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A Study of Current Land Use in the Urban Area of Ma'anshan City

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Abstract With the acceleration of urbanization, urban development poses a growing demand for land. China's national conditions of a large population with relatively little arable land require us to intensively use land, and more and more departments have been aware of the importance of intensive urban land use. The study on the current land use in the urban area of Ma'anshan City, is not only conducive to adjustment of land use layout and structure as well as urban ecological construction, but also of guiding significance to the economical and intensive land use in Ma'anshan City. This paper first describes the natural, social and economic situation of Ma'anshan's urban area, then analyzes the land use structure, layout and problems, and finally puts forth the recommendations for improving current land use situation in the urban area of Ma'anshan City.

Key words Current land use, Intensive land use level, Urban ecology, Recommendations

1 Overview of the urban area of Ma'anshan City

1.1 Natural conditions Ma'anshan City ($31^{\circ}17' \text{--} 32^{\circ}03' \text{N}$, $117^{\circ}53' \text{--} 118^{\circ}52' \text{E}$) has jurisdiction over three districts (Huashan, Yushan, Bowang), with a total area of 704 km^2 . It is located in the subtropical zone, with annual average rainfall of 1080 mm and annual average temperature of 15.8°C , and on the south bank of the lower and middle reaches of the Yangtze River. It is also at the conjunction of the coastal and the Yangtze River economic regions, an east door of Anhui opening to the outside world. It is an important port city along the Yangtze River, and also the core city of the Yangtze River Delta economic circle within Anhui Province^[1]. Ma'anshan has landforms dominated by alluvial plains with hills interwoven with hillocks. The terrain is relatively flat, slightly higher in the northeast and lower in the southwest. Plains and hills show ribbon-like parallel distribution, roughly parallel with NE—SW tectonic line^[2].

1.2 Socio-economic conditions In 2014, Ma'anshan's economy maintained good momentum of steady and rapid growth, and the economic aggregate increased quickly, with annual GDP of 135.741 billion yuan, an increase of 9.7% over the previous year. In 2014, the urban area of Ma'anshan's had a total population of 1.474 million, with the natural growth rate of 4.12 %. In terms of industrial structure, there was 3.519 billion yuan of investment in primary industry, an increase of 4.7% over the previous year; there was 79.575 billion yuan of investment in secondary industry, an increase of 12.7%, with industrial investment accounting for 47.5% of the city's total investment; there was 84.38 billion yuan of investment in tertiary industry, an increase of 14.1% (Fig. 1). Restructuring has made new breakthrough, the

modern industrial system has basically taken shape, and the added value of strategic emerging industries and modern service industry has quadrupled. Urban residents' consumption rate has improved steadily. The added value of service industry accounted for 35% of regional GDP; the output value of strategic emerging industries accounted for 30% of industrial output value; the share of added value of cultural industry in GDP was greater than or equal to 5%; non-public economy accounted for 60% of total economy. It has initially formed the growth pattern jointly driven by investment and consumption^[3]. In terms of industrial layout, Huashan District cultivates "four leading industries" (modern business, modern leisure industry, animation software industry, machinery and electronics manufacturing), gradually establishes a distinctive modern industrial system, and accelerates the establishment of new pattern of characteristic industry. Yushan District vigorously develops equipment manufacturing industry around engineering machinery, hydraulic machinery and metallurgical machinery, fosters three emerging industries (electronic information, new materials, energy saving), and enhances the competitiveness of traditional metal product industry. Bowang District focuses on three leading industries (metal products, paper and printing, electrical energy), accelerates the development of three major emerging industries (modern service industry, new materials, energy saving and environmental protection), and strengthens the building of four parks with characteristics (export processing logistics park along the Yangtze River, recycling economy demonstration park, equipment manufacturing industry park, ecological economic park). In terms of transport, it is convenient in transport by water, land and air. It only takes a 40 minutes' drive to Nanjing Lukou International Airport. Ma'anshan Harbor, one of the ten major harbors on the Yangtze River, is the State first-class harbor opening to foreign ships. The Nanjing-Tongling Railway Line runs through the city, linking up with Beijing-Shanghai, Beijing-Jiujiang, Wan-Gan and Xuancheng-Hangzhou main trunk lines. The proposed Nanjing station of the Beijing-Shanghai express railway under construction

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will be 20 km away from the city and the Nanjing-Anqing intercity railway under construction will pass through the city. The Ma'anshan bridge across the Yangtze River is under construction, linking up with Shanghai-Nanjing expressway, Nanjing-Hangzhou expressway and Nanjing-Ma'anshan expressway.

