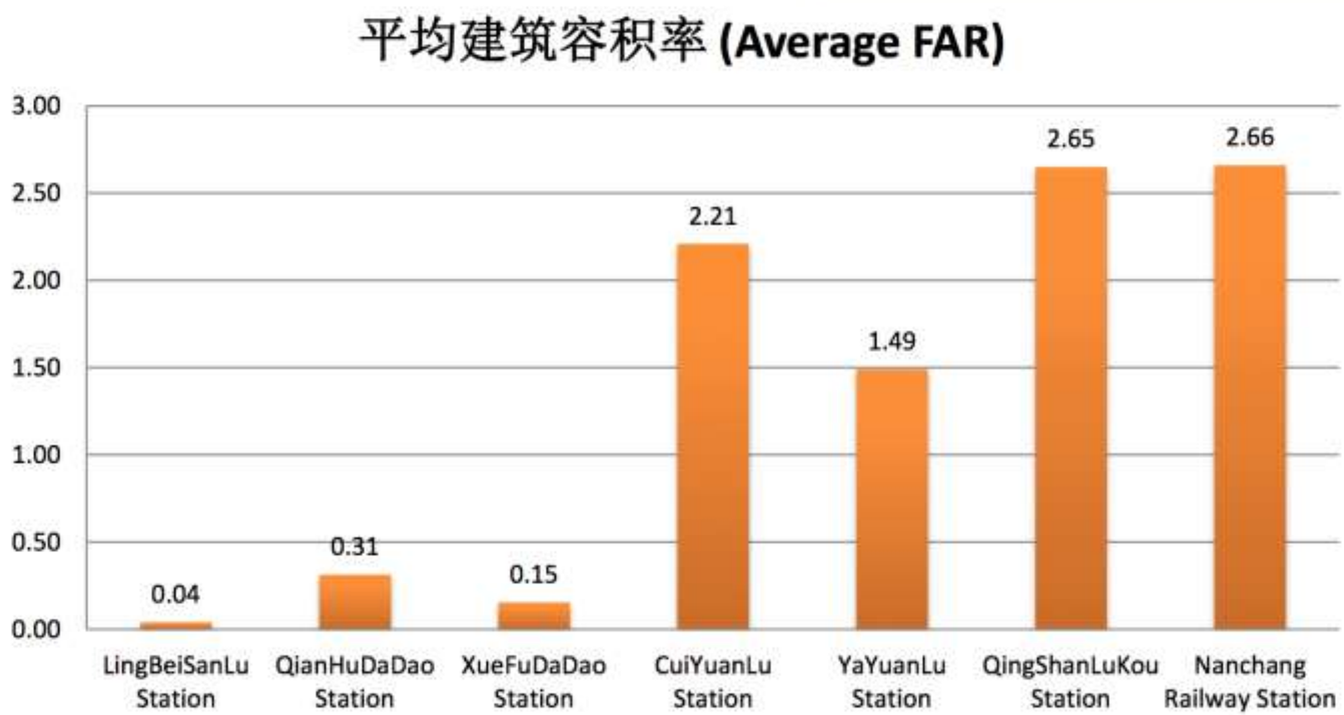


	浦西虹口 Puxi HongKou	浦东陆家嘴 Pudong
建筑类型 Building type	低层住宅为主 Low rise housing	高楼为主 High rise
建筑物占地率 Coverage ratio	53%	14%
容积率 Floor area ratio	1.9	1.2

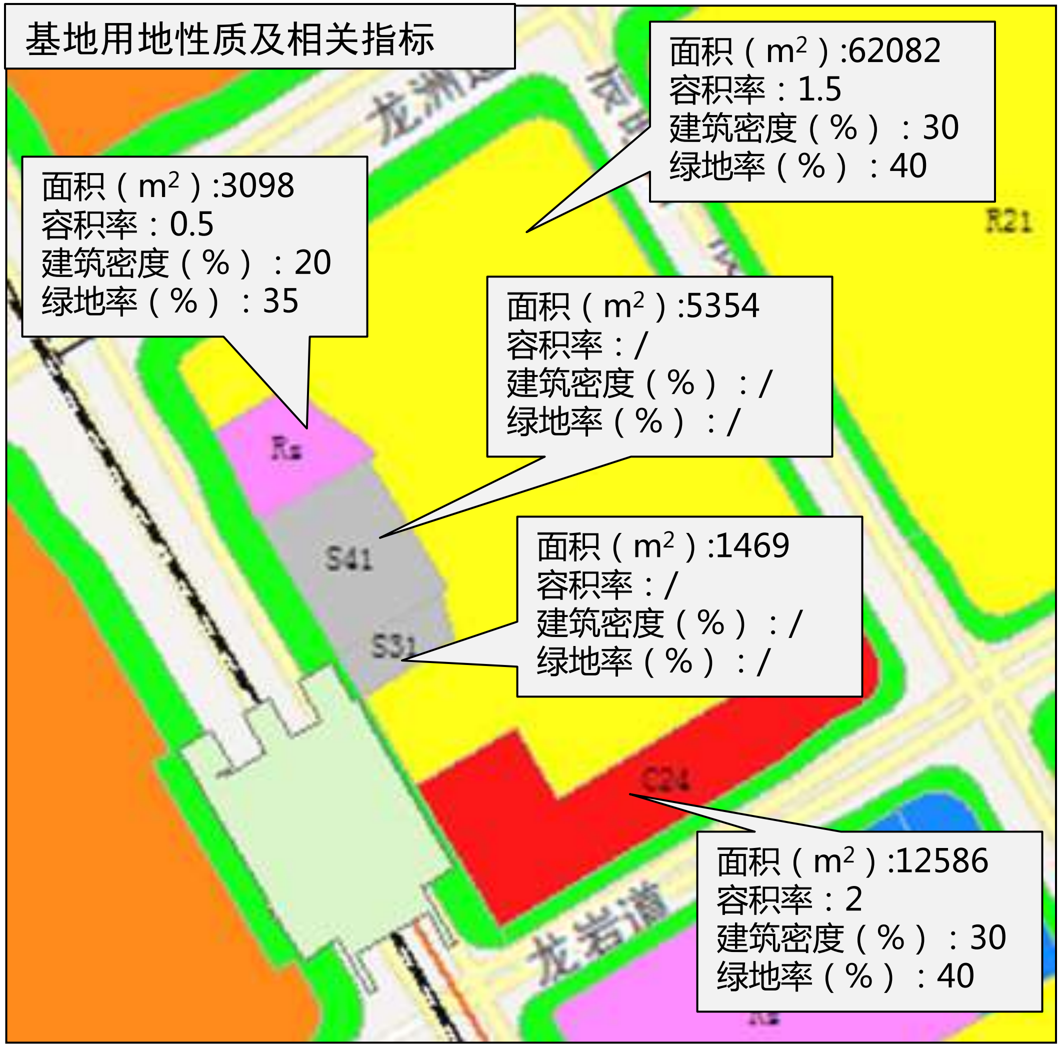
Floor Area Ratio (FAR)

- FAR has a major impact on the value of the land. Higher allowable FAR yields higher land value.
- Higher FAR also brings higher population/job density.





Average FAR around Nanchang subway stations
Source: The World Bank



Low FAR: 0.5, 1.5, 2

Low coverage ratio: 20, 30, 30 %

No public space

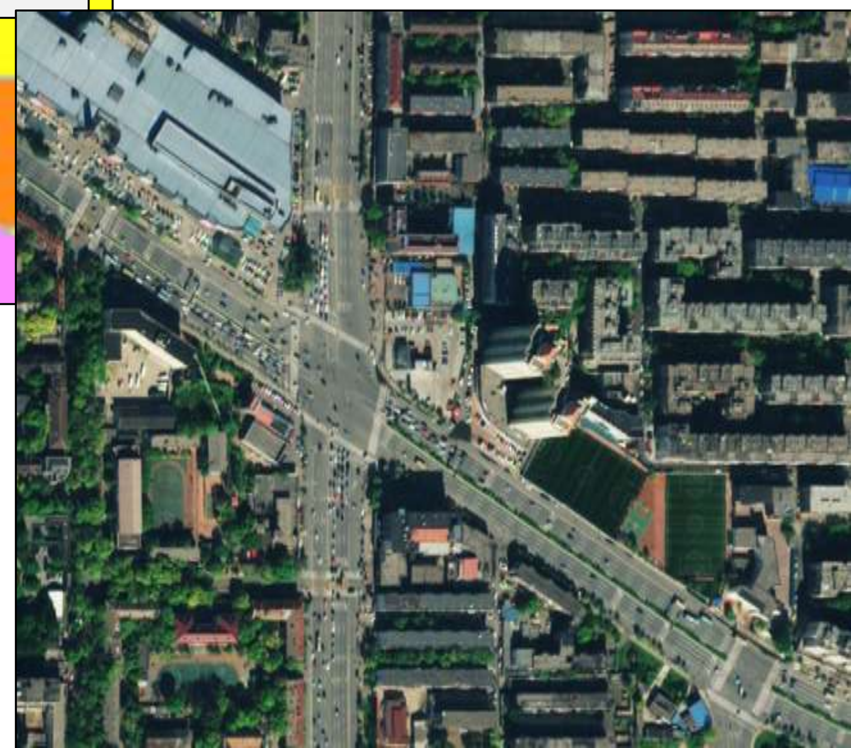
Higher FAR and coverage only in Golden Triangle

