

Can Light Rail Benefit Job-Housing Relationships and Land Use-Transportation Integration in New Town? ——case study of Yizhuang in Beijing

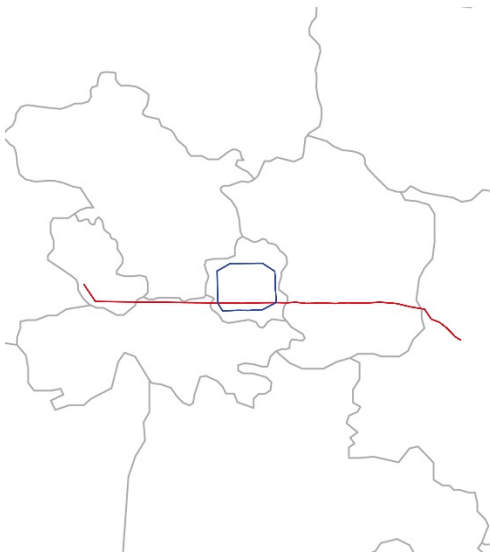
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USC Nov 10, 2016



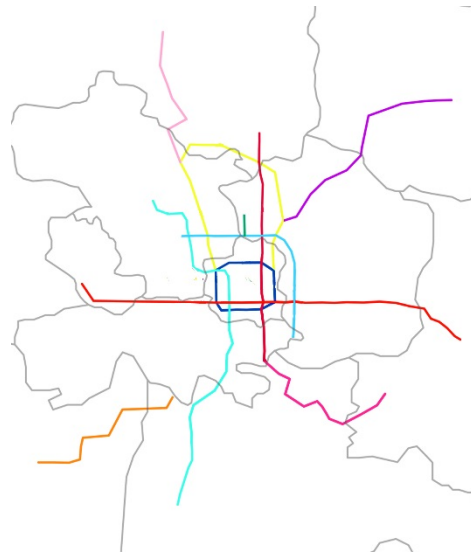
1.The Research Background

1.1 Beijing Urban Rail Transit bursty expansion

- After 2002 ,the Beijing urban metro construction suddenly accelerated, and firstly the northern part of Beijing which is more developed than southern part formed the urban metro network.



urban metro network 2000



urban metro network 2010

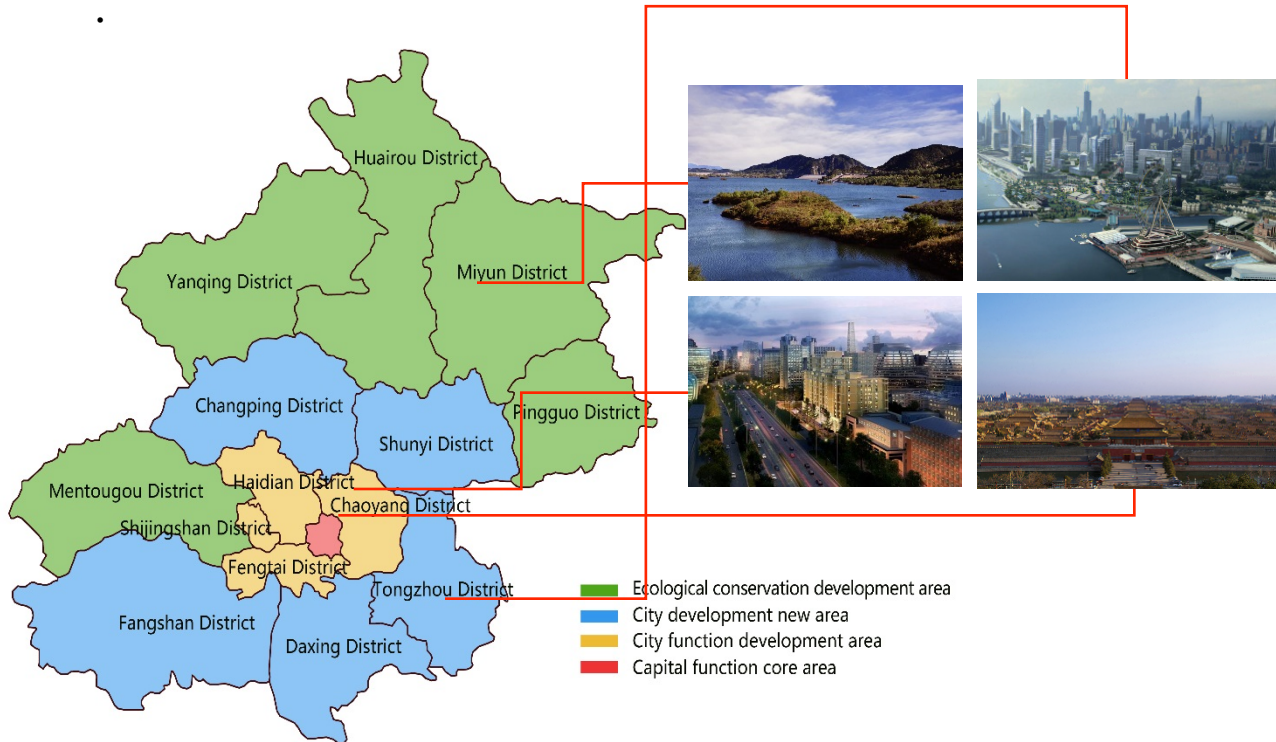


urban metro network 2015

1.The Research Background

1.2 Spatial differentiation of urban functions

- With the expansion of the population and scale of city , the function and division of urban land are more clear than ever, the phenomenon of urban spatial differentiation is more obvious.

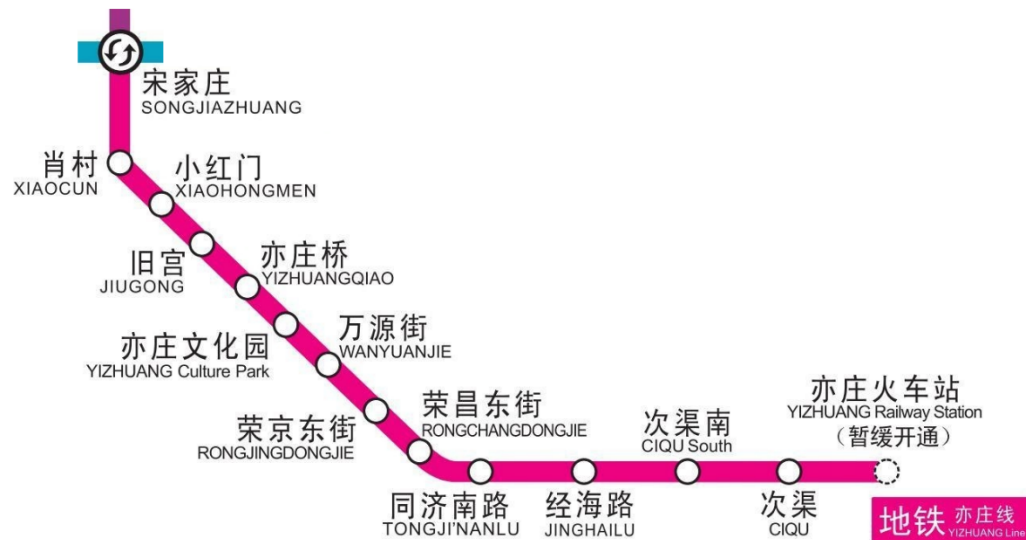


- The city of Beijing is divided into 4 different functional areas. Different urban functions require organic connection, and mutual complement among urban functions can help city work effectively.