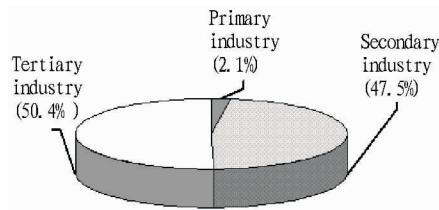


Fig.1 Proportion of investment in three industries to total investment

2 Current situation of land use in the urban area

2.1 Overall situation of land use In 2014, the construction land area was 67605. 99 ha in Ma'anshan City, accounting for 16.7% of total land area; the area of land for city, town and village as well as mining and industry was 55062. 36 ha, accounting for 81.45% of total construction land area; the area of land for transportation and water conservancy was 11094 ha, accounting for 16.41% of total construction land area; the area of other types of land was 1449. 63 ha, accounting for 2.14% of total construction land area.

2.2 Land layout in the urban area There were significant differences in the construction land distribution between districts. The area of construction land was largest in Yushan District, reac-

hing 8711. 61 ha, accounting for 12.89% of the city's construction land; the area of construction land was 7612. 08 ha in Huashan District, accounting for 11.26% of the city's construction land; the area of construction land was smallest in Bowang District, with an area of only 5323. 81 ha, accounting for only 7.87% of the city's construction land (Fig. 2).

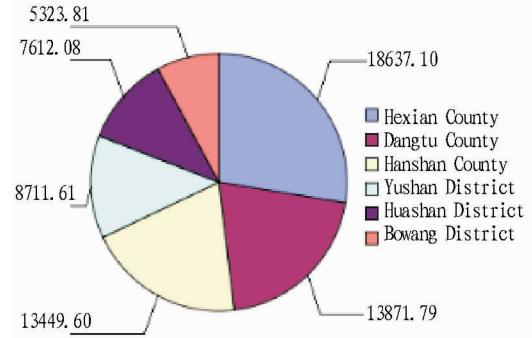


Fig.2 Construction land distribution in Ma'anshan City

2.3 Construction land changes during 2005-2014 During 2005-2014, the construction land area in Ma'anshan City increased from 49802. 68 ha to 67605. 99 ha, with the average annual growth rate of 1780. 33 ha. And the urban and rural construction land occupied a large share, increasing from 39845. 55 ha in 2005 to 55062. 36 ha in 2014; the area of land for transportation and water conservancy increased from 8859. 84 ha in 2005 to 11094. 00 ha in 2014; the area of other types of construction land increased from 1097. 30 ha in 2005 to 1449. 63 ha in 2014 (Table 1).

Table 1 Construction land changes in Ma'anshan City during 2005-2014

	Total area of construction land	Area of urban and rural construction land	Area of land for transportation and water conservancy	Area of other types of construction land	Increment
2005	49802.68	39845.55	8859.84	1097.30	290.63
2006	52730.02	42116.64	9278.00	1335.38	2927.34
2007	51704.76	41447.85	9015.19	1241.72	-1025.26
2008	53990.66	43192.53	9718.32	1079.81	2285.90
2009	62378.46	51276.58	9670.43	1431.45	8387.80
2010	63263.15	5186747.00	9936.41	1459.27	942.58
2011	65056.77	53159.88	10442.93	1453.96	1962.29
2012	65983.38	53832.25	10704.87	1446.26	1207.42
2013	66730.41	54255.19	11027.96	1447.26	762.00
2014	67605.99	55062.36	11094.00	1449.63	786.56

