

Planning in Restrictions for Beijing Urban and Rural Development

Introduction

With the rapid urbanized pace, the urban sprawl could not be effectively controlled. The land use transform is rising from non-built-up to built-up. Fig.0-1 displays the urban sprawl (from 1975 to 2002). Beijing City Master Plan (2004-2020) has specified the new pattern of Beijing urban spatial development in the next 15 years: two axes, two belts, and multiple centers, to reduce the pressure caused by the congregation of the single center city, take the harmony of development into account. After the Master Plan approved, the plain cities and towns, especially located on the east development belt, would have been greatly developed. The hot spots for the urban construction continue to shift outskirts. Together with the new village construction in full swing, it is inevitable to put the ecological protection of former non-built-up space in danger. Meanwhile, the factors of natural disasters may also endanger to the security of the urban and rural construction.

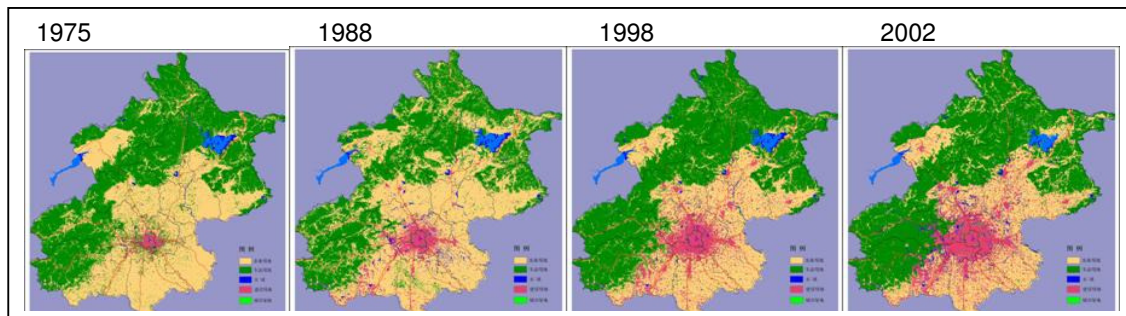


Fig.0-1 Remote sensing classification diagram of Beijing land use (1975-2002)

Source: Beijing Municipal Commission of Urban Planning, 2003.

The disordered urban sprawl causes the damages of the ecological environment, which impels the planners to re-examine the conventional planning methods. *AFTER SPRAWL* interpreted the spatial forms of built-up space, infrastructure, negative space, nature, agriculture and water for the different city clusters of London Randstad, Flemish Diamond, which called the "Blue Banana" urban and town zone, see Fig. 0-2 for details. The study based on the negative planning has not taken the lands outside the built-up space, as the background, the non-built-up space, equivalent to the built-up space should be re-examined within the regional range and the whole environment. To ensure the ecological functions should be put on the top priority, the urban spatial arrangement followed up to reasonably guide the direction of city sprawl.

The Metropolitan New York (including New York City and the part of New Jersey, New York State and Connecticut State) compiled the first metropolitan regional planning in the world in 1929. The contribution is to restrict the ecological sensitive areas at the initial stage of the urban sprawl, put forward the construction control for those lands need to be protected. Fig.0-3 shows the results of control for the mountain and the protection areas for water resource through implementing the regional planning during about next 60 years' urbanization process.

Compared with Metropolitan New York, the history of urban sprawl in Beijing is short, but more drastic, so it is urgent to study the non-built-up space to ensure the ecological functions, and further ensure the sustainable urban development. In 2003, "Beijing Urban Spatial Development Strategy" firstly put forward the concept of

“limited zone” on the Beijing city planning history, to guide the urban spatial layout, besides the consideration of population capacity. Until 2004, during the period of the “Beijing City Master Plan (2004-2020)”, the planning of limited zone was deepened by analyzing the restrictive elements, and carrying out zones into three levels.