Tianjin Liu Yuan Station and Golden Triangle FAR

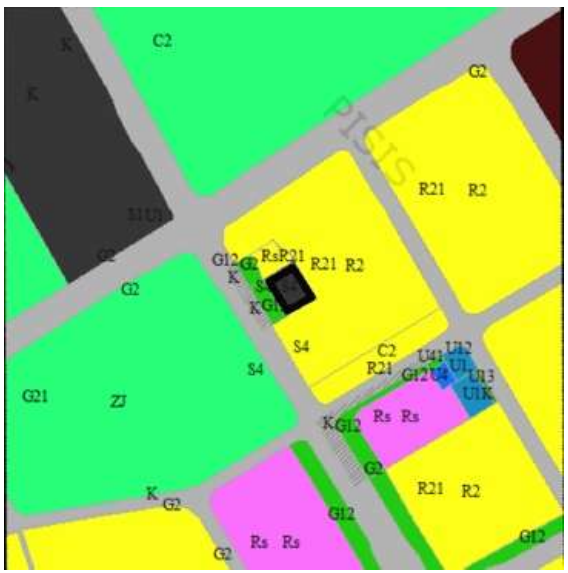
Medium FAR and low coverage ends up in inefficient urban forms lacking density, integration and variety

Tianjin Tu Cheng Station FAR

Wide roads and setbacks are further barriers to connectivity



2. Shift from Superblocks to Small Blocks从大型街区转变为小型街区

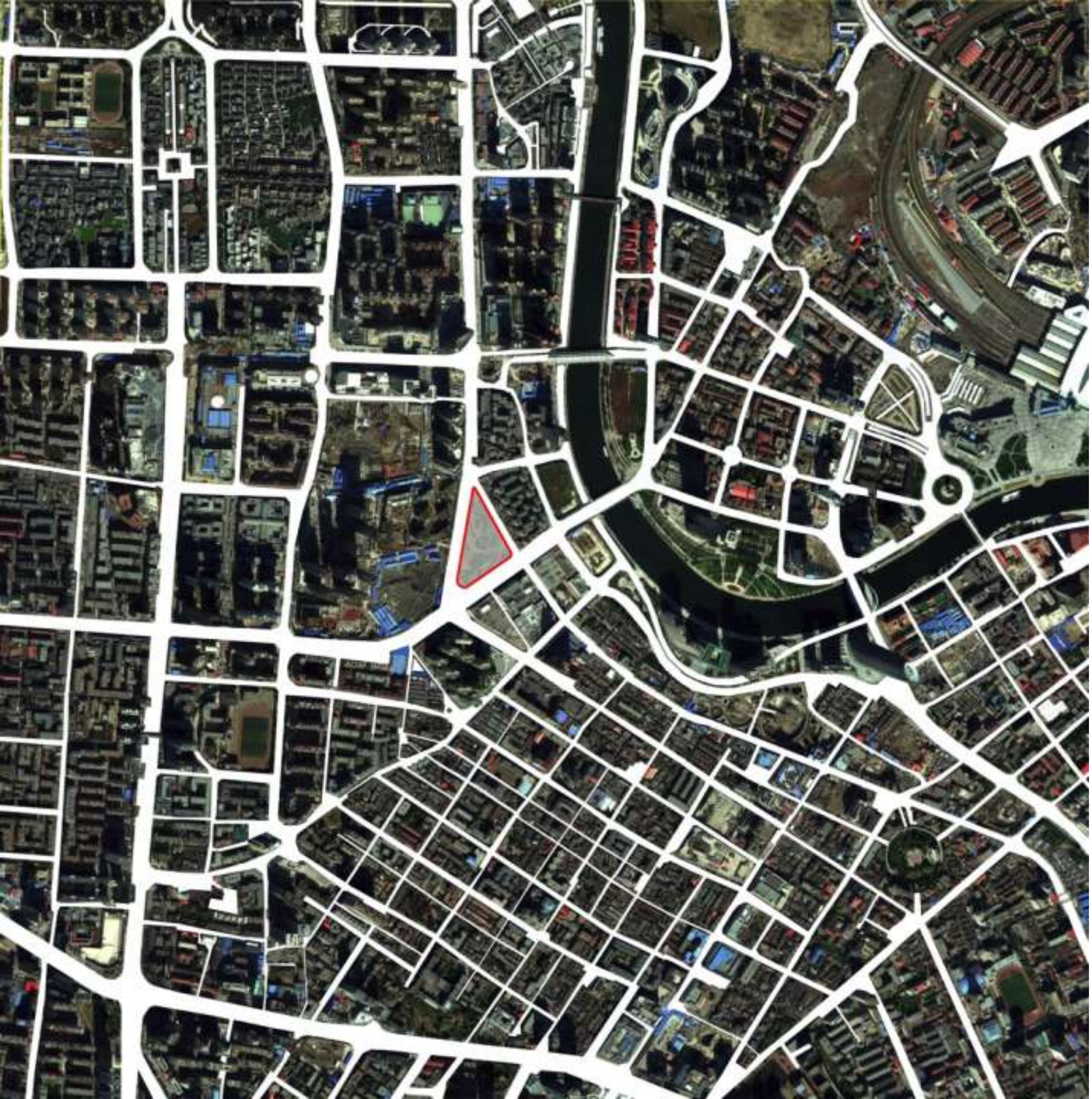


At the same scale in a square 1 km side:
Left: London King’s Cross,
Right: Tianjin stations 1. Liu Yuan, 2. Golden Triangle, 3. Tu Cheng