During 2005-2014, the total area of construction land in Ma'anshan City showed an overall increasing trend, and there was significant fluctuation in the increment. In 2005, there was little change in total area of construction land in Ma'anshan City compared to 2004, an increase of 290.63 ha. In 2007, due to different degrees of reduction of urban and rural construction land, land for transportation and water conservancy, and other types of construction land, the total area of construction land in Ma'anshan City decreased compared with the previous year, from 52730.02 ha in 2007 to 1025.26 ha in 2006. During 2008-2014, the total area of construction land in Ma'anshan City always showed an overall upward trend. In 2009, the total area of construction land

increased most, an increase of 8387.8 ha over the previous year. During 2011-2014, the increment of construction land decreased from 1962.29 ha to 786.56 ha (Fig. 3). With the social and economic development, the level of urbanization is constantly improved, and Ma'anshan is bound to have a growing demand for construction land. At the same time, more attention will be paid to farmland protection and ecological construction, which will inevitably limit the new construction land, and pose unprecedented pressure on the supplying of all types of construction land.

3 Problems in land use

3.1 A huge demand for land and obvious contradiction between supply and demand Ma'anshan City is at the rapid de-

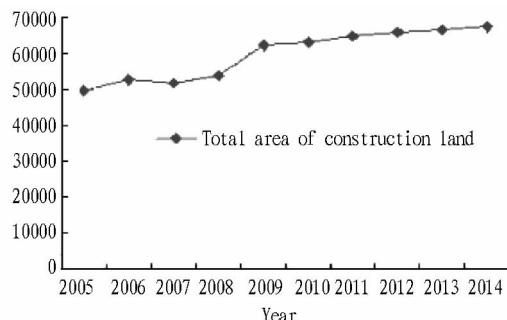


Fig.3 Changes in the total area of construction land in Ma'anshan City during 2005-2014

development stage of urbanization and industrialization, and there is a huge demand for construction land. With the development of the tourism industry, it will increase the land for traffic, post and telecommunications, and communications, as well as the land for trade, food processing and other supporting industries, so the demand for construction land is large^[5]. According to statistics, the proportion of investment in secondary and tertiary industries to total investment is increased in Ma'anshan City, posing an increasing demand for construction land. Based on the annual land use and control quota released by the authorities^[6], the construction land quota is mainly obtained by striving for the planned quota of provincial key projects and reclaiming the homestead land and other types of construction land. However, after the national macro-control on the economy, the land quota is more tightly controlled. There is still a large gap between actual demand for land and usable land quota. Thus, the land shortages will continue for a long time.

3.2 A large area of arable land occupied for new construction land From the annual land use change survey table, it can be found that the annually newly-added construction land in Ma'anshan City occupied a large area of arable land. According to the "balance between occupying and compensation" provisions regarding farmland in *Land Management Law*, for the farmland occupied by non-agricultural construction, it is necessary to supply the farmland of the same quality and area. However, the arable land is still decreasing in Ma'anshan City, and from maintaining food security, economic security, ecological security and social stability, there is a need to implement the most stringent farmland protection system, adhere to both arable land quantity and quality protection, and strictly protect arable land, especially basic farmland. It is necessary to control farmland occupation for urban and rural construction, and increase land consolidation and reclamation efforts to achieve "balance between occupying and compensation" for arable land.

3.3 Low economical and intensive use level of land According to the statistical analysis of land parcel conditions in Ma'anshan City, the plot ratio of high-tech industry zone can reach 2.0, and the building density of commodity retail space is about 40% to 50%, an average of 4 floors, so the standard price index plot ratio of first class commercial land is about 1.8; the building

density of first class residential land is about 25% to 30%, an average of 6 floors, so the standard price index plot ratio of first class residential land is about 1.5; the plot ratio of industrial land is generally about 1.0. In order to promote the economical and intensive use of construction land, the provincial and municipal governments have introduced a number of policies, but the extensive use of land still exists from the current approval of project land.

3.4 Fragile land ecological environment and low ecological carrying capacity Due to limitations in natural geographic and environmental conditions as well as the impact of human economic activity in Ma'anshan City, the natural vegetation has been damaged to varying degrees. In addition to the heavy chemical industry development in recent years, the urban ecological environment is deteriorating, the land contamination is serious, and the sustainable regional development faces great pressure.