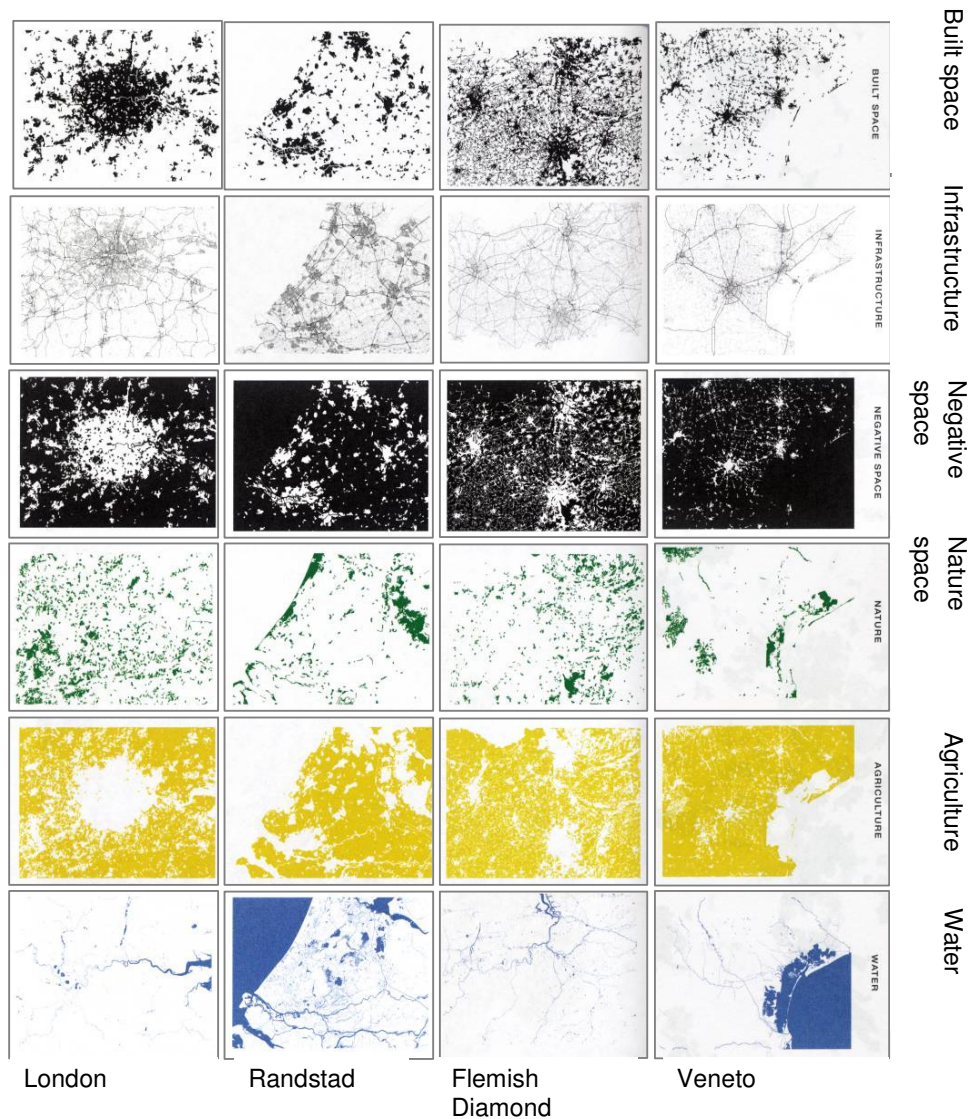


Fig.0-2 Illustration of the negative planning in “Blue Banana”

Source: XAVEER DE GEYTER ARCHITECTS, 2002.

Under the instructions of the “Beijing City Master Plan (2004-2020)” and the official approval of the Central Government, this paper introduces the urban spatial development planning study with the respect of the ecological restriction by selecting the restrictive elements, classifying, zoning, and compiling the restrictive guidance for non-built-up space in Beijing. According to the comprehensive consideration for the restrictive elements, evaluate the construction conditions of optional areas to make the restrictive recommends and put forward the planning guidance.