2.The Research methods

2.1 The research target

- Yizhuang line is the suburb line of Beijing urban metro network, the line starts with the Songjiazhuang station in the Fengtai District and end with Yizhuang railway station.

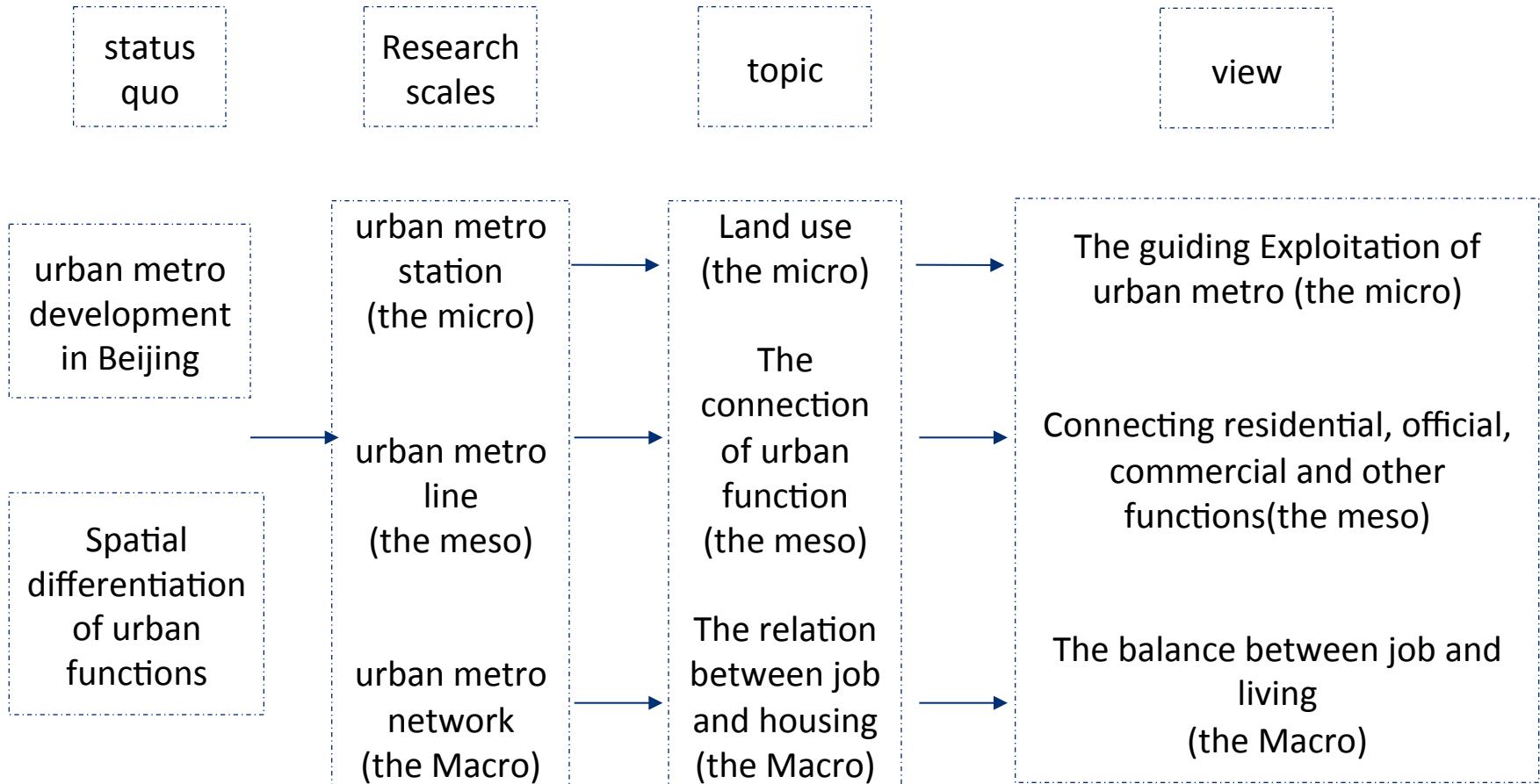


- Yizhuang line makes the urban metro network cover the southeast part of Beijing, connects the center part and Yizhuang Economic Development Zone.



2.The Research methods

2.2 Research Framework



The study on synergy development of urban metro and urban space

3.The node of urban metro and land use (Yizhuang line as example)

3.1 the impact of urban metro on land use

- The effects of node
The large number of people in intersections of different traffic corridors can bring correspondent opportunities and also produce an impact on the surrounding adjacent spaces, the surrounding city functions spontaneously gather to the node.



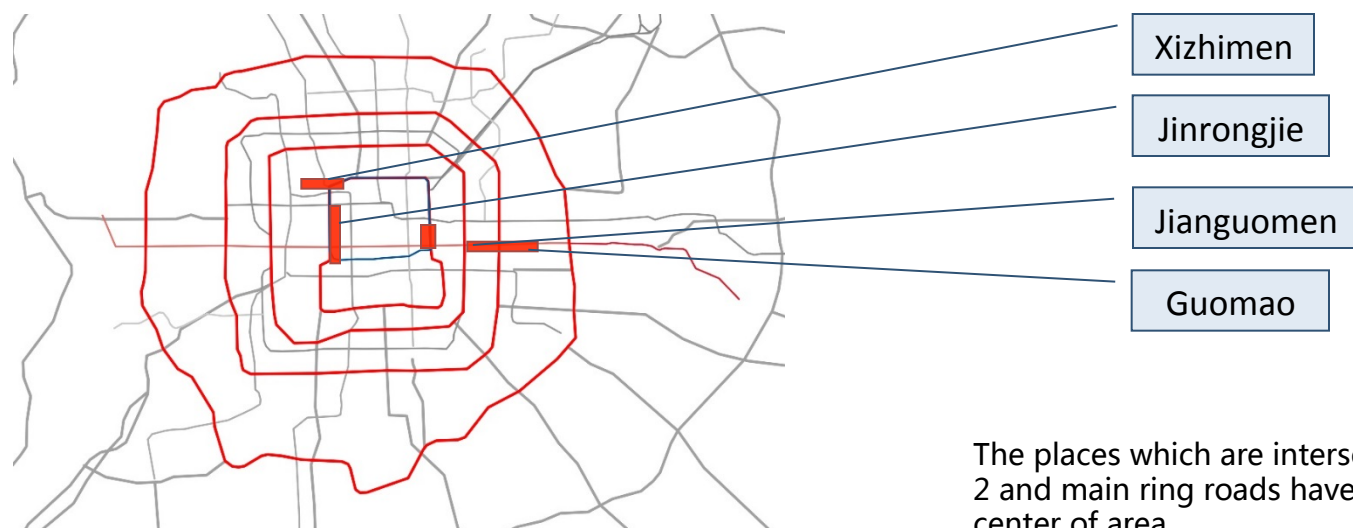
The traffic node of Pingguoyuan in line 1

3.The node of urban metro and land use (Yizhuang line as example)

3.1 the impact of urban metro on land use

- Extension node functions

A large number of functions related to services generate near the station of urban metro, urban metro has a huge role in promoting of surrounding urban space and industry distribution.