4 Recommendations

4.1 Regulating supply and demand to achieve a balance between urban land supply and demand Based on the principle of regulation, we must determine the nature of various types of construction land, and sort the construction land in terms of importance. It is necessary to give priority to affordable housing project land, livelihood project land, major public infrastructure land, strategic emerging industry land and other types of major municipal project land, to ensure that such land demand is not reduced; optimize construction land supply structure and spatial layout, prohibit overcapacity and redundant construction project land, adjust and optimize residential land supply structure, and reduce low density housing supply^[7]. Ma'anshan City is in the city group in Central Anhui and along the Yangtze River, and it lacks land quota, so it is difficult to resolve the problem by tapping the stock of construction land. Without reducing the total amount and quality of arable land, it is necessary to loosen the control over construction land quota and farmland protection indicators, and implement the strategy of "Urbanization away from Home" in the province^[8]. Ma'anshan can use the off-site land transfer paid methods to buy the farmland quota from other cities in the province.

4.2 Putting the protection of arable land high on the agenda

It is necessary to implement special protection for existing cultivated land and strictly implement basic farmland protection system. The National Agricultural Comprehensive Development and Construction Project of High Standard Farmland in Bowang District basically completed in late March 2016, is just an important measure to protect farmland in Ma'anshan City.

4.3 Increasing the displacement of urban land and optimizing the structure of urban land use Irrational structure of urban land is a hidden factor to hinder intensive land use, and it is necessary to establish a long-term intensive land use concept, and shift from the pursuit of maximal use efficiency of single plot to the pursuit of optimal overall structure and function of urban land. The urban land displacement is an important means to achieve op-

timal allocation of stock urban land. Ma'anshan City should continue to implement land displacement system to promote the concentration of industry in park and the concentration of houses in community.

4.4 Optimizing the layout of functional zones based on principles of "centered layout, intensive land use, industrial clustering"

In terms of structural pattern, after the spontaneous development of city, the city will present ring type structure, but in the long run, such structure will cause environmental pollution, traffic congestion and many other social problems, and also lead to isolation of urban space from natural space, thereby having a negative impact on the long-term development of city. Firstly, it is necessary to control the ring type spread of city edge, and obtain the economic vitality of "point-axis" development on this basis. It is necessary to build administrative offices, and science, education, culture and health public facilities in the southwest of the urban area as administrative core while upgrading and improving the existing urban area and cultivating core business area on the original commercial basis, to eventually form "dual-core linkage" pattern. Secondly, for the outlying areas of the city, it is necessary to change ideas and adopt multi-center group structure to make space arrangement of different kinds of industrial parks and future residential areas, respectively, to avoid mutual interference between industry and residence, and the negative impact of mixed industrial types and super large residential areas on the ecological environment, so as to build the spatial structure of whole city of Ma'anshan^[9]. In terms of division of main function areas, in accordance with the planning direction of Ma'anshan City in Urban System Plan in Anhui Province (2011-2030), the urban space is divided into three main functional areas: key development area; restricted development area; prohibited development area. According to the main function area orientation, it aims to gradually form the land spatial development pattern with population, economy, resources & environment in harmony^[9]. Huashan District should focus on cultivating "four leading industries" (modern business, modern leisure industry, animation software industry, machinery and electronics manufacturing), and gradually establish a modern industrial system with distinctive characteristics, to accelerate the establishment of new characteristic industry pattern in Huashan District. Yushan District should vigorously develop equipment manufacturing industry around engineering machinery, hydraulic machinery, metallurgical machinery, and foster three emerging industries (electronic information, new materials, energy saving and environmental protection), to enhance the competitiveness of traditional metal product industry. Bowang District should focus on enhancing the overall quality of industry, lay great emphasis on NC machine manufacturing, precision cutter manufacturing, high-performance precision tools, and vigorously develop equipment manufacturing and machinery industry. Economic and Technological Development Zone should focus on three leading industries (automobiles and parts, modern equipment manufacturing, high-grade food processing); cultivate three emerging indus-