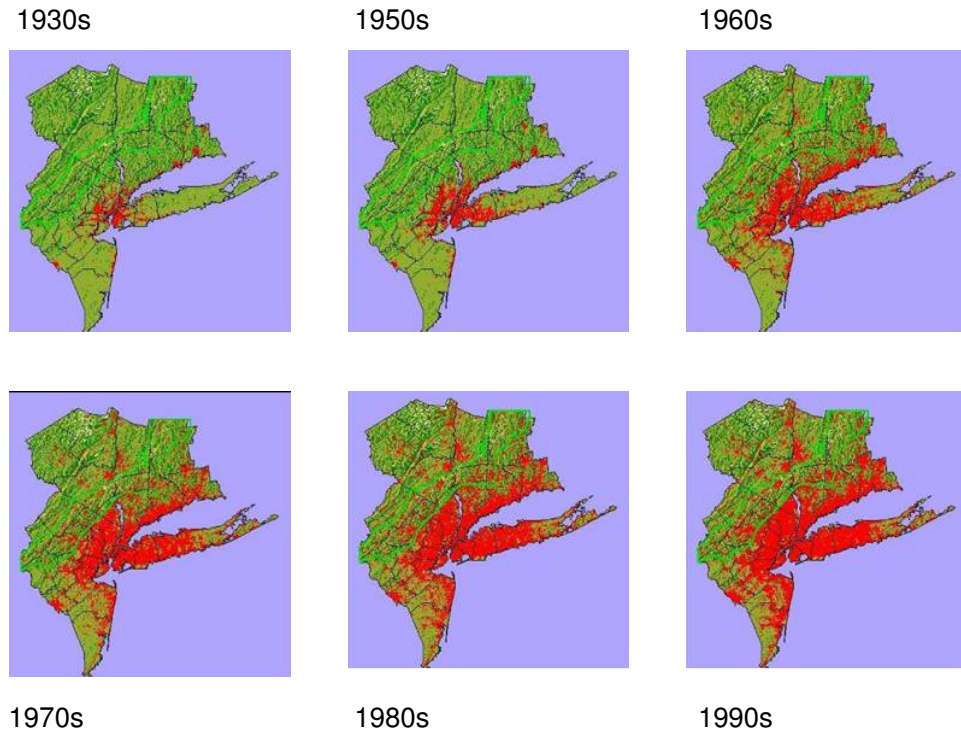


Fig.0-3 The historical diagram of urban sprawl in Metropolitan New York

I. Analyse of the construction restrictive elements based on the principle of the full protection for natural resources and the prevention of disaster risks

Analyzing the construction restrictive elements is the basis for identifying the limited zones. In this study, the restrictive elements indicate the natural and human environmental elements, which may give influences to construction within the Beijing urban area. The restrictive elements can be classified in several angles. Firstly, seen from the objective attribute of elements, it can be divided into two types of elements: resource type and risk type.

(1) Resource type: indicating the protection for resources and environment with the values of humane, science and history and the important ecological service functions or the relatively sensitive resources, such as potable water source protection area, scenic spots and historical sites, natural resources protection area, and geologic relics etc..

(2) Risk type: in order to meet the basic demand of city security, the built-up land use must be kept away from the area with hidden troubles of the disasters and the risks. The earthquake, geological disasters, flooding disasters considered. The gas, power and oil pipeline could cause the combustion, explosion or other induced disasters. The treatment facilities of waste and wastewater are easy to cause the induced pollution.

Seen from the grouping of disciplines, the restrictive elements can be divided into five groups of water (concerning with the blue space), green (concerning with the green space), geology (earthquake and geology), environment (environmental protection), and relics (heritage protection), total 16 categories of elements, and 110 layers, shown as table 1-1.

Table 1-1 Classifying of restrictive elements in group and relevant restrictive levels

Discipline 1 Water

| Category | Layer number | Title of layer | Restrictive level |
|-----------------------------|--------------|--|------------------------------------|
| 1 Wetland | 1 | River type wetland | Relatively prohibited construction |
| | 2 | Pond and reservoir type wetland | Relatively prohibited construction |
| | 3 | Reservoir buffer zone | Generally restricted construction |
| | 4 | River buffer zone | Generally restricted construction |
| 2 Water source protection | 5 | Surface water source type I protection area | Relatively prohibited construction |
| | 6 | Surface water source type II protection area | Strictly restricted construction |
| | 7 | Surface water source type III protection area | Generally restricted construction |
| | 8 | Mountain small watershed protection area | Suitable construction |
| | 9 | South-to-north water transfer pipeline protection area | Generally restricted construction |
| | 10 | Underground water treatment plant | Relatively prohibited construction |
| | 11 | Underground water source protection area | Strictly restricted construction |
| | 12 | Underground water source make-up area | Generally restricted construction |
| | 13 | Underground water environment unsuitable area | Suitable construction |
| 3 Overdraft | 14 | General overdraft area of underground water | Suitable construction |
| | 15 | Non-overdraft area of underground water | Suitable construction |
| | 16 | Serious overdraft area of underground water | Generally restricted construction |
| 4 Flood storage and control | 17 | Flood diversion door | Absolutely prohibited construction |
| | 18 | High flood risk area | Strictly restricted construction |
| | 19 | Low flood risk area | Strictly restricted construction |
| | 20 | Relative flood safety area | Generally restricted construction |
| | 21 | Flooded area | Suitable construction |
| | 22 | Central urban flood storage and detention areas | Generally restricted construction |