Tianjin
Liu Yuan
Station

3 km
X3 km

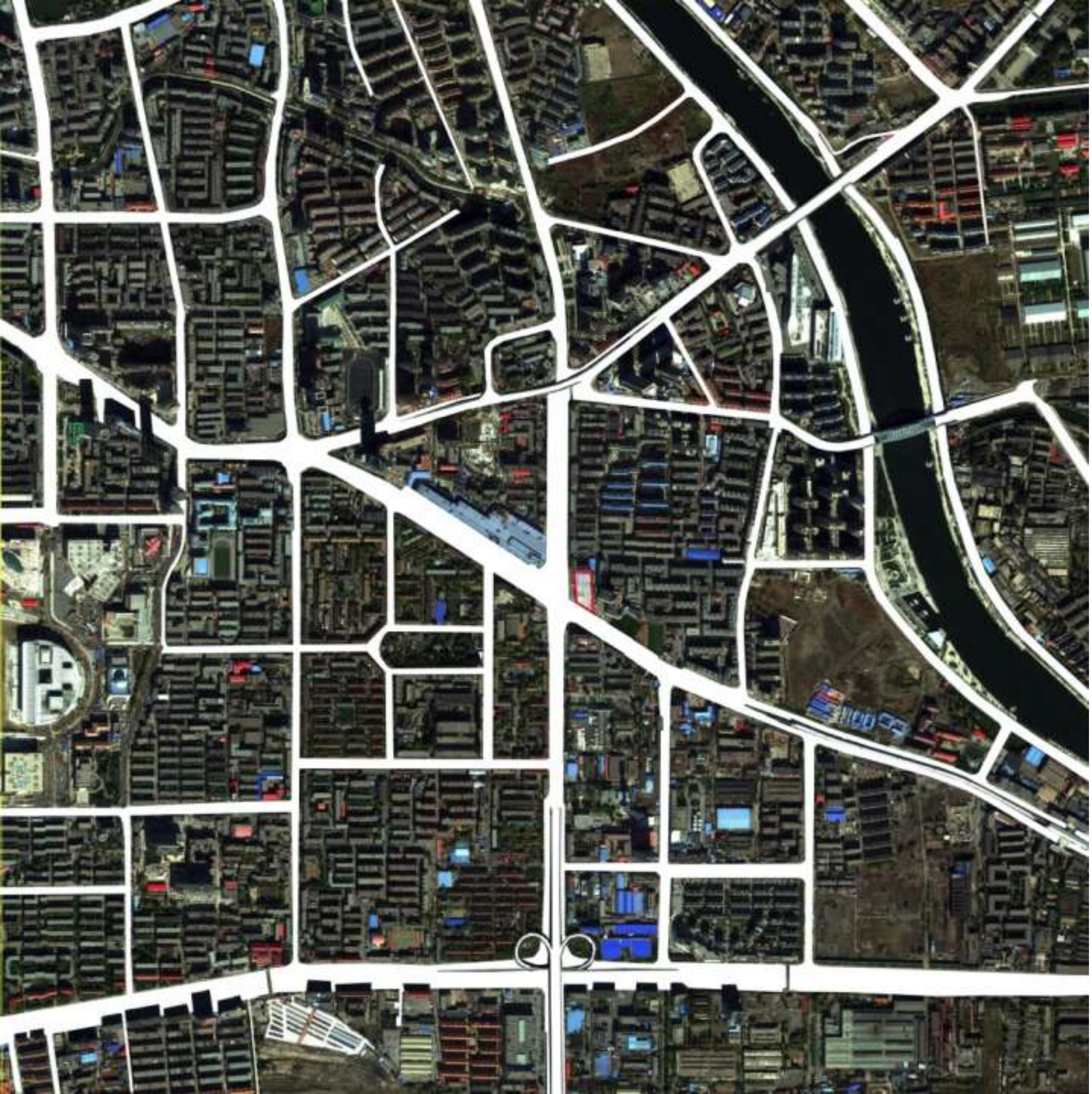
Source: Urban
Morphology Institute



Tianjin
Golden
Triangle
Station

3 km
X3 km

Source: Urban
Morphology Institute



Tianjin
Tu Cheng
Station

3 km
X3 km

Source: Urban Morphology Institute

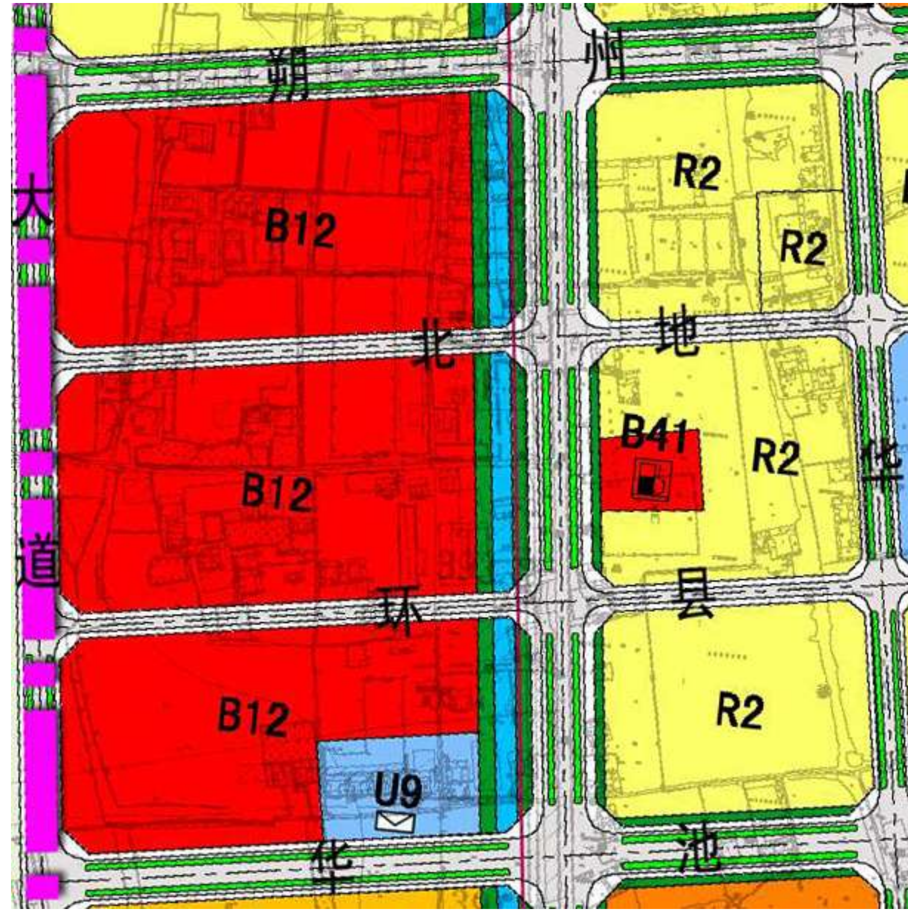
1 square mile Source: Urban Morphology Institute

Paris / Tianjin Liu Yuan station

Lower Manhattan /Tianjin Golden Triangle station

Manhattan /Tianjin Tu Cheng station

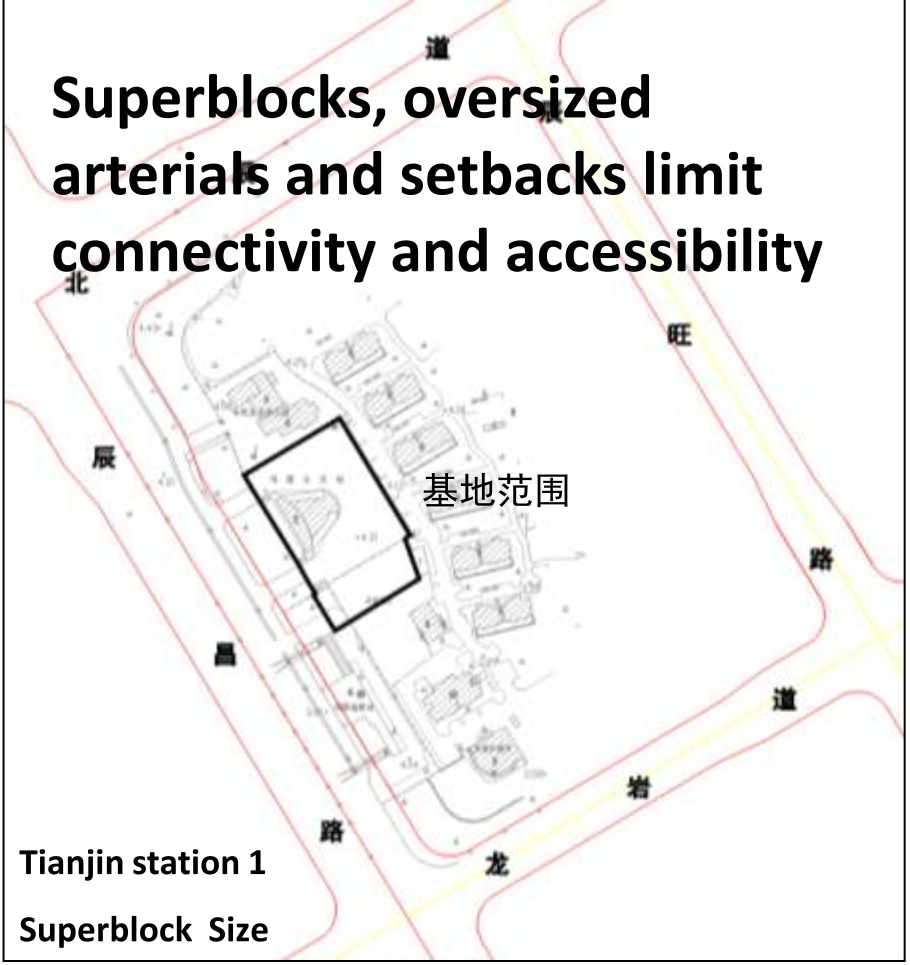
Superblocks lead to a collapse of FAR, of connectivity and of linear density of streets



Manhattan (selection of 800 m side)
120 intersections / km2
Density of blocks= 90/km2
Average distance between intersections=120 m
Linear density of streets = 18 km /km2

Qingyang (selection of 800 m side)
18 intersections /km2
Density of blocks= 8 to 12/km2
Average distance between intersections=400 m
Linear density of streets =4 to 7 km / km 2

Superblocks, oversized arterials and setbacks limit connectivity and accessibility