The places which are intersected by line 1, line 2 and main ring roads have developed into the center of area

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

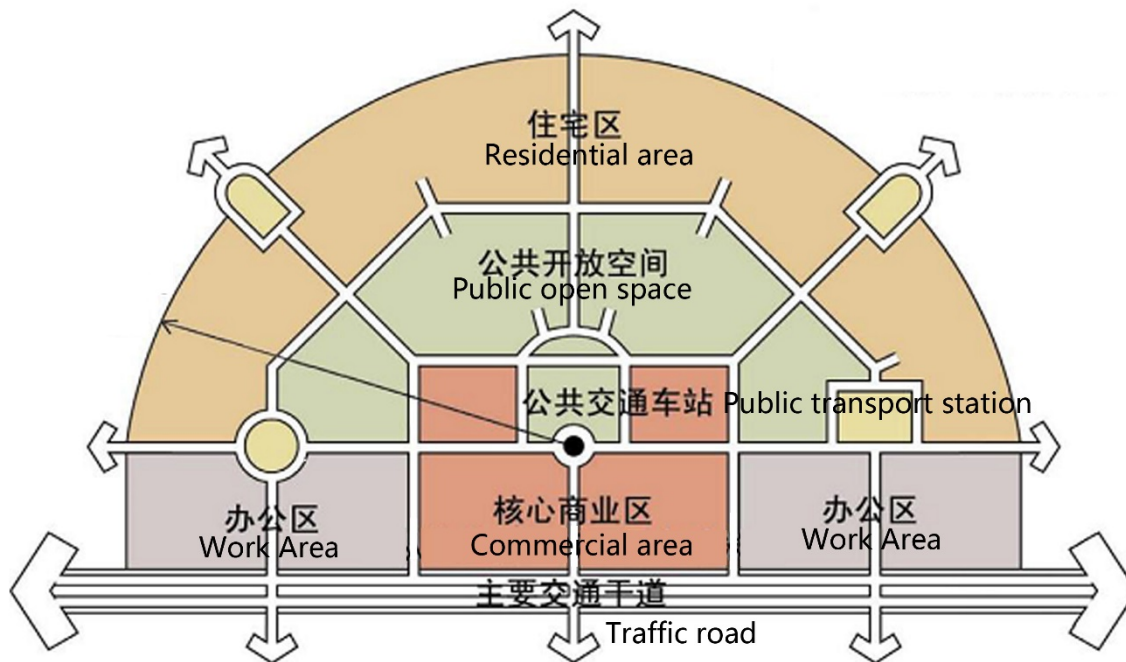
- the circle of node
We choose the Wanyuanjie station, Rongjingdongjie station and Jinghailu station as the research target, and determine the urban metro affected zone which regarded station as center and one kilometer as radius.



3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

We should plan residential, commercial and retail as well as school sites in the zone which is direct influenced zone(300m-1km) that people only walk 5-15 minutes from station to make sure convenience and accessibility. The area outside 1km can be used as the large residential communities and industrial sites.