Discipline 2 Green

| | | | |
|-----------------------|----|---|------------------------------------|
| 5 Greening protection | 23 | Plain area road forest network | Generally restricted construction |
| | 24 | Plain area farmland forest network | Generally restricted construction |
| | 25 | Plain area water system forest network | Generally restricted construction |
| | 26 | Scenic spot and historical relics special grade protection area | Relatively prohibited construction |
| | 27 | Scenic spot and historical relics grade I protection area | Relatively prohibited construction |
| | 28 | Scenic spot and historical relics grade II protection area | Strictly restricted construction |

| | | | |
|-----------------------------|----|--|------------------------------------|
| | 29 | Scenic spot and historical relics grade III protection area | Generally restricted construction |
| | 30 | County level scenic spot and historical relics area | Strictly restricted construction |
| | 31 | Planned scenic spot and historical relics area | Generally restricted construction |
| | 32 | Core zone of national municipal level natural protection area | Absolutely prohibited construction |
| | 33 | Buffer zone of national municipal level natural protection area | Relatively prohibited construction |
| | 34 | Testing zone of national municipal level natural protection area | Strictly restricted construction |
| | 35 | Forest park | Strictly restricted construction |
| | 36 | County level natural protection area | Strictly restricted construction |
| | 37 | Important ecological public welfare forestry land | Relatively prohibited construction |
| | 38 | General ecological public welfare forestry land | Strictly restricted construction |
| 6 Urban and town green belt | 39 | First green belt nail piling Greenland | Relatively prohibited construction |
| | 40 | Central city first green belt planning range | Strictly restricted construction |
| | 41 | Second green belt existing and planning forestry land | Strictly restricted construction |
| | 42 | Second green belt other green limited zone | Generally restricted construction |
| | 43 | Green wedge green space | Relatively prohibited construction |
| | 44 | Green wedge non-green space | Generally restricted construction |
| | 45 | City green line | Relatively prohibited construction |
| 7 Agricultural land | 46 | Basic farmland | Relatively prohibited construction |
| | 47 | General cultivated land | Strictly restricted construction |
| | 48 | General agricultural land | Strictly restricted construction |

Discipline 3 Relics

| | | | |
|------------------------------|----|--|------------------------------------|
| 8 Cultural relics protection | 49 | The Great wall 500m protection belt | Relatively prohibited construction |
| | 50 | The Great Wall 3000m protection area | Strictly restricted construction |
| | 51 | Range of cultural relics protection unit | Relatively prohibited construction |
| | 52 | History culture protection area | Strictly restricted construction |
| | 53 | Underground cultural relics buried area | Generally restricted construction |

Discipline 4 Geology

| | | | |
|---------------------|----|---|-----------------------------------|
| 9 Geological relics | 54 | Mineral resources rich district | Strictly restricted construction |
| | 55 | Geological relics and scenic spot resource area | Strictly restricted construction |
| 10 Plain geology | 56 | Plain area with poor engineering geology | Generally restricted construction |
| | 57 | Plain area with ordinary engineering geology | Suitable construction |

