

Redevelopment of Industrial Wasteland Based on Renewal of Mining

Cities: A case study of Xiaqiao industrial wasteland

A mining city means that the city rises and develops because of the exploration of the mineral resources. The mining industry has a radiant effect to the development of economy and society, and has the decisive function to the rise and fall of the city. Currently there are 426 mining cities (towns) in China, where residents' population amounts to 310 million, distributing in most of provinces and municipalities of China. Because of the un-regeneration of mineral resources, as well as the increase of the exploitation strength, and the accumulative effectiveness of mining, in recent years, the proportions of mining cities (towns) in our country, which are in initial stages and mature stages, are 20% and 68% respectively. These mining cities (towns) had ever done huge contribution to the natural economy in the planned economy period of China, 12% of which are placed to the declining period. Because resources in mining cities have already appeared to dry up, the development of cities meets many difficulties: the deficiency of infrastructure, the low level of city construction, the singleness of industrial structure, the slow development of third industry, the increase of unemployment, the serious destruction of the environment. Many mines are discarded; much land falls to subside; the water system is polluted; waste piles up such as hills. So the mining cities in the declining period, have to reply the common challenges from economy, society and ecosystem. It becomes the basic aim of the renewal of mining cities that how to convert the cities full of contradictions to the cities suited for living, which have the motive of the development.

1. The background and problems of the Xiaqiao industrial wasteland

1.1 Background

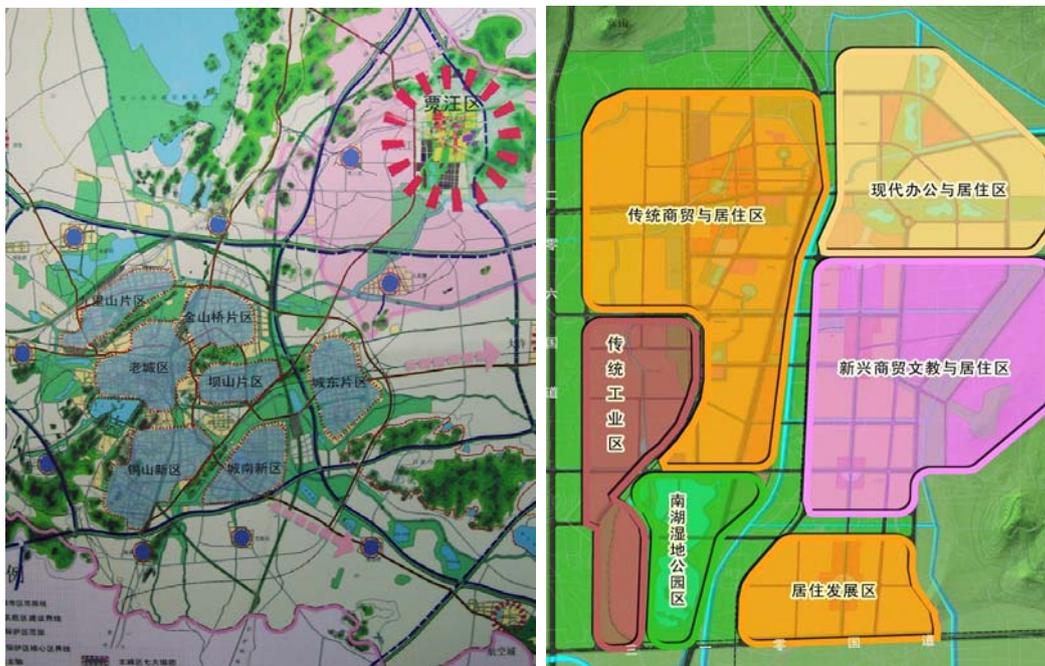
The Jiawang district where the Xiaqiao mine stands, is the farthest administrative area from the centre in the city of Xuzhou, which is apart from the main city area about 38 kilometers, forming a comparatively independent city area (graphics 1). The Jiawang district is a typical model of resource-city area, where "mines were built for coal, and city was constructed surrounding the mines", and it has a history of nearly 100 years. The administrative area of the Jiawang district is 690 km², and the area of the coal field is 202 km², which takes up near 1/3 of the total area (graphics 2). As the pillar industry of the Jiawang district, the coal industry has done huge contribution to the development of city of Xuzhou even the Jiangsu province, but as the coal resource drying up, numerous coal mines in Jiawang district have stopped production and closed successively since 2001. Up to the present, there have been 3 large state-owned coal mines to be closed successively, each of which produced more than 1.2 billion tons each year. All the small coal mines are ordered to close. Currently there are only few mines exploiting in Jiawang district, where there were mines everywhere in the past. As a typical model of resource-city area, Jiawang district faces the serious shakings from the structural transformation to the regrouping of resources and the unbalance of environment. The Xiaqiao mine the paper talks about is the biggest in numerous