Tianjin station 1

Superblock Size

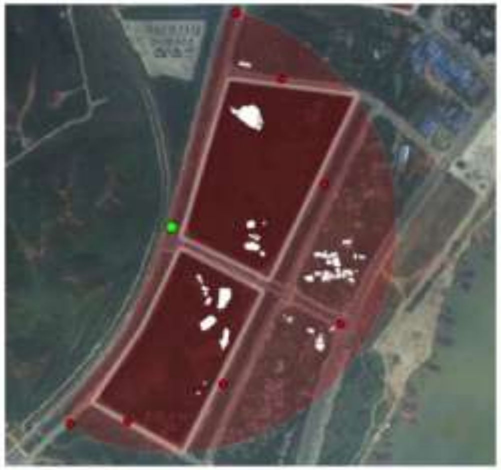
350 m x 480 m = 168 000 m2 (bigger than Nanchang)

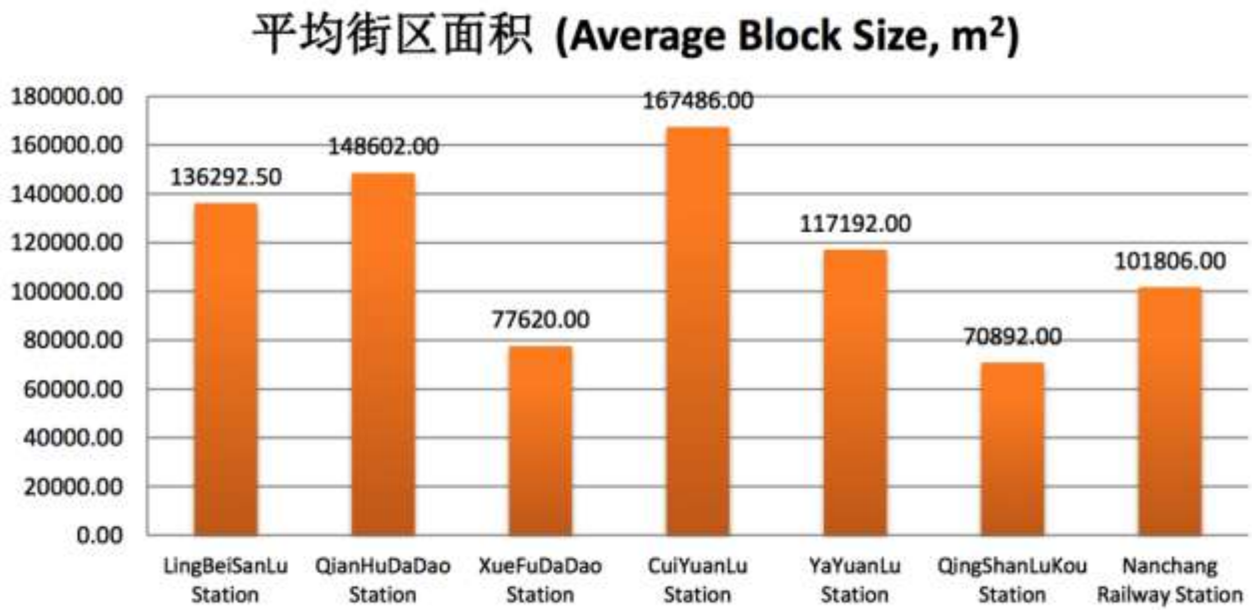
Planning of roads

Distributors, red line width of 60 meters + 20 m setback each side. Main trunk, red line width of 60 meters = 100 m with setback.

Secondary road, 30 meters wide red line = 50 m with setback

Average Block Size





Average block size in a 10 mn walk radius (800 m) in Nanchang / Source The World Bank