| | | | |
|------------------|--|---|---|
| | 58 | Plain area with good engineering geology | Suitable construction |
| | 59 | Plain area with very good engineering geology | Suitable construction |
| 11 Seismic risks | 60 | Seismic dynamic boundary area | Suitable construction |
| | 61 | Seismic dynamic 0.1g area | Suitable construction |
| | 62 | Seismic dynamic 0.15g area | Suitable construction |
| | 63 | Seismic dynamic 0.2g area | Suitable construction |
| | 64 | Active fault zone | Strictly restricted construction |
| | 12 Water and soil loss and geologic disasters prevention and control | 65 | Valley with the danger of mud-rock flow |
| 66 | | 25°steep slope area | Relatively prohibited construction |
| 67 | | Piedmont ecological protection area | Generally restricted construction |
| 68 | | Main wind-sandy control and management area | Suitable construction |
| 69 | | Land decertified area | Suitable construction |
| 70 | | Sandy soil liquefied area | Generally restricted construction |
| 71 | | Collapse hazard zone | Relatively prohibited construction |
| 72 | | Avalanche hazard zone | Relatively prohibited construction |
| 73 | | Landslide hazard zone | Relatively prohibited construction |
| 74 | | Area of Great Wall located | Absolutely prohibited construction |
| 75 | | Within 100m along both sides of Great Wall | Strictly restricted construction |
| 76 | | 100 to 500 m along Great Wall | Generally restricted construction |
| 77 | | Land subsidence dangerous area | Generally restricted construction |

Discipline 5 Environment

| | | | |
|---|----|---|------------------------------------|
| 13 Protection of treatment facilities | 78 | Refuse treatment plant protection area | Strictly restricted construction |
| | 79 | Refuse transfer station protection area | Strictly restricted construction |
| | 80 | Night soil treatment plant protection area | Strictly restricted construction |
| | 81 | Refuse incineration plant protection area | Strictly restricted construction |
| | 82 | Refuse landfill space protection area | Strictly restricted construction |
| | 83 | Refuse composting plant protection area | Strictly restricted construction |
| | 84 | Wastewater treatment plant protection area | Strictly restricted construction |
| | 85 | Construction wastes treatment protection area | Strictly restricted construction |
| 14 Electromagnetic radiation protection | 86 | Microwave passage radiation protection area | Generally restricted construction |
| | 87 | Broadcast and TV transmission control area | Generally restricted construction |
| | 88 | Broadcast and TV transmission protection area | Strictly restricted construction |
| | 89 | 500KV substation protection area | Relatively prohibited construction |
| | 90 | 220KV substation protection area | Relatively prohibited construction |
| | 91 | 110KV substation protection area | Relatively prohibited construction |

| | | | |
|---|-----|---|------------------------------------|
| 15 Municipal passageway protection | 92 | 500KV transmission line protection area | Relatively prohibited construction |
| | 93 | 220KV transmission line protection area | Relatively prohibited construction |
| | 94 | 110KV transmission line protection area | Relatively prohibited construction |
| | 95 | Oil/gas pipeline (grade I) | Relatively prohibited construction |
| | 96 | Oil/gas pipeline (grade II) | Generally restricted construction |
| | 97 | Oil/gas pipeline (grade III) | Suitable construction |
| 16 Noise pollution prevention and control | 98 | Railway noise (zone I) | Strictly restricted construction |
| | 99 | Railway noise (zone II) | Generally restricted construction |
| | 100 | Light rail noise (zone I) | Strictly restricted construction |
| | 101 | Light rail noise (zone II) | Generally restricted construction |
| | 102 | Urban road traffic noise (zone II) | Generally restricted construction |
| | 103 | Urban road traffic noise (zone I) | Strictly restricted construction |
| | 104 | Road traffic noise (zone II) | Generally restricted construction |
| | 105 | Road traffic noise (zone I) | Strictly restricted construction |
| | 106 | Beijing Capital Airport category 1 zone | Suitable construction |
| | 107 | Beijing Capital Airport category 2 zone | Suitable construction |
| | 108 | Beijing Capital Airport category 3 zone | Generally restricted construction |
| | 109 | Beijing Capital Airport category 4 zone | Strictly restricted construction |
| | 110 | Other airport noise effect area | Strictly restricted construction |

II. The construction restrictive zoning identified by the risks of the natural disasters, the value of the natural resources and the environmental protection, and the influences of the pollution source protection

1. Restrictive level

The restrictive level, according to the restrictive elements, specifies the different levels of restrictive requirements for urban and rural construction, it can be divided into 3 categories or 6 levels. The different restrictive elements have the different restrictive levels; see Table 1-1 for corresponding relationship.