closed mines, and it is the one that is nearest to the main city area.

The Xiaqiao mine locates the southwest of the central city of Jiawang district, and it is a large state-owned coal mine which produced more than 1.2 billion tons every year before. Because coal resource was dried up, the mine closed on 22nd, November, 2001. The Xiaqiao industrial area including waste dump, covers nearly 80 hm², which is 1/4 built-area of Jiawang district. After the closure of mine, many industrial equipments and workshops were completely neglected. The industrial square, covering the area of nearly 31.5hm², is managed in a closed way because the land property belongs to the former mine enterprise.

The huge industrial wasteland not only destroys the spacial structure of the inner city, but also brings a series of problems involving economy, society and ecosystem, obstructing the long-term development of the city. So it becomes the key problem of the wasteland redevelopment and land reuse in Jiawang district, that how to deal with the numerous industrial wasteland created by closure of mines, and how to redevelop the wasteland and change the burden to the resource at last.

1.2 Problems



Graphics 1~2 Sources: Planning Department of Jiawang District

- The unbalance of industrial structure

Up to 2002, many mines including Xiaqiao mine in Jiawang district had been closed, and 300 billion property was covered under mines. In that year the finance income of Jiawang district reduced about 50 billion Yuan. Because of the degeneration of the related industries of mining industry, the industrial structure faces adjustment and transformation as a whole. Although the government has also started the investment on non-traditional industries, the advantage with industrial features of Jiawang district has not been expressed.

The economic structure still centralizes the traditional industries with intensive labor and resource such as building materials, electric power, chemical engineering and exercise equipment, etc. The modern manufacturing industries with intensive technique and capital are weak, as well as the market competition power of the industrial products. The stagnation of

economy results in the weakness of finance power, the reduction of investment to the construction, the lack of city functions as a whole, and it brings disadvantageous influence to the development of mining city.

- The loss of land function and the preservation of the city culture

On the one hand the loss of original function in industrial wasteland makes the history of mining be forgotten gradually, and the dynamic atmosphere of mining production has disappeared in people's memory. On the other hand, because the mines hasn't any planning after sudden closure, it can be viewed as a fast-changing process, that the industrial construction is out of balance, the land function transforms, and the population structure changes. The traditional cultural circles and living modes in mining cities are broken, but it is difficult to build up the new living environment and cultural atmosphere in a short time. Therefore the mentality of persons in original mining area becomes out of balance, and the former community structure was destroyed and disaggregated, etc.

- The closure of mines and the stabilization of society

The closure of the Xiaqiao mine makes lots of workers be unemployed, bringing extreme pressure of reemployment. Among them many people have to leave the hometown to find new means of subsistence, and the large state mine-enterprises unburdened the weight to withdraw in a whole skin, which makes the retired workers that belong to these mine enterprises before not only independent on the government but also deviated from the former mine enterprises. They only depend on slender pension or expenses that are paid according to the working age to keep the pot boiling, whose lives and the living conditions are difficult. From the statistical data, it can be seen that in 1991 when the industry was most flourishing, the amount of the workers who went down mines in the Hanqiao mine¹ was 5254, but in 2000 before closure of Xiaqiao mine, the number of workers under mines already reduced to 2800, and after closure of the mines, the workers in Xiaqiao mine were all bough off by the working age (table 1). Then a great deal of unemployed persons appeared apart from few workers in Hanqiao mine. At the same time, because the local economy is declining, the number of unemployed persons increases continuously; the public security is worsen and the contradiction between the mine enterprise and the present government tend to be much acuter day by day.