Average block size within 10 mn walk circle (800 m) in Tianjin

Tianjin Liu Yuan station

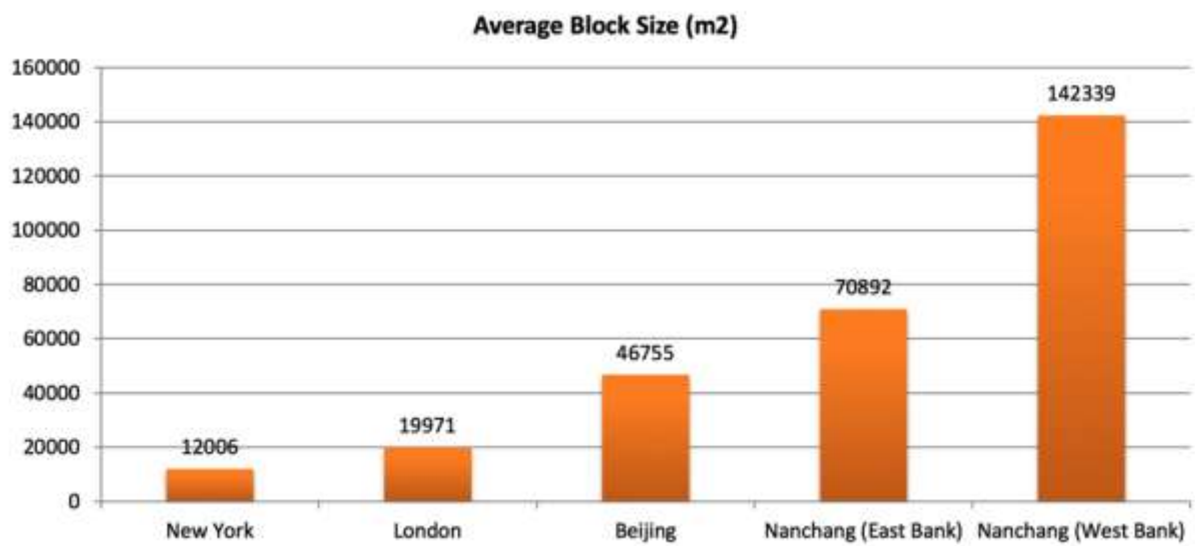
103 000 m2

Tianjin Golden Triangle station

25 400 m2

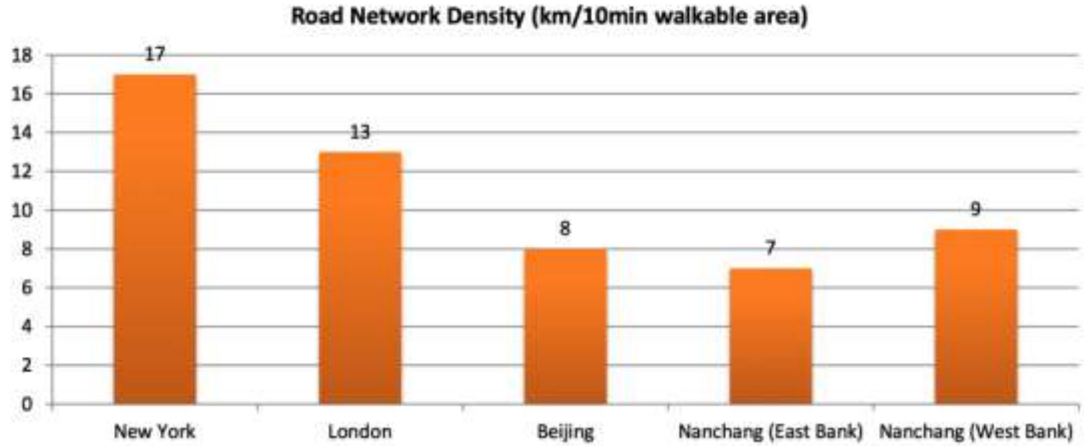
Tianjin Tu Cheng station

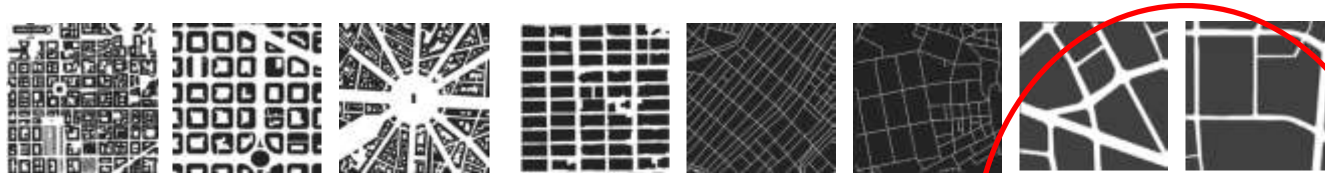
74 000 m2



Compariso
n
with other
cities

3. Develop Finer, More Connected and Longer Street Networks
开发更细致、联通性更好、更长的街道网络

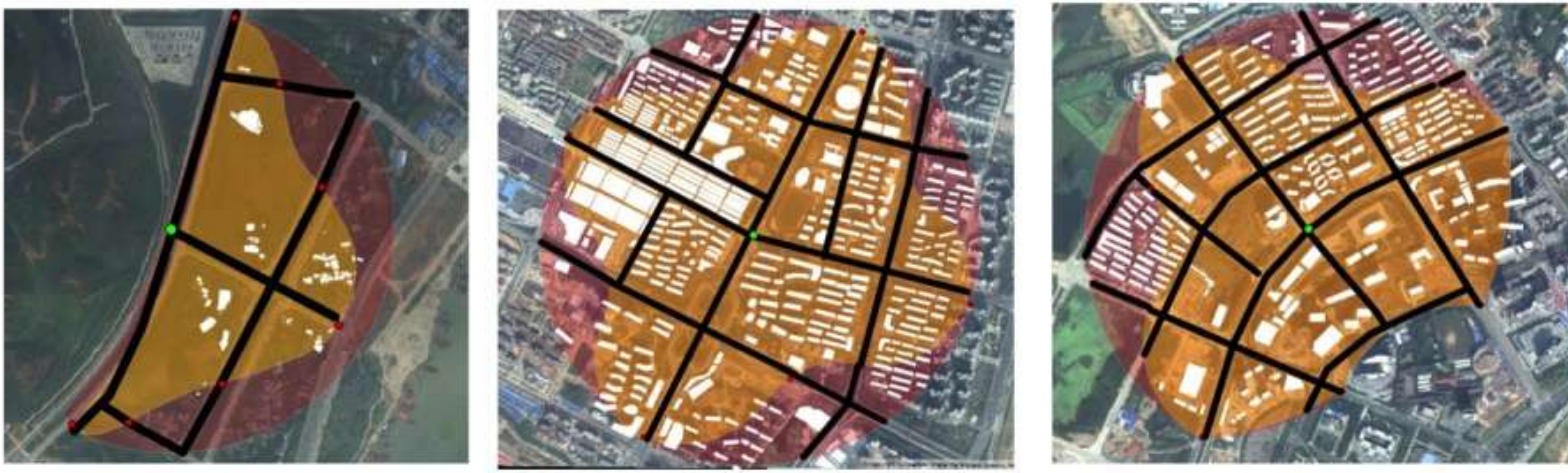


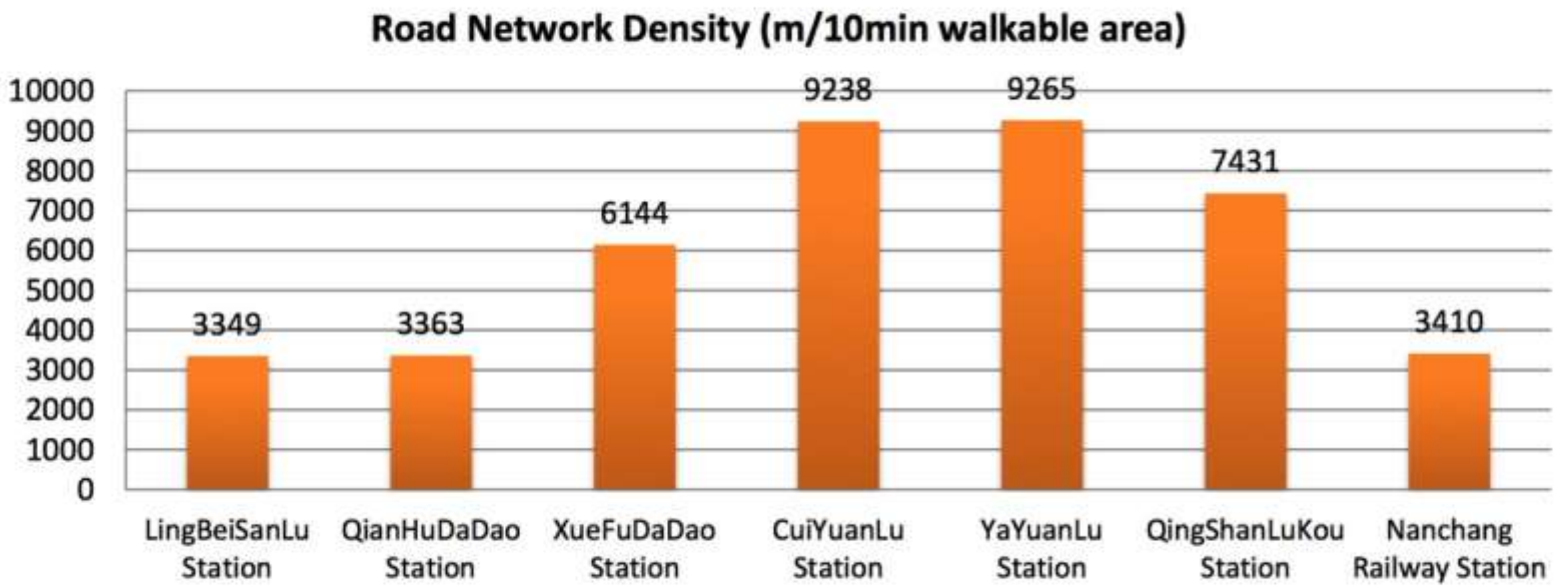


	图林 Torino	巴塞罗那 Barcelona	巴黎 Paris	曼哈顿 Manhattan	东京Ginza	东京 Shinjuku	上海浦东 Pudong	北京一例 Beijing
每平方公里连接口数 Number of intersections per km^2	152	103	133	120	211	111	**17**	**14**
连接口平均间距 Average distance between intersections (m)	80	130	150	120	43	50	**280**	**400**

Source: Serge Salat, *Cities and Forms*

Road Network Density





Nanchang road network density / source The World Bank

Tianjin road network density天津路网密度

inside 10 mn walk area (800 m radius) / Source: Urban Morphology Institute

Liu Yuan Station

Total length of streets: 8.75 km

4.4 km / km2

Number of blocks: 13

Average block surface: 103 300 m2

Golden triangle Station

Total length of streets: 22.5 km

11.2 km / km2

Number of blocks: 68

Average block surface: 25 400 m2

Tu Cheng Station

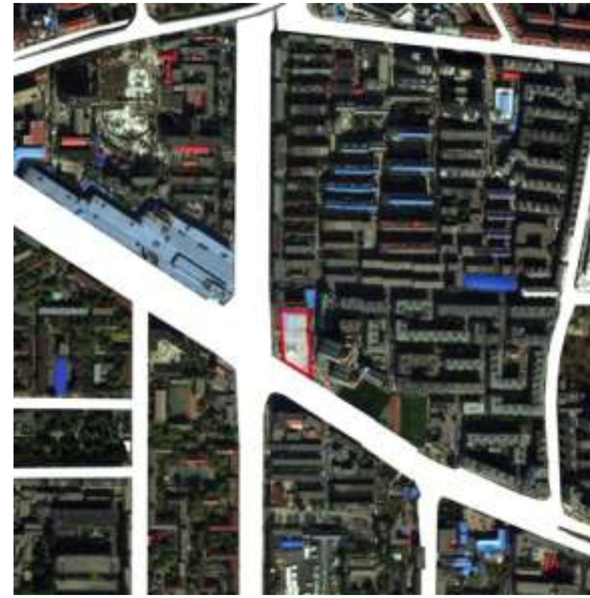
Total length of streets: 11.6 km

5.8 km / Km2

Number of blocks: 13

Average block surface: 74 250m2

4. Increase Walkable Accessibility



Liu Yuan Station Golden Triangle Station Tu Cheng Station

Tianjin stations existing land use on a selection **1 km side**

Source: Urban Morphology Institute

Superblocks limit accessibility

Tianjin Liu Yuan station

Tianjin Golden Triangle station

Tianjin Tu Cheng station

Red: accessibility at 200 m
Yellow: accessibility 400 m
Green: accessibility 800 m
Source: Urban Morphology Institute

Liu Yuan Accessibility analysis / Source ITDP

EXISTING PROBLEMS

1. No crossing 没有过街设施

2. Temporary pass 临时过街通道

3. Empty space 空地

4. Glass-covered footbridge with green house effect.
产生温室效应的天桥

Liu Yuan Accessibility existing problems / source:ITDP

King's Cross Central
In a square
1 km side

T intersections : 56
X Intersections : 23

Total number of intersections

T + X : 79

Number of links : 131

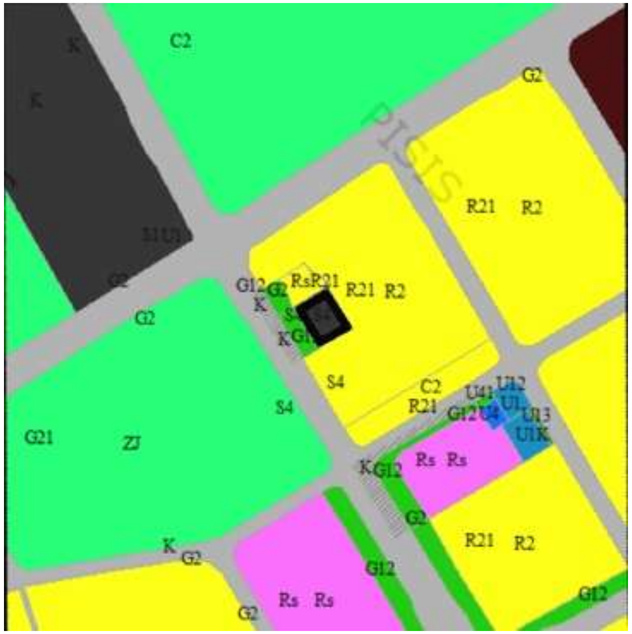
Number of blocks : 53

Total length of streets:

13,34 km

Are there enough new planned roads around Tianjin stations ?