- (1) Prohibited construction: indicates the very strict ecological restrictions, the areas forbidding the entry of urban construction and strictly controlled, including:
 - absolutely prohibited construction: The restrictive elements are extremely strict for the ecological restrictions of the urban and rural construction, and we should strictly forbid all urban and rural construction activities within the space range located.
 - relatively prohibited construction: The restrictive elements are strict for the ecological restrictions of the urban and rural construction; we should forbid the construction unconcerned with the restrictive elements within the space range located.
- (2) Restricted construction: indicates the relatively strict ecological restrictions, the areas with limitations for the aspects of land scale, land type, construction intensity of urban construction and relevant urban activity and behavior, including:

- ① Strictly restricted construction: the restrictive elements have the relatively strict ecological restrictions for urban and rural construction. It is unable to overcome or reduce the conflicts between the restrictive requirements and construction; otherwise, it is easy to cause the serious adverse influences. Within the space range of elements located, we should strictly limit the land scale, land type, construction intensity of the urban construction, and relevant urban activities and behaviors.
 - generally restricted construction: The restrictive elements have the relatively strict ecological restrictions for urban and rural construction, under the special cases, the conflicts between the elements and construction can be reduced through technical and economic transformation. Within the space range of elements located, limit the land scale, land type, construction intensity of the urban construction and relevant urban activities and behaviors.
- (3) Suitable construction: indicates the areas with single limitations on the aspects of land scale, land types, construction intensity of the urban construction and relevant urban activities and behaviors, under normal situations, the moderate urban construction can be carried out, including:
 - Moderate construction: The restrictive elements have the specified ecological restrictions for the urban and rural construction, within the space range of elements located, the urban construction lands planning must be comprehensively considered.
 - Suitable construction: The restrictive elements have no ecological restrictions for the urban and rural construction, and no special restrictive requirements for the urban and rural construction.

2. Construction restrictive zoning

Through the summary of restrictive elements, finally specified 110 restrictive layers, which almost covers the municipal area of Beijing, and the overlapping phenomenon of restrictive elements is also universal. In order to distinguish the main features of municipal restrictive elements space distribution, all restrictive elements within the municipal domain must be integrated. According to the principle of “maximum identical range of restrictive elements distribution”, with the UNION algorithm of planning supported system, all restrictive elements should be carried out the restrictive unit space calculation to create the restrictive unit, and the number of finally specified restrictive units is 250,000, shown as Fig.2-1.

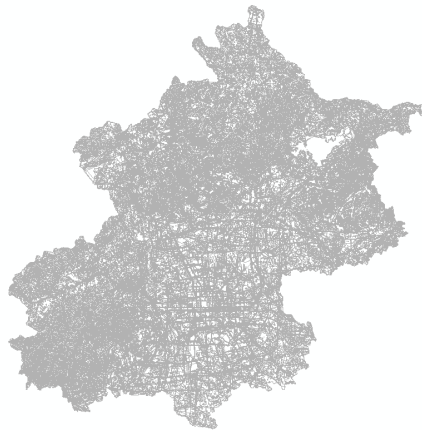


Fig.2-1 Restrictive unit distribution diagram

Because the restrictive level has been established in each layer of elements, the restrictive level of the restrictive unit with multiple elements overlapped should be determined by the strictest layer, which is called the polarization model. Then the restrictive units with the same level should be merged to generate the construction restrictive zoning, shown as Fig.2-2.