- Ambiguity of the land power and management of the city construction

The long-term abandon of industrial wasteland attributes to the ambiguity of the land ownership and usufruct between the government and the mine enterprise. Before the closure

Table 1 the final numbers of the workers under mines in the Hanqiao mine (1991-2000)

The Hanqiao mine

unit: person

Sort \ Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
All workers under mines	5254	5166	5364	4596	4286	4066	3880	3291	3046	2800
Workers on the mine working face	1061	1294	1176	1060	797	834	843	742	580	419
Digging workers	1289	1248	1227	1188	1054	1042	902	546	537	608

Source: 《Compilation of The Economic Development of the mine department in Xuzhou》

of mines, the mine enterprises and the city government usually set out from their own benefit respectively, so they are lack of necessary coordination and unification when solving problems of city construction and development, which results in the abruption and insulation of the city structure as a whole. And after mine closure, the problem of power adscription rises again as a key point to emphasize, which brings much encumbrance to the reformation and reuse of the wasteland. The sharp reduction of finance income of the government and the economic decline of district make the contradiction between them much more severe. So the benefit cooperation and management implementation of the city construction won't go on successfully.

- Industrial pollution and the renewal of the city environment

The abandon of the industrial wasteland causes many extreme pollution problems in city, especially in the area where the function of production and life were mixed. A great deal of waste water, gas and waste residue brought by mining not only results in many phenomenon such as cracks, transform, subsidence of ground and pollution of soil, etc, but also destroyed the ecosystem completely, having an huge effect on the environment quality of surrounding communities and public open spaces(graphics 3~4). According to statistics in 2001, there are 26 waste dumps on big or small scale in the Jiawang district, and the total quantity piled up is close to 16.5 Mio. t, covering about 66 hm². The wasteland left by closed mines for the exhaustion of mineral resource takes up areas nearly 133hm².

2. The values of the Xiaqiao industrial wasteland



Graphics 3~4 Sources: photos by authors in 2006

2.1 Regional value

The Xiaqiao industrial square is located in the southwest of the Jiawang district, covering nearly 1/4 built-up area of the Jiawang city. In the east of the industrial square there is the main street called the Jiahan Street, and the Jiawang Cultural Park is built up on the east, around which there are lots of former workers' residence zones left. The Jiawang dynamoelectric factory is neighboring in the south. Currently a cement enterprise occupies the south of square, where parts of original mine facilities were reused even destroyed by now.

There is a large area of farmland that has been already reclaimed, and many fish ponds caused by subsided area of mining are of high value of landscape, composing a beautiful drawing. Besides, there are also many workers' residence zones in the north, as well as a rail station used to transport mining products specially.

2.2 Historical and cultural value

Although the mining activities have destroyed the natural physiognomy seriously, the long history as well as special forms of the industrial wasteland has formed the special humanism and historical landscape of the mining areas, among which the places and constructions that



Graphics 5~8 sources: photos by authors in 2006

are used for mine exploitation have become the symbols of the mining area, and refracting the dynamic changes of the industrial development in mining cities at the same time, including the history of economic and social development as well. it's the mine equipments and factory buildings even the slogans existed in the field that write down the glorious history covering more than 100 years from the rise to the decline of mining cities (graphics 5~8) .

2.3 Economic value

In the aspect of the renewal of mining cities, the regeneration and reuse of the Xiaqiao industrial wasteland can acquire a great deal of constructing land, not increasing new land.