Tianjin stations planned on a selection 1 km side



Liu Yuan Station

T intersections : 4

X Intersections : 3

Total nbr of intersections

T + X : 7

Number of links : 16

Number of blocks : 10

Total length of streets:

4.5 km

Golden Triangle Station

T intersections : 21

X Intersections : 27

Total nbr of intersections

T + X : 48

Number of links : 73

Number of blocks : 26

Total length of streets:

12.6 km

Tu Cheng Station

T intersections : 4

X Intersections : 5

Total nbr of intersections

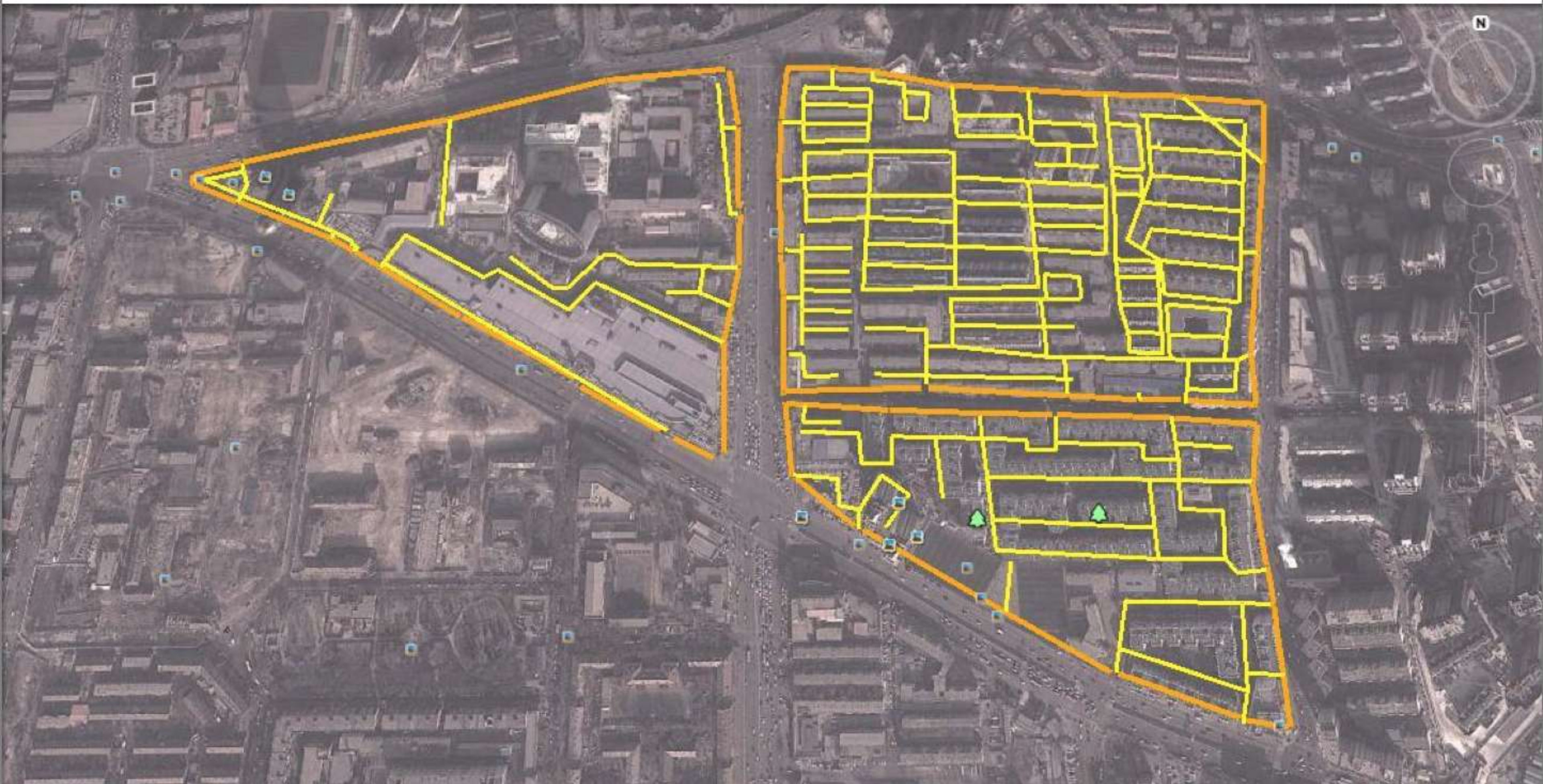
T + X : 9

Number of links : 14

Number of blocks : 6

Total length of streets:

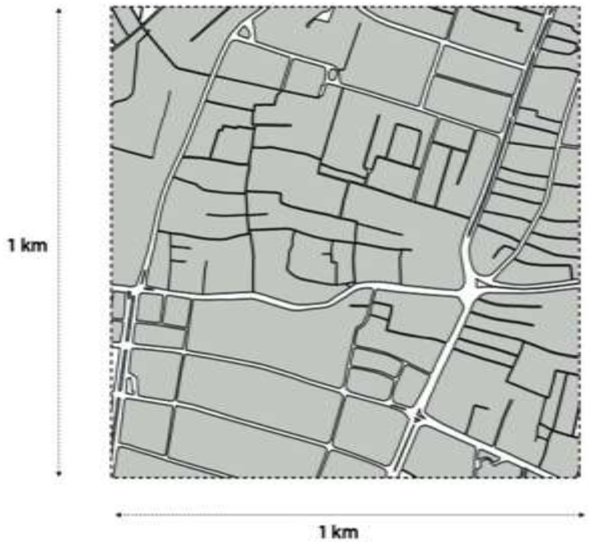
6.1 km



Disconnected private street patterns within superblocks do not connect to the public realm
Source: ITDP

Dense irregular street patterns increase accessibility

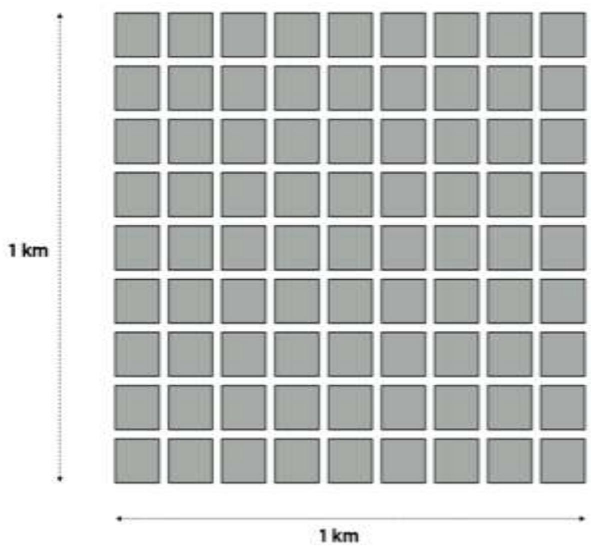
Surabaya case study / Source The World Bank and City Form Lab



BG Junction descriptive measures

- Total blocks: 95
- Total block area: 87.6 Ha.
- Total street area: 12.4 Ha.
- Total street length: 19 km.
- Average block side length: 69.2 m.
- Real intersections total: 152
- Dead ends: 18
- Real intersections by type:
  - 5 way or more intersections: 1
  - 4 way intersections: 22
  - 3 way intersections:120

Compared to a regular grid, a more complex street pattern develops more street length (+20%), shorter blocks (- 25%) and much more intersections (+ 130%)