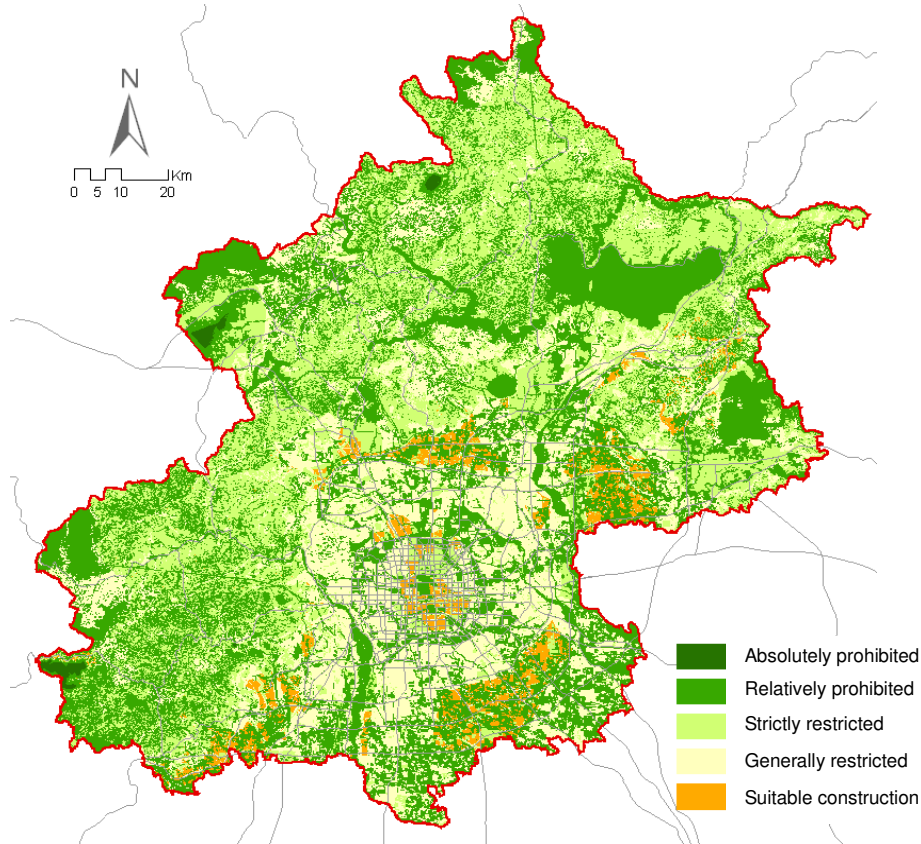


Fig.2-2 Urban area construction restrictive zoning diagram

The prohibited zones can be specified as the first choice for ecological cultivation and ecological construction, and in general, be prohibited to carry out the large-scale urban and town construction behaviors. Most of limited zones are the key protection or sensitive areas with a good natural conditions and strict restrictions, which can be used for carrying out the scaled urban and rural construction under the prerequisite of meeting the control requirements. However, the relevant ecological impact assessment and ecological compensation measures must be put forward; the suitable zones are preferred for urban development, however, the construction behaviors should also refer to the resource and environmental conditions, and the development mode, scale and intensity should be identified scientifically and reasonably.

III. Making the restrictive planning guidance according to the prevailing laws/regulations and planning approval documents

The restrictive guidance, basing on the relevant laws, regulations and rules, combines with the existing study results, integrates the restrictive requirements for all restrictive elements to form the standardized articles for guiding the urban and rural planning and construction. It mainly focuses to describe the restrictive elements, conditions of entry and permissible development mode, development intensity, and space form within the planning scope.

The restrictive guidance comprises the restrictive purpose, the restrictions to urban and rural construction, and the restrictions to urban activities, the law and regulation basis for restrictive requirements, the required professional assessment and administrative organs.

1. Restrictive content

For the scale of construction lands, according to dimensions of restrictive elements, control scope and construction capacity analysis, three levels of restrictive requirements for projects, villages and urban and town can be given.

For the types of the built-up land, the urban built-up lands can be classified from the angle of restrictive construction into several restrictive types such as the urban and town layout, village and town layout, industry layout, road and traffic infrastructure layout, municipal infrastructure layout, public green space, special lands and reserved lands. In addition, the restrictive requirements can be put forward respectively.

For the construction height, it can be divided into the constant-value limitation, relative height limitation and building type limitation, according to the scenery requirements of elements and safety requirements.

For the development of underground space, no classifying of levels or categories, it is only need to consider the prevention of hidden troubles of underground works' safety or environmental impact caused by the underground excavation, and give the limitations for some elements.

2. Limitation of urban activities

Limit the damages to facilities and environment, for example, illegal excavation of storing pit, tomb buried, blasting, drilling, excavating pits and backfilling ponds, burning the grass on the wasteland, and cutting into a mountain.