The reuse of land involves many ways: to provide the industrial field for the high-tech

business enterprises based on environmental protection; to explore residence zone with mining features in order to make population accumulate in the south of Jiawang district where the environment is worse now; to built up a large base for leisure and education and provide the spaces of amusement and studying to the citizens. No matter which form it develops in, the redevelopment of Xiaqiao industrial land will be beneficial to the local economy.

2.4 Ecological value

As the long-term abandon of the Xiaqiao industrial wasteland, new areas with higher ecological value around many buildings or water have appeared (graphics 8~10) . The abundant original biology species can be reserved, and the microorganism circulation which forms in a long time provides the living space for many species which existence is threaten in other regions of the mining cities, establishing the foundation for increasing the species of the mining cities. On the other hand, the special manifestation of the industrial square will increase the landscape elements of the mining areas, such as waste dumps, abandoned industrial facilities and factory construction, new water system, etc. The redevelopment of the field will make their own features of mining emerged in front of people.

2.5 Educational value

Through the reservation of the old facilities and the conformity of the production lines in the Xiaqiao industrial wasteland, one of possibility is to build up an industrial educational base and construct a landscape park with distinct subjects, making full use of science education potential of the wasteland, The successful cases in reuse of industrial wasteland of foreign



Graphics 9~10 sources: photos by authors in 2006

countries indicate that, it is of profound sense that making most of abandoned mines match with the various real remains, and carrying on various education and publicity on science knowledge, ecosystem environment and sustainable development of mining cities, surrounding the process of mining exploitation, which makes people understand the operation process of the original industrial production, and obtain knowledge in the course of playing.

3 The city renewal targets of the industrial wasteland redevelopment

The redevelopment of industrial wasteland is considered as a motivation of economic development, society progress and environment improvement in the city renewal and also as