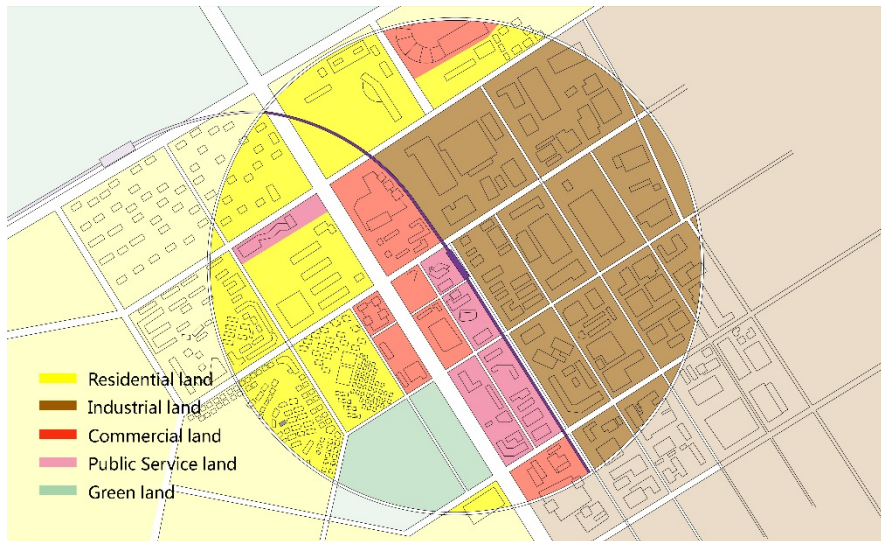


The model of TOD

The study on synergy development of urban metro and urban space

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station



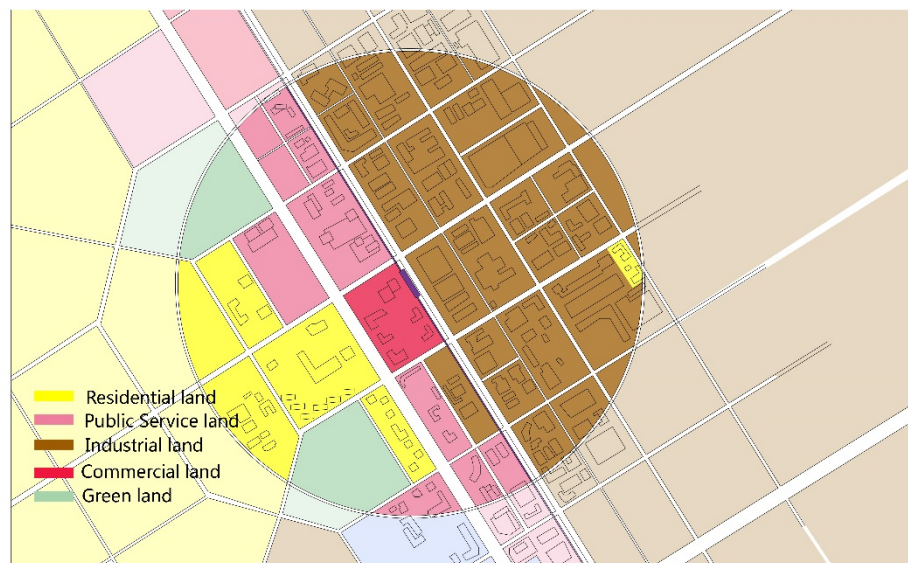
- 1km Wanyuanjie circle zone



- 1km Wanyuanjie circle zone in planning

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station



- 1km Rongjingdongjie circle zone
- 1km Rongjingdongjie circle zone in planning

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

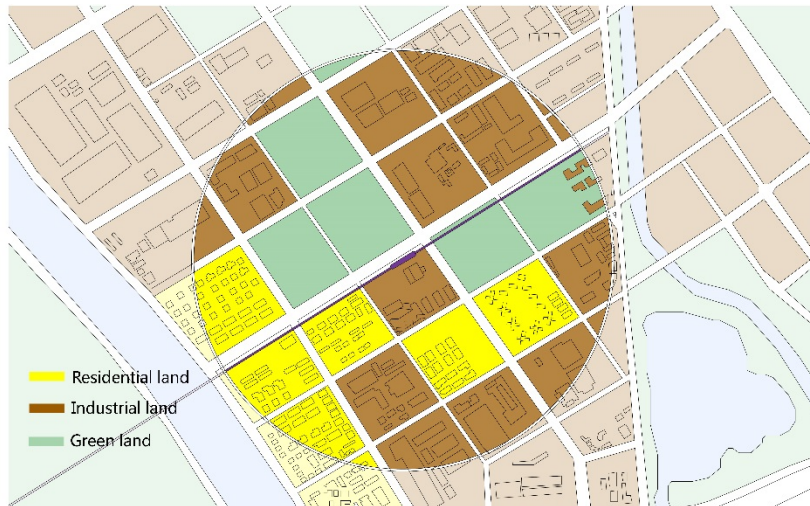
The areas surrounding the Wanyuanjie and Rongjingdongjie station especially in the radius of 500m are used as commercial and business services land, gathering a variety of functions of city, and residential and industrial land are put in the area which located in the radius of 1km. Residents and staff can easily complete their commuting activities through the "Walk + Urban metro ".



Compared with the planning, some parts of land properties have changed. In actual operation phase, residential, commercial, entertainment and business services exploit simultaneously, this time the land value around the station rises obviously, we could adjust partly the property according to the fact to maximize the economic benefits.

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station



- 1km Jinghailu circle zone

- 1km Jinghailu circle zone in planning

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

Jinghailu station is located in exurban area, surrounding land is main for industrial use and residential use, residents and employees can take urban metro to complete daily commuting activities conveniently. But the relevance of the metro and surrounding land use is not tight,. Being lack of business and other functions implants, it can not meet the needs of daily life.

But the impact of urban metro on land value is a long time process with the urban metro planning, construction and operation. The area surrounding Jinghailu station exploit the residential land as the forerunner, absorb the population and set aside land which has the potential to build distinctive and attractive public spaces.

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

- Dynamic Evolution

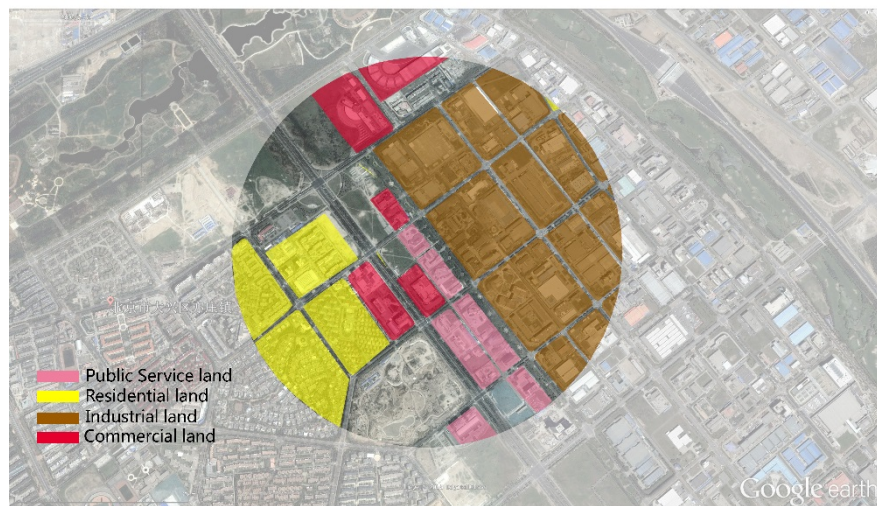
Between 2008 to 2015, the impact of urban metro on space form and land use around three stations is obvious, especially in Rongjingdongjie and Jinghailu station.

3.The node of urban metro and land use (Yizhuang line as example)

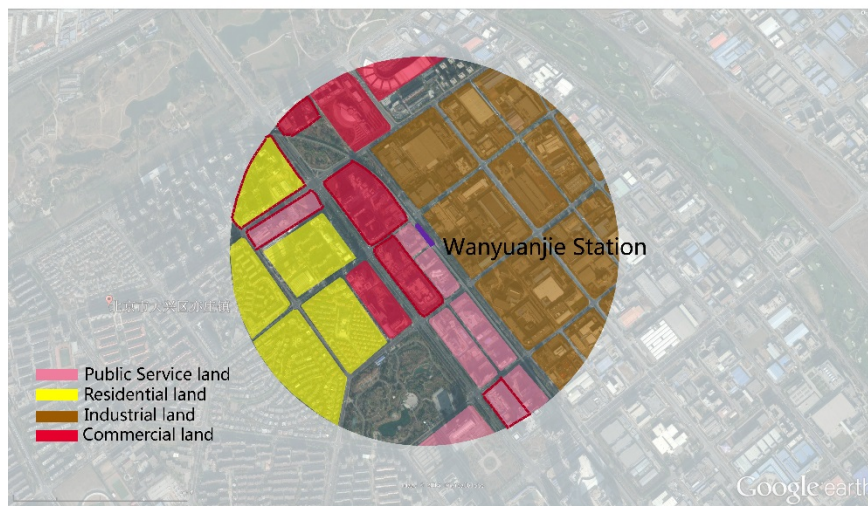
3.2 Analysis of station

- Dynamic Evolution

Emerging of commercial land



- 1km Wanyuanjie circle zone 2008



- 1km Wanyuanjie circle zone 2015

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

- Dynamic Evolution

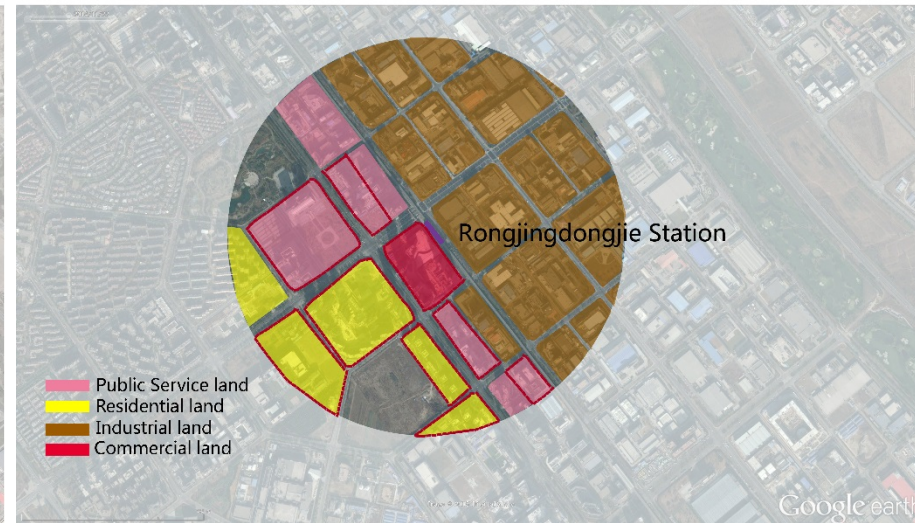
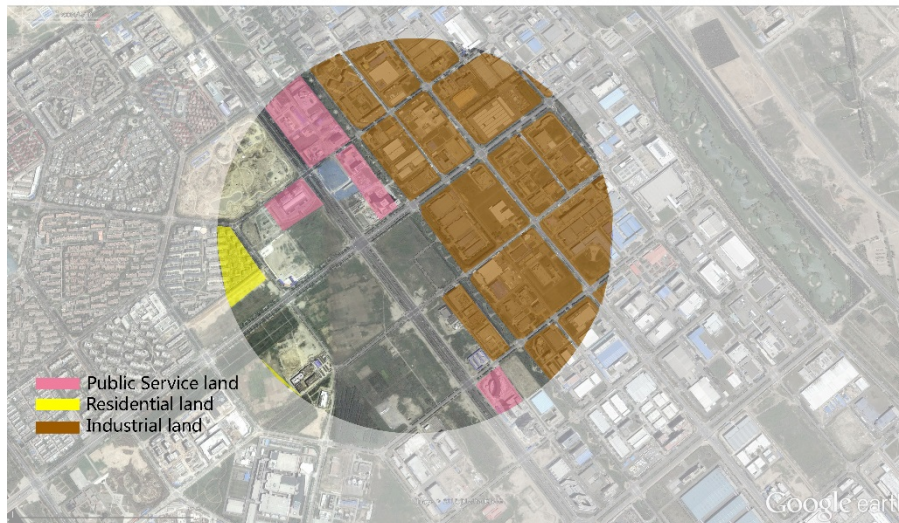
Wanyuanjie is the traditional business area of Yizhuang, urban landscape has been formed, the construction of urban metro strengthen the function of the central area, it strengthens traditional business position while integrating business and leisure.