Regular grid descriptive measures

- Total Blocks: 81
- Block length: 93.3.
- Total block area: 70,6 Ha.
- Street width: 20 m.
- Total street length 16 km
- Total street area: 29.4 has
- Real intersections total: 64
- Dead ends: 0
- Real intersections by type:
  - 4 way intersections: 64

Irregular dense street pattern

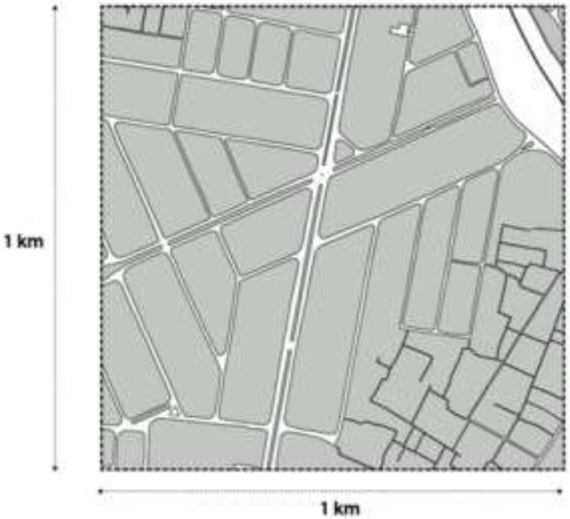
T+X = 152

Regular grid

T+X = 64

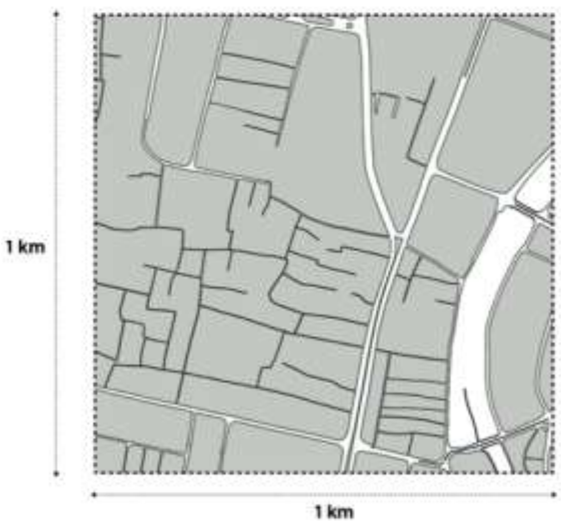
Dense irregular street patterns increase accessibility

Surabava case studv / Source The World Bank and City Form Lab



Darmo descriptive measures

- Total Blocks: 67
- Total block area: 83.5 Ha.
- Total street area: 13.5 Ha.
- Total river area: 3 Ha.
- Total street length: 16.9 km
- Average block side length: 85.2 m.
- Real intersections total: 92
- Dead ends: 5
- Real intersections by type:
  - 4 way intersections: 12
  - 3 way intersections:80



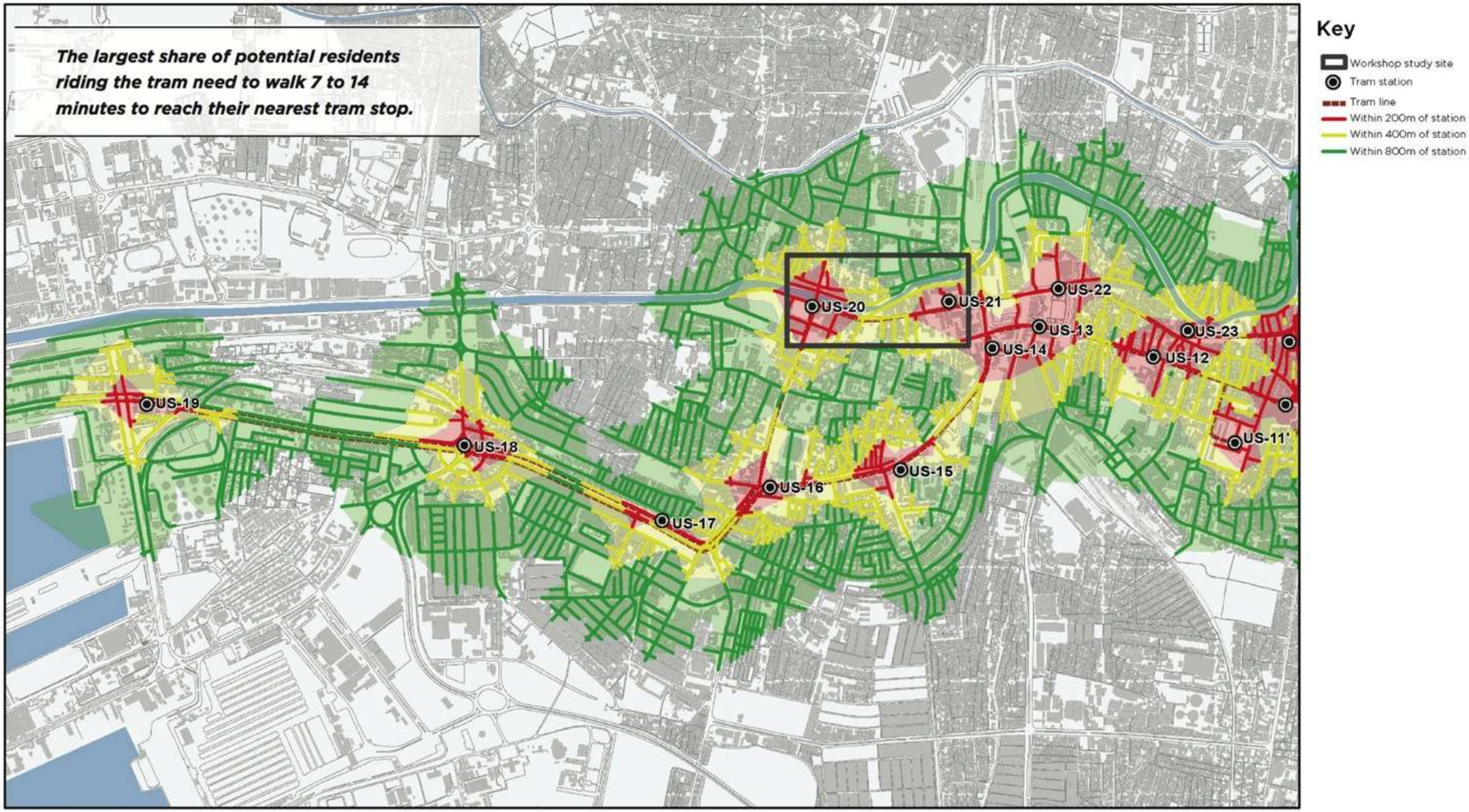
Keputran descriptive measures

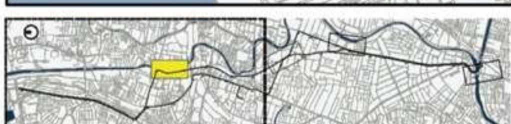
- Total Blocks: 57
- Total block area: 84.3 Ha.
- Total street area: 10.4 Ha.
- Total river area: 5.3
- Total street length: 16.3 km
- Average block side length: 94.5 m
- Real intersections total: 104
- Dead ends: 20
- Real intersections by type:
  - 5 way or more intersections: 1
  - 4 way intersections: 7
  - 3 way intersections: 96

Irregular Street Patterns With right average block length (85 and 95 m) and right density of intersections **(T + X = 92 and 104** per square km)

Dense irregular street patterns increase accessibility

Surabaya case study / Source The World Bank and City Form Lab





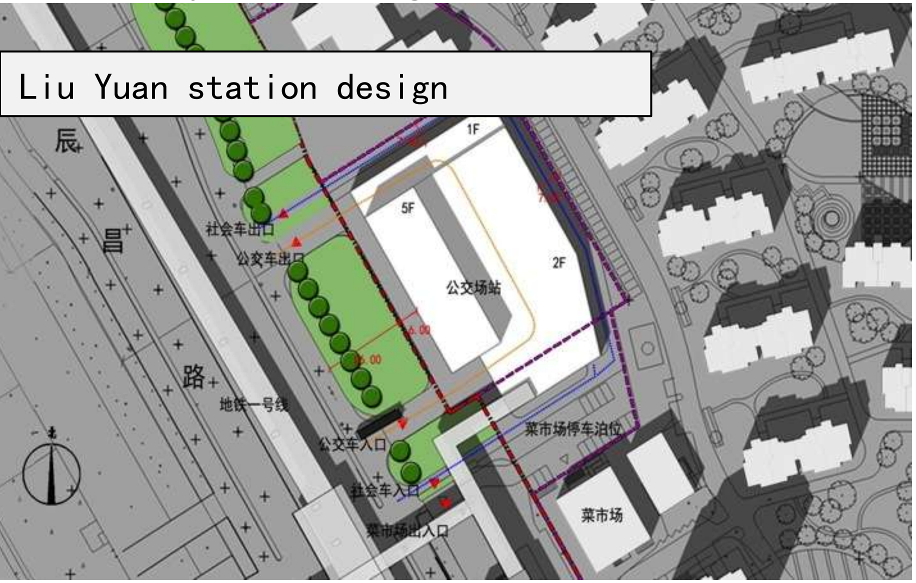
Dashed line box indicates area shown in map in relation to tramway's full extension