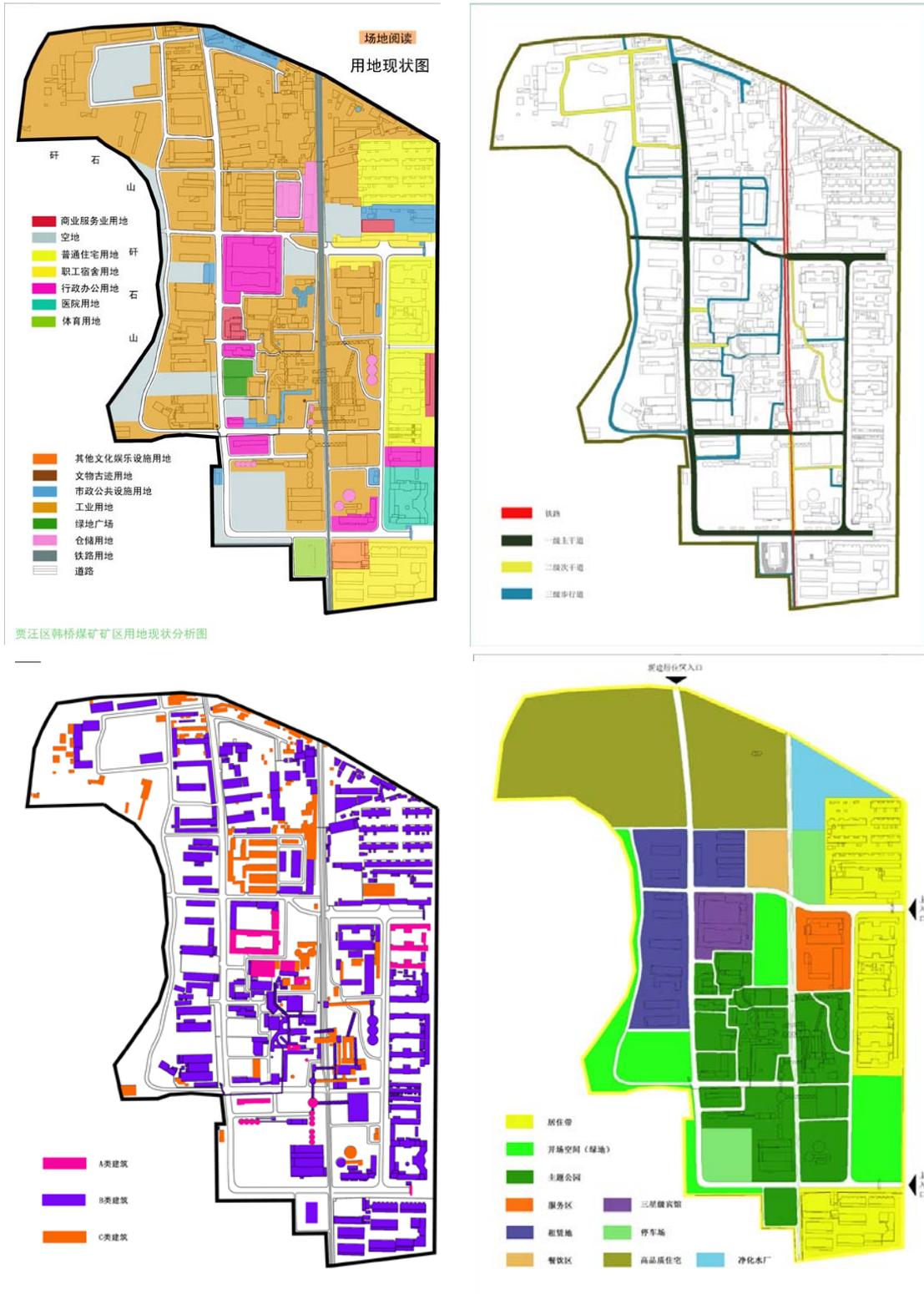
a chance of remolding the spirit and image in the city. The target of the city renewal should be based on the adjustment of the whole functions and structures in the city, and it should be changed from purely paying attention to the improvement of the city material environment in the past to paying attention to the comprehensive target of the city competitive abilities, exalting the city life quantity and pushing the society overall progress. So the city where the mines have been closed not only need to integrate the material space, but also urgently need to integrate the economical and cultural structure in the whole frame of the city renewal.

- Excavate the potential of the industrial wastelands and change the burdens into resources;
- Improve the whole environment of the industrial wastelands and construct new living space in the city;
- Build up a new city center with creative meaning which is based on an old mining area;
- Integrate the comprehensive resources in the city and create new opportunities for unemployed people;
- Create beautiful environment and improve the dirty, disorderly and bad images of the mining city in people's mind;
- Attract foreign investment and optimize the industrial structures of city step by step.

4 The redevelopment planning of the Xiaqiao industrial wasteland

4.1 The investigation of the field

Since November of 2005, the research group has earnestly investigated the Xiaqiao industrial square by the methods of noting, gathering news, taking photos, measurement, drawing, etc. At first, after touching bottom of the land totally, we complete an analytic picture which points out the original functions of land-use and the present road condition in the Xiaqiao industrial square (graphics 11~12). Then we valuate and categorize the buildings and constructions in the field by six aspects: structure, space characteristic, building style characteristic, historical value, material color and peripheral environment. Each factor is counted as 5 points, and from high to low represents the good, the comparative good, the general, the comparative bad and the bad respectively. After the decision of each factor's point by the case summaries and the expert assessments, we grade the points to each building and get the worth classification graphics of the buildings in the base (graphics 13). Speaking in a specific way, we classify the buildings and constructions as the A class, the



Graphics 11~14 Sources: drawn by the research group

B class and the C class according to the last points. The A class constructions preserved well totally, have higher reuse value and can not be tore down if no special request. The B class constructions preserved generally, can continue to use after carrying on reformation or adding constructions, which usually are suggested to reserve. The present condition of the C class constructions is worse, so the reuse possibility is little and they can be considered to tear

down when re-planning.