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

- Dynamic Evolution

Real estate development



- 1km Rongjingdongjie circle zone 2008
- 1km Rongjingdongjie circle zone 2015

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

- Dynamic Evolution

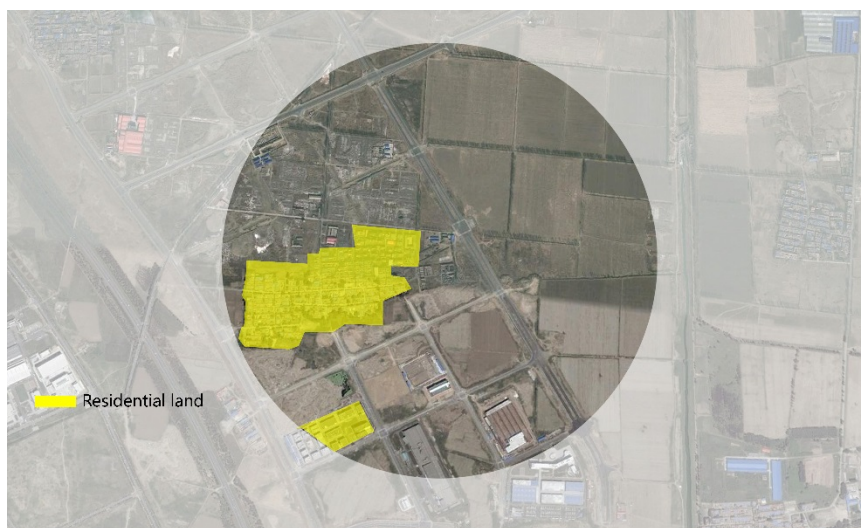
The land surrounding Rongjingdongjie station gradually gathered various industries with the construction of urban metro and became the core of Yizhuang.

3.The node of urban metro and land use (Yizhuang line as example)

3.2 Analysis of station

- Dynamic Evolution

Emerging of industrial land



- 1km Jinghailu circle zone 2008



- 1km Jinghailu circle zone 2015

3.The node of urban metro and land use (Yizhuang line as example)

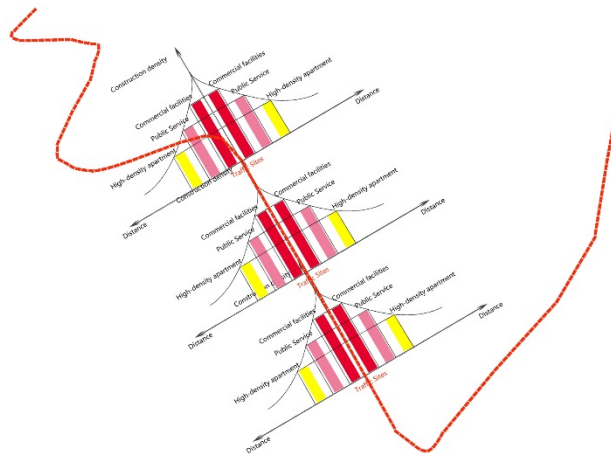
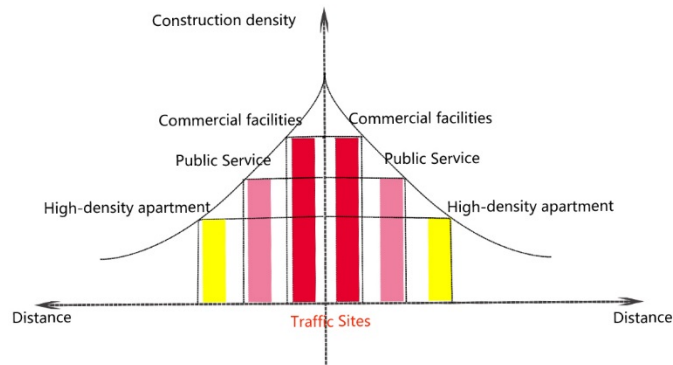
3.2 Analysis of station

- Dynamic Evolution

Jinghailu station is located in the outer suburbs, but with the urban metro construction, the accessibility of surrounding land has been improved, a large number of residential zones emerged to the expand the city's commuter circle.

4.The connection of urban function and urban metro line (Yizhuang line as example)

4.1 The impact of urban metro line on function of city



urban metro like the corridor organizes and links the different functions to make the city run healthily. The function of urban metro playing as corridor mainly is manifested by gathering and evacuation.

Gathering function is mainly reflected by that different urban functions are planned compactly around station and expand along urban metro lines to form finger-like structure.

The evacuation is based on the characteristics of urban metro. The original function of the central area in the city expand outside along the urban metro lines to reduce traffic pressure and employment pressure.

4.The connection of urban function and urban metro line (Yizhuang line as example)

4.2 The analysis of Yizhuang Line

- The changes of Yizhuang Line station spacing and urban road network



The selection of station location and spacing is to ensure that residents and staff surrounding the station can conveniently travel. The spacing between Wanyuanjie and Rongjingdongjie station which through the city center area is about 1kilometer to make sure residents within 500 m radius travel conveniently and at the same time the division of the road network in this area is tight. The spacing of both ends of the Yizhuang line is 2kilometers to coordinate positioning of industrial area and exurban areas.

4.The connection of urban function and urban metro line (Yizhuang line as example)

4.2 The analysis of Yizhuang Line

- correspondent relationship between urban space and urban metro lines



The primary issue of layout of urban commercial facilities and public centers is accessibility, the features of urban metro provide a solution. Business environment optimized by urban metro attract a variety of industries to gather around the station automatically. The main economic activities in Yizhuang are stretched along the line and concentrate near the Wanyuanjie and Rongjingdongjie station.