Limit the emission and retaining of substances, for example, illegal emission or retaining of pollutants (sewage, night soil, industrial slag, refuse and dissolvable toxic and harmful wastes. It is prohibited to drain the wastewater through seepage pit, seepage well, crevice, karsts cave, open canal, cross flow, and materials storage. It is prohibited to store the petroleum, natural gas, radioactive substances, toxic and harmful industrial chemicals, and pesticide, flammable and explosion and other substances endangering to other cultural relics with the water permeable layer pore, crevice, karsts cave and abandoned mine pits), planting of the unsuitable plants, and applying of the pesticide (toxic fish medicines, organ chlorine pesticide).

Limit the intake of resources, for example, illegal intake of water (open a canal and drive a well), recovery of the minerals (stone quarrying, sand excavation, and soil quarrying), hunting, cutting and transplanting of the trees, gathering of the herbal

medicines, and opening up of the wasteland.

Limit the land occupying behaviors, for example, illegal sunning of grain, traffic transportation (toxic and harmful substances and pollutants, illegal aviating, shipping and driving), planting, herd, breeding, tour and entertainment, swimming, training, washing (vehicles, and clothes), business services, open market, scientific study observation and education.

3. Law and policy basis

Different to the subjectivity of conventional city planning, this planning study is based on the prevailing laws, local regulations, administration regulations, rules, technical standards and technical specifications, relevant study results (including the topic research results) and planning results, international treaties and agreement and other standardized documents. It is the objectively restrictive requirements for the urban spatial development.

4. Professional evaluation

Once conflicts with the restrictive elements, the construction can be completed by improving the construction standard, moving the current construction, reducing the activity frequency and intensity, adjusting the position of restrictive elements, professional assessment or technical approval. The total 12 types professional technical assessments comprise environmental impact assessment, the underground water zoning assessment, water resource assessment, flood impact assessment, scenery resource assessment, water and soil conservation plan, geologic disasters hazard assessment, cultural relics appraisal, the mineral resource survey, seismic safety assessment, electromagnetic radiation environmental impact assessment, noise impact assessment.

Conclusion

This paper is an advanced planning study about the construction restrictive zones nationwide, all the ecologically sensitive elements and disasters risk elements within the Beijing municipal domain were sorted into 5 groups, 16 categories and 56 restrictive elements, total 110 layers, and 250,000 restrictive units, clarified the land use capacity of urban and rural construction.

Basing on the principle of obeying the actual situations, this study has carried out the construction restrictive zoning, the individual management can be given for different projects, villages and scaled urban and town construction. Seen from the results of the construction restrictive zoning, the prohibited zone is 43.7% of the municipal domain area, and the suitable zone is only 527.1 km², see Table 4-1 for details.

Table 4-1 The results of the construction restrictive zoning

| Construction restrictive zoning | Area (km ²) | Percent (%) |
|---------------------------------|-------------------------|-------------|
| Absolutely prohibited zone | 55.5 | 0.3 |
| Relatively prohibited zone | 7130.1 | 43.4 |
| Strictly limited zone | 4819.2 | 29.4 |
| Generally limited zone | 3878.2 | 23.6 |
| Suitable zone | 527.1 | 3.2 |

The prohibition or conditioned construction restrictions on the aspects of land types, construction height, and underground spatial development for various urban and rural constructions can be put forward in the restrictive guidance. Meanwhile, the restrictions for urban activities, such as the damages to environment, the emission of pollutants, the take of resources and the land occupy, can also be put forward therein. Take the limitation of built-up lands for urban and town use as an example, the suitable built-up lands for urban and town use in the whole city is about 3400km², see Table 4-2 for details.

Table 4-2 The restrictive zoning of the built-up land for urban and town use

| Zoning (km ²) | Prohibited urban and town | Limited urban and town | Suitable construction |
|---------------------------|---------------------------|------------------------|-----------------------|
| Whole city 16410 | 13004 | 2937.3 | 468.7 |
| Mountainous area 10072 | 9216.3 | 805.8 | 49.9 |
| Plain 6338 | 3787.7 | 2131.5 | 418.8 |

In this study, the laws, regulations, rules and codes concerning with the urban and rural restrictive elements and 12 categories of professional evaluation have been systematically sorted for the first time. Once the construction conflicting with the restrictive elements, all the relevant organs may cooperate to control the illegal construction from the sources, establish an effective base platform for the management of urban and rural construction.

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