In addition, the group also carries on a detailed investigation of the plants in the land. There are 26 kinds of original living and reborn plants, among which the evergreen is in a great measure, and the hardwood only has a small percent. The plant clusters inside distribute in the form of blocks, and based on the original planting system, a new ecosystem has been built up for the long-term abandon. The growing ages of the original planting clusters are about 50 years with strong stability; but that of the newly developed plant clusters are 2 or 3 years, which stability is extremely weak.

4.2 Establishment of the integrating and reborn system of the industrial wasteland in the Xiaqiao mine

According to the investigation before and the objectives of integrating system, and in the restriction of the general planning of Jiawang district, the research group consults and discusses with the planning department in the government for many times, then establishes a new planning system for the industrial wasteland of the Xiaqiao mine, in consideration of the total functions of the city area. We define the function of the land as a comprehensive land including residence, entertainment, leisure, business and restaurant as a whole, in the middle of which there is a mining topic park (graphics14).

According to the conditions of the wastelands, it is planned as 9 different functional areas to be reused, and we will construct the integrating and reborn system in 4 aspects as follow:

4.2.1 Integration of the material space

The integration of the city space: The space conformation and the function of a city affect and restrict mutually. Although the disappearance of original functions of mining, the wasteland in the Xiaqiao mine is inevitably requested to produce new city space conformation in the face of the transplantation of new functions and new industries. At first, it is necessary to strengthen the weak relation between the wasteland and the Jiawang city space, to break the close structure of the original land, to connect the reconstructed industrial wasteland with the central city areas organically. It must be paid attention to that the new buildings should be harmonized with the old buildings in appearance characteristic. The original space structure, the road system, the environment in the field and the whole style of building clusters must be preserved, developed and improved in course of wasteland redevelopment.

Secondly, it is considered that a two-core space structure in old city area of Jiawang district will be built up through redevelopment of the Xiaqiao industrial wasteland, namely the former business center in the north of the old city and the cultural and entertainment center surrounding the Xiaqiao mine in the south. In the latest construction planning of "Xuzhou general planning", it is suggested to establish a mining topic park making use of the relic in the wasteland, and construct public facilities such as cultural center, library and calligraphy houses, etc, which will promote the development of culture in Jiawang district and make people congregate by setting up a particular industry cultural atmosphere. So the redevelopment of the Xiaqiao industrial wasteland is not only the renewal of the edge regions, but also the creation of another pole to make the Jiawang city become the two-core space

structure.

The integration of the land use: it is suggested that the construction should be considered in a step-by-step way following the new planning, according to the principle of “classified preservation, gradual exploitation”, in order to avoid the negative effect brought from the gusty reconstruction in a big scale and at a high speed. So the construction of the mining topic park and the reuse of the main industrial buildings around are considered as the programs operated in the first instance, then the renewal of the residence zones in the north and east is carried on afterward. Generally speaking, the variety of the functions in the field indicates the diversity of the land-use and comprehensive effect of redevelopment:

- the one-floor workshops preserved well In the west are suggested to be rebuilt as leasing areas, and supplied for some high-tech business enterprises as office areas, or for the artists as places of creating, living and communicating. These buildings even can be rebuilt as apartment-style hotels for business.
- The mining topic park in the middle of field is the emphasis in the redevelopment of Xiaqiao wasteland. We think the complete producing lines, the original space structure and the appearance characteristics in the main factory area should be reserved first, then the industrial buildings should be rebuild as a museum or a cultural center for art communication. At the same time, a series of open and half-open spaces for citizens' activities formed.
- Requirement for various residence become increasing rapidly in Jiawang district, including the economical houses for former mine workers and the high-quality buildings provided for high-income families in the city, so the land in north is identified as a high-quantity residence zone: firstly, appropriate development economizes the land resource effectively by making use of original infrastructure, and activate the construction of public service as well as the development of the third industry. Secondly, the reservation of industrial landscape and industrial inheritances increases some new active element for residence, with which the design of the public open spaces will raise people's historic memories of mining production.
- The green open space which located in the north of the topic park, is surrounded by the comprehensive public service such as hotel, dinning house, gymnasium, etc, which create opportunities to develop the third industry. The land will build up a link between the high-quality residence zone and the mining topic park.
- The integration of the road system: the former web of transportation will be remained, and the walking system and the linearity open space system are emphasized following the old railway. When dealing with the planning of entrance, two main entrances in the east of the field are reserved, and a special entrance in the north for residence zone will be constructed. It must be emphasized that one of entrance in the southeast will be expanded in the form of a piece of green land, in order to make this field open and