4.The connection of urban function and urban metro line (Yizhuang line as example)

4.2 The analysis of Yizhuang Line

- commuting and cross - region employment



In Yizhuang, residential and industrial, business services land roughly have the same proportion, people living in Yizhuang can take metro to workplace to achieve the ideal state which is job-living self-balance. However, in the process of questionnaire survey, we find local residents use the metro to achieve cross - region employment.

4.The connection of urban function and urban metro line (Yizhuang line as example)

4.2 The analysis of Yizhuang Line

- commuting and cross - region employment

Survey questionnaires collected 108 samples, in these samples there are 55 people living in Yizhuang and 50 people working in Yizhuang, and 27 people live in Yizhuang while working in Yizhuang .We use the following formulas respectively to calculate the ratios.

外来通勤比例=（就业样本数-居住且在本地区就业的样本数）/就业样本数

$$I=(W-RW)/W$$

外出通勤比例=（居住样本数-居住且在本地区就业的样本）/居住样本数

$$O=(R-RW)/R$$

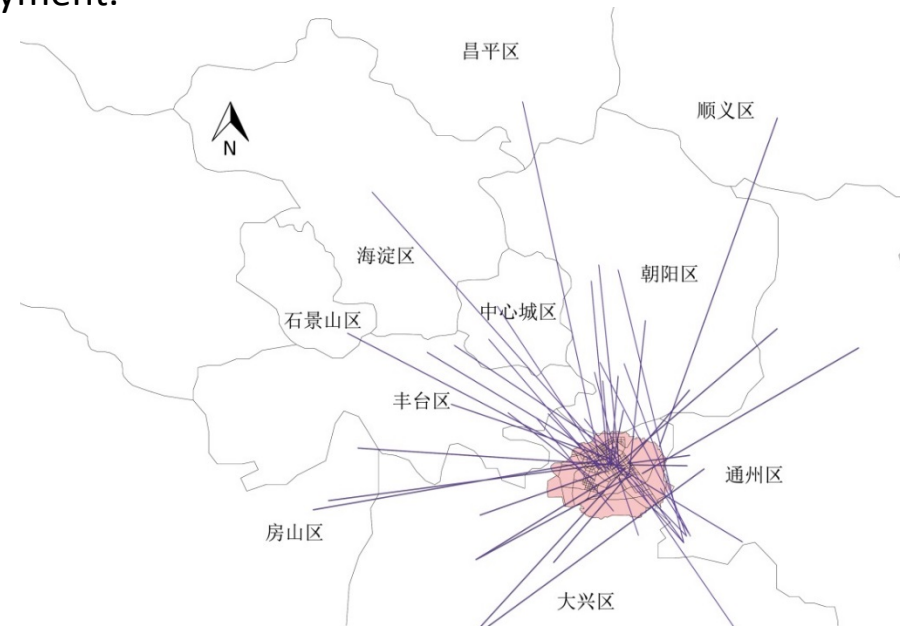
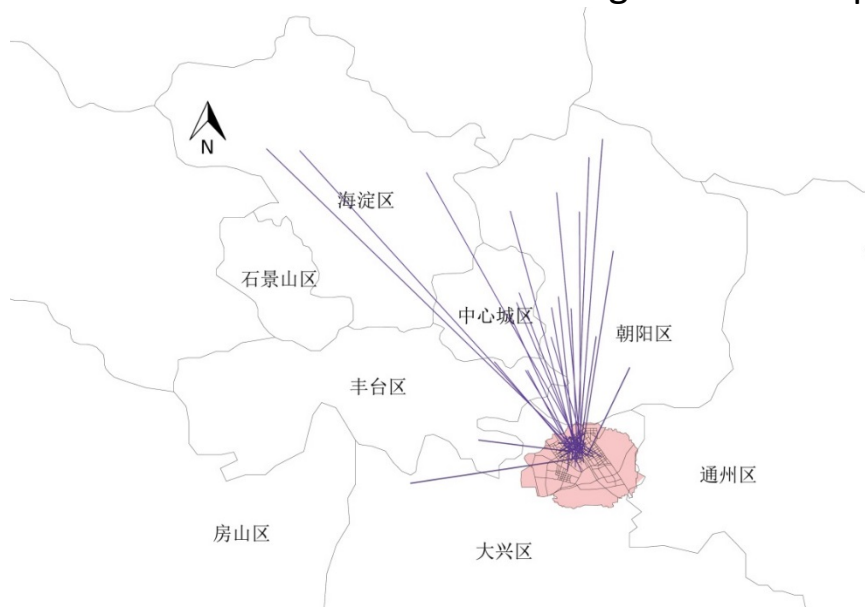
区域 area	居住样本数 Residents in the area (R)	就业样本数 Workers in the area (W)	居住且在本地区 就业的样本 数 Residents as workers (RW)	外来通勤比例 Inbound commutes ratios (I)	外出通勤比例 Outbound commutes ratios (O)
亦庄	55	50	27	46%	50.91%

4.The connection of urban function and urban metro line (Yizhuang line as example)

4.2 The analysis of Yizhuang Line

- commuting and cross - region employment

Through the analysis of the crowd employment, it reflect the direction of commuting flows of staff, and reveal the extent of separation of job and living in Yizhuang. The data from the form reflects that outbound commutes ratios is higher than inbound commutes ratios, it shows that local residents choose urban metro to achieve long-distance employment.



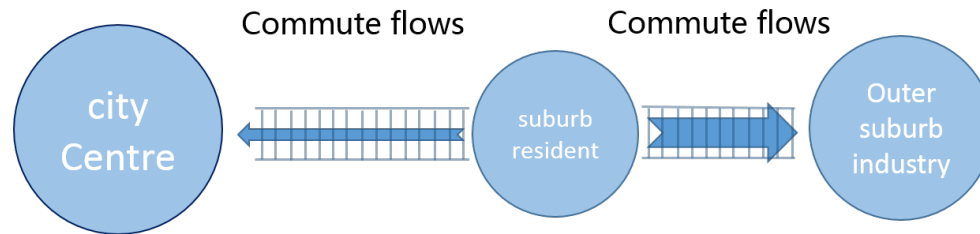
The study on synergy development of urban metro and urban space

4. The connection of urban function and urban metro line (Yizhuang line as example)

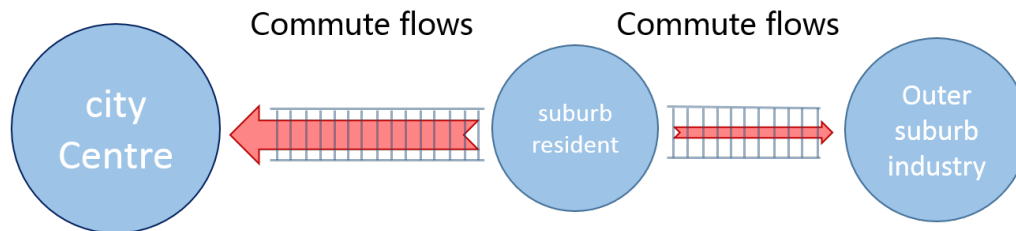
4.2 The analysis of Yizhuang Line

- commuting and cross - region employment

Ideal state :



Reality state :



Construction of Yizhuang line did not reach the purposes which is to transport the population of center to suburb. In contrast, residents living in the suburb choose the urban metro to transit to the city center for employment.