Yellow box shows areas studied during February 19-24, 2014 Workshop

5. Increase Mixed Use, Variety and Flexibility

增强土地混合利用、多样性和灵活性

Left: Tianjin Stations, Right: London King’s Cross Central

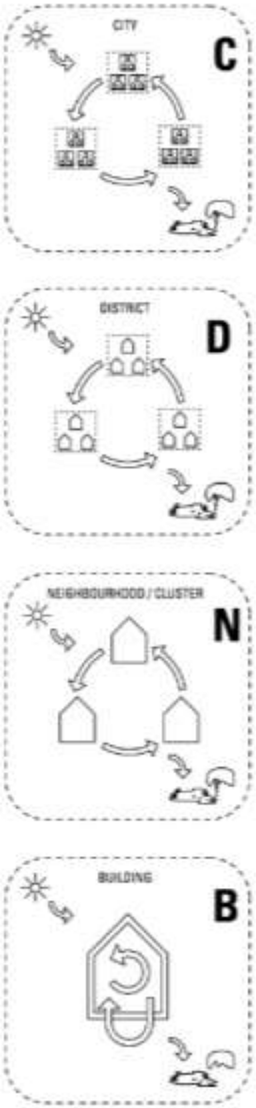


6.Develop Integrated Synergized Energy Planning

Most of the energy consumption is lost as non-functional waste energy. So the initial demand for useful energy can be reduced by more effective usage, such as by low-exergy strategies. Low exergy strategies consist in cascading and recycle energy flows according to their quality (electricity, mechanical, thermal) to improve the energy process overall. A key issue in improving the efficiency of urban energy systems is an optimal matching of various energy-demand categories with energy-conversion processes. This matching is usually achieved by exergy analysis. Exergy analysis considers quality differences in energy forms (which energy form is most adequate for delivering a particular task) and defines efficiency in relation to what thermodynamically represents an upper bond of energy conversion efficiency.

Mapping energy demand on the district scale allows quantifying the potential of low exergy strategies

Energy mix on the district scale (REAP)

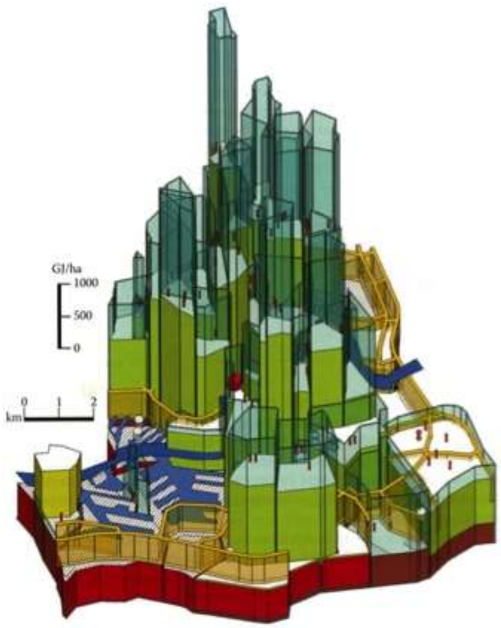


6.Develop Integrated Synergized Energy Planning

Heat mapping

The purpose of a heat mapping is to provide a geographical imprint of the various thermal sources and sinks as well as infrastructures in an area, showing the net energetic – or even better exergetic – balance and providing planners a catalogue by which to design a thermal energy plan.

Local industries, for example, may require higher temperatures than dwellings, and similarly the heat generated in green houses may not have a temperature high enough to heat a living room. Upgrading the generally ubiquitous low-temperature renewable heat to a (less available) higher temperature by means of a heat pump requires additional energy, whereas industries using high-temperature heat may have lower-temperature residual heat available to start a heat “cascade”. The resulting exergy distribution will thus make optimal use of the quality of valuable high temperature heat.



Energy potential map in Rotterdam (REAP)

6.Develop Integrated Synergized Energy Planning

Feasibility for a subway station district in a Chinese city

The Business as Usual (BAU) scenario is representative of the way transit-oriented development planning is typically done in China today. The Synergy scenario presents an alternative vision for local area development that includes district energy management. In the BAU scenario, each building has its own heating, cooling and ventilation (HVAC) system, and electricity is supplied from the grid.

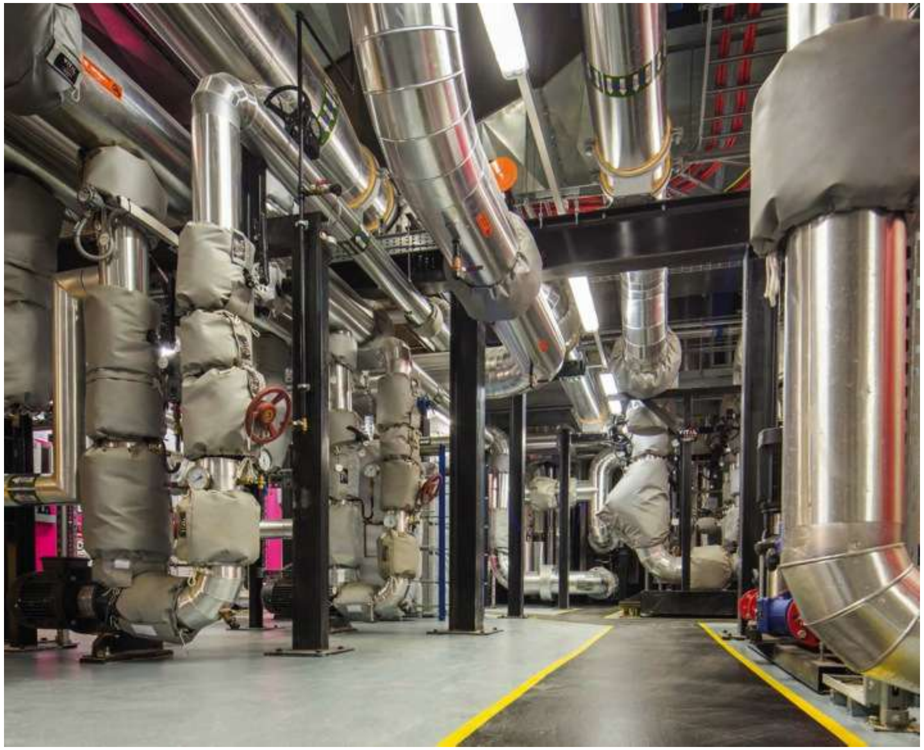
In the Synergy scenario, energy use in the district is optimized by means of:

- A District Cooling and Heating System (DCHS), which supplies hot and chilled water to the buildings in the district via a network of underground distribution pipes.
- A Smart Microgrid System, which complements the DCHS with a portfolio of smart energy technologies to further reduce energy costs.

	Description	Unit	BaU	Synergy	% Savings
Load	Cooling Demand	TR	49,669	44,953	9.50%
	Heating Demand	kW	88,818	77,373	12.90%
	Electrical Power Demand	kW	147,104	140,910	4.20%
CapEx	Heating & Cooling Equipment Cost	¥'0000	25,163	19,793	21.30%
	HVAC Plant Room Area	¥'0000	55,237	37,300	32.50%
OpEx	Demand Charge (¥/kW/yr)	¥'0000	10,592	10,145	4.20%
	Annual HVAC Operating Cost	¥'0000	13,170	9,724	26.20%
	Annual HVAC Water Consumption	¥'0000	443	323	27.20%
Total CapEx	Total Capital Expense	¥'0000	80,400	57,093	29.00%
Total OpEx	Total Operating Expense	¥'0000	24,205	20,192	26.20%

TSD Project, AECOM

6.Integrated Synergized Energy Planning in King's Cross Central



99%

of the development's heat demand is met from the on-site energy centre

79%

of the development's total power demand is offset by the CHP engines

Thank you for your attention

感谢諸位的時間

The World Bank seminar on TOD, Tianjin, June 2014

The World Bank