tries (energy saving and environmental protection, new materials, electronic information); improve comprehensive supporting service function, moderately develop logistics business, real estate and other industries; create new development park with clustered industries, developed business services, and sound life function. Demonstration Park should intensify the efforts in infrastructure construction and investment promotion, and accelerate the cultivation of service areas of new energy, equipment manufacturing, electronic information, modern logistics, creative industries, business and government administration, in order to make it become a forerunner area undertaking industrial transfer in the Wangjiang area and a demonstration area of urban and rural coordination. Cihu High-tech Zone should accelerate the transformation of park, promote the optimization and upgrading of industrial structure, and focus on the development of port processing, industry of fine chemicals, paper making, metal products, modern logistics, energy and other industries, in order to become a modern open economic development zone with great economic strength, high technological level, optimal industrial structure, and complete traffic facility^[10].

4.5 Establishing evaluation system for intensive land use

Land administration departments should establish the evaluation system for intensive land use, and adopt incentives to encourage intensive land use and measures to inhibit extensive land use, to promote intensive urban land use. For the approved projects, it is necessary to evaluate the intensive use level of the land approved earlier, and for the projects which do not meet the standards, the land at later stages will not be approved. In addition, we can conduct annual intensive land use assessment in the subordinate areas. For the areas with high intensive land use level, there is a need to give a series of awards such as preferential arrangement of the next year land use plan; for the areas with low intensive land use level, it is necessary to limit the expansion of existing construction land, and strengthen the intensive use of existing land.

4.6 Protecting the existing ecological land from being reclaimed into construction land

It is necessary to strength the work in human and nature reserves, and stop the destruction of tourism resources. Apart from the buildings directly related to protection, any other type of construction is prohibited. Any unit or individual occupying land and building tourism-related facilities in tourism protection area, has to be approved by land and resources departments and scenic area management departments in accordance with plan. Afforestation is encouraged for landscaping and improving the construction of ecological civilization.

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land requisition notice in advance, and formulate land requisition compensation scheme in time. For farmers unwilling to accept land requisition, government should promptly communicate with them, patiently explain related land laws and regulations, to satisfy demands of farmers as much as possible. Government should not take force in land requisition, to avoid more land requisition disputes and conflicts. Besides, before land requisition, government should invite farmer representatives to discuss matters about land requisition, encourage farmers to put forward suggestions, jointly discuss land requisition compensation procedure and scheme, and reduce information asymmetry as much as possible, to raise satisfaction of farmers with land requisition.

5.3 Improving land requisition compensation and resettlement and increasing compensation standard Regression results indicate that land requisition compensation and resettlement have significantly positive influence on satisfaction of farmers with land requisition. In regression coefficient of all variables, the compensation and resettlement have the largest regression coefficient, indicating farmers care much about compensation and resettlement. After losing land, farmers lose dependence and thus urgently hope government can solve the problems of their employment, housing, household registration, and children education. Farmers stated that the compensation standard is relatively low, so most of them do not accept land requisition. Therefore, government should formulate land requisition compensation standard as per supply and demand relationship of land market. When formulating the compensation standard, government should take full consideration of opinions of farmers, meet their expectations as much as possible. Farmers are weak groups and need certain time to adjust and adapt to new life and new jobs after losing land.

5.4 Enriching land requisition compensation content to promote diversified compensation ways At present, many places implement lump-sum monetary compensation and rapidly implement compensation. Although this can rapidly complete the problem of land requisition compensation payment, the lump-sum monetary compensation is not favorable for long-term livelihood of farmers. Lump-sum monetary compensation only provide monetary compensation for farmers, but offer no guidance about employment or undertaking, and related social security is not well established. If farmers have no plan about the compensation amount, they will use up rapidly, leading to hard living and decline of living conditions. Therefore, government should promote diversified land requisition compensation ways, such as buying social insurance for

farmers, allowing farmers to participate in bonus share through pooling of land as shares, or making them share bonus of land appreciation, so as to realize sustainable development of farmers and promote construction of new socialist countryside.

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