The reason is that the sub-center of employment has not kept the pace with the residence.

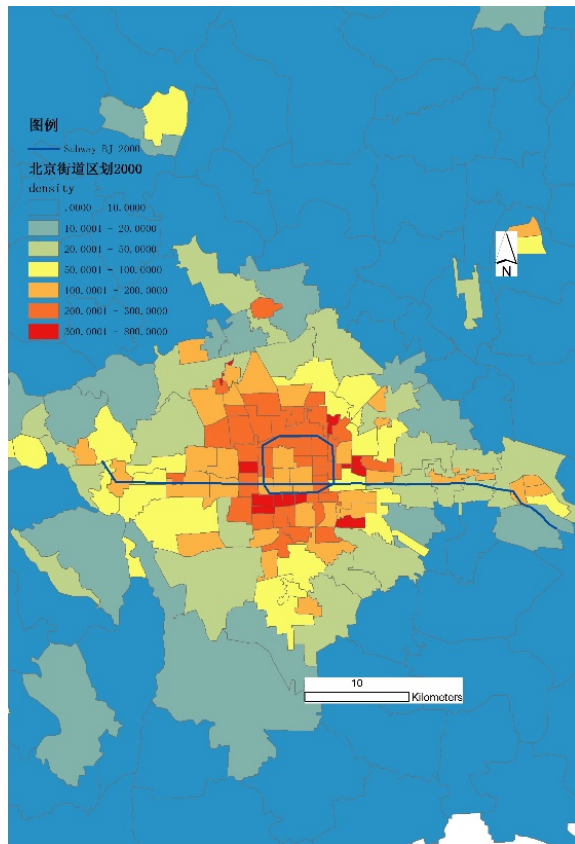
5.The urban metro network and relation between job and housing (Yizhuang line as example)

5.1 relationship between urban metro and residential area

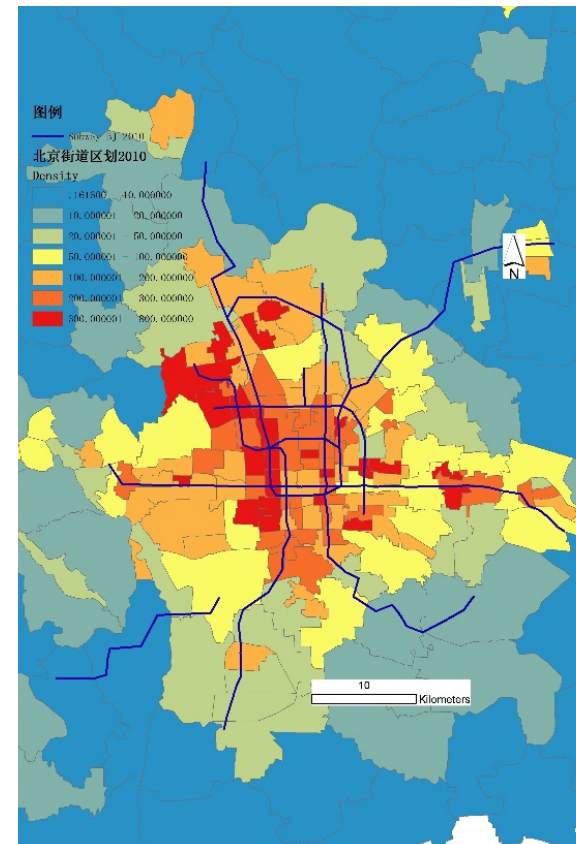
With urbanization, a large residential area emerge in the suburbs, but the suburbanization of job position is lagging behind and it bring "separation of job-living". To solve the problem that the residents still commute mainly outbound, the metro is the best way to link residence and employment .

5.The urban metro network and relation between job and housing (Yizhuang line as example)

5.1 relationship between urban metro and residential area



relationship
 between
 urban
 metro and
 residential
 area 2000



relationship
 between
 urban
 metro and
 residential
 area 2010

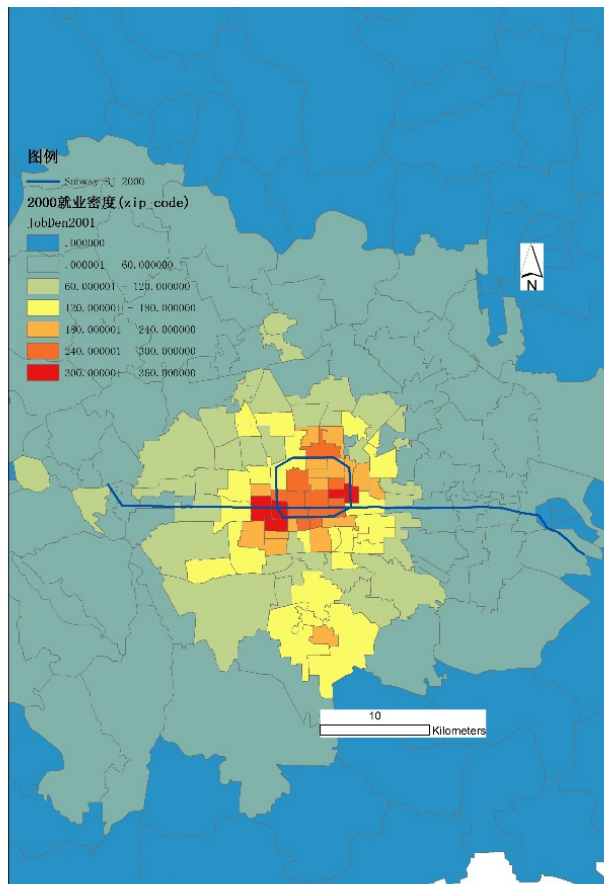
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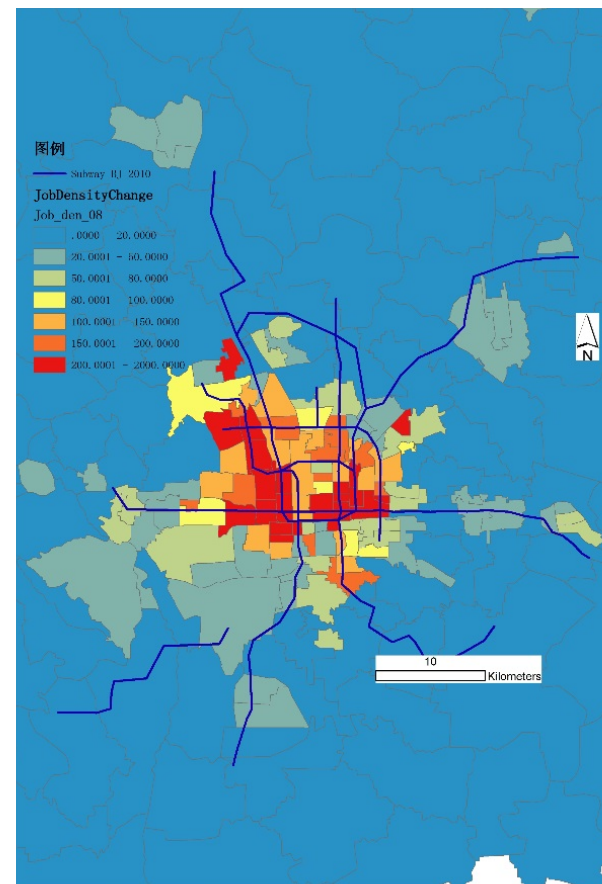
According to the data and the diagram drawn by software arcgis which show the relationship between urban metro and living space in 2000 and 2010, the urban metro networks cover most large living area including Tongzhou, Huilongguan and Tiantongyuan to facilitate the commuting of residents.

5.The urban metro network and relation between job and housing (Yizhuang line as example)

5.2 relationship between urban metro and employment area



relationship
between
urban metro
and
employment
area2000



relationship
between
urban metro
and
employment
area2010

The study on synergy development of urban metro and urban space

5.The urban metro network and relation between job and housing (Yizhuang line as example)

5.2 relationship between urban metro and employment area

There is a clear employment gathering phenomenon in Beijing, jobs are mainly centralized in center area, the effect of employment evacuation is not obvious. With the city's expansion and the construction of urban metro, job position gradually spread from center area to other areas of city to form the sub-center of employment. And urban metro connect the different employment center.

5.The urban metro network and relation between job and housing (Yizhuang line as example)

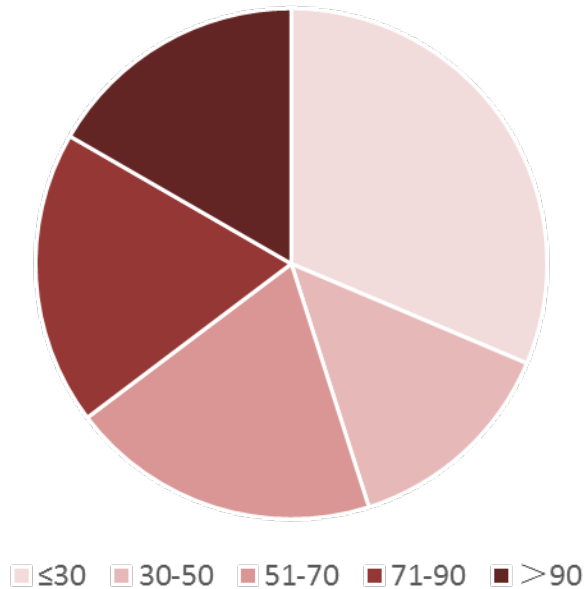
5.2 relationship between urban metro and employment area

A whole spatial layout of Beijing residence and employment show the view that only part of it are both centers of employment and residence. As cities continue to expand, many parts of the land functions change, It failed to keep balance of employment and living in local region. But the urban metro link the both effectively.

5.The urban metro network and relation between job and housing (Yizhuang line as example)

5.3 Yizhuang line and the urban metro network of Beijing

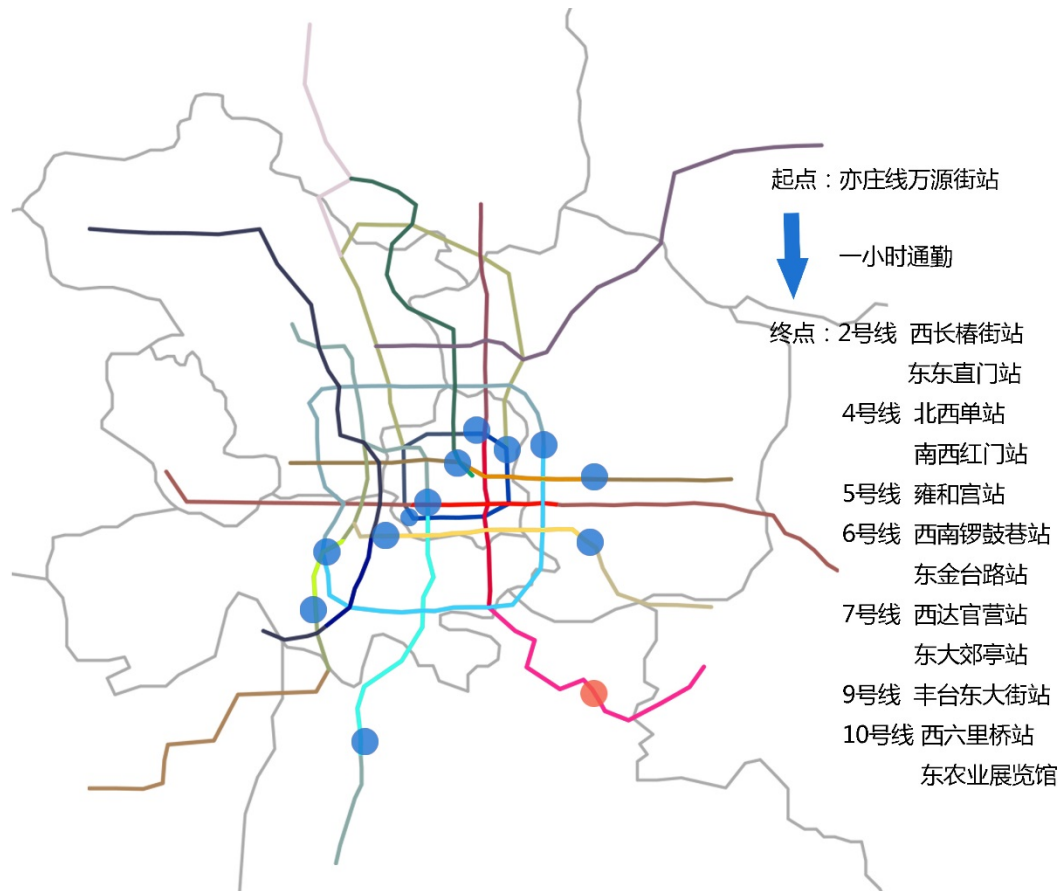
the time of commuting(one way)



The average one-way commute time is 61.2 minutes which is given by survey data. If we use one hour of commuting time as standard and consider the transfer which Yizhuang line connect with other lines, we can find the area that the residents of Yizhuang can reach by urban metro in one hour to show the positive impact of urban metro.

5.The urban metro network and relation between job and housing (Yizhuang line as example)

5.3 Beijing Yizhuang line and the urban metro network of Beijing



We consider the Wangyuanjie station which is surrounded by a large number of residential zone as the start site, and find the stations we can reach in one hour by urban metro including transfers. The result as shown in picture. We can reach the line 2 and line 4 and etc. If we combine the walking, buses and urban metro, the traffic has the greater impact on cross-region separation of job-living.

6.Conclusion

- 1)The **synergy** of Yizhuang line and surrounding land using is not high, we should clear the properties of the land and reserve potential land with the improvement of accessibility of land surrounding station.
- 2)Urban space expand around the station and form the belt pattern, and avoid urban space development as single center circle.
- 3)The planning of Yizhuang line is to **transport the population of center to suburb**, but it makes more people transfer to center of city. the problem of job-housing balance can not focus on the one metro.
- 4)Urban metro network effectively link the center of employment and residence, and the connection of Yizhuang line and other lines expands the scale of commute region.

Thank you