continuous to the outer space, and change the close endocentric wasteland into public green land open to the citizens in Jiawang district.

4.2.2 Integration of economic structure

From the perspective of mining city renewal, it is important for mining cities to integrate present economic structure before the closure of mines, and find new follow-up industries to attract high-tech enterprises to invest in Jiawang district. The essential of the reorganization and transformation of the industrial structure of mining cities is to promote the sustainable development of economy and make the economic activities develop in a diversity way.

Concretely speaking, the reconstruction and redevelopment of the Xiaqiao industrial wasteland should completely respect the objective economic rules in the Jiawang district. The government should make sure of the industrial development objectives in the frame of the macroscopical adjustment of industrial structure, and put forward planning and designs of new programs in relation to reconstruction of wasteland and introduction of new industries by conceptive design competitions. The permutation of land makes the adjustment of industrial functions possible to offer new chances for the development of economy and supply more opportunities for the unemployed.

4.2.3 The integration of social culture

As the mining birthplace of Xuzhou city, the Xiaqiao mine has high historic and social value, where the remaining buildings and constructions in the field are of special esthetics values. As the history witnesses of industrial development of Jiawang, they are important mediums by which the mining city will be known by external world.

As a carrier of history and culture, they compose a special landscape in the balance of the new and the old, arousing the development motivity of the city. It is very important to emphasize the significance of industrial cultural heritage with the view of culture of city in the course of the redevelopment of wasteland, and identify the basic objectives of renewal according to the principle of protecting history and culture. Then all the valuable heritages should be preserved and reused, and be endowed with new forms and functions in the memory of old mining culture. At the same time, it is paid attention that the special industrial cultural resource is the hard base for the culture development of Jiawang, and the meaning of which should be understood. The new regional image of Jiawang district should be built up, to improve the humanity environment, to increase the self-identity and pride of local residents. Besides, it is efficient supplement to carry on the industrial cultural exhibition and travel activities in the renewal of mining city.

4.2.4 Integration of ecosystem environment

The continuous decrease of the environmental quality has already become the significant reason for the stagnation of the mining city development. the pollution of surrounding environment for long-term mining in the area makes it difficult to attract population and powerful investment. So it is a premise of economic and social renaissance to build up proper

green-space system, and to renew the ecosystem with the respect of original plants. In the redevelopment of Xiaqiao wasteland, the integrality and value of the green-land system in the city should be promoted by protecting the original and neonatal plants; open spaces should be encouraged to interlude orderly into the green-land system by integrating city space especially in areas with high density; the image of Jiawang district with serious pollution should be altered completely in order to increase the attraction to the business enterprises, and provide the possibilities that new ecosystem can be maintained and balanced.

5 Conclusion

With the propulsion of the economic globalization, the adjustment of the industrial structure and the reduction of mineral resources lead to the profound transformation of the external and internal environment of mining cities in China. Under the background, it should be firstly considered how to integrate present resources of mining cities and how to discover the latent resources. It is a trial on mining city renewal to research on the redevelopment of Xiaqiao industrial wasteland in this paper, which is aimed at economizing land, improving environment, promoting economy, reforming city image, changing the “burden” into “capital”, etc.

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¹ Hanqiao Coal Mine is made of two parts: Hanqiao mine and Xiaqiao mine. Xiaqiao mine was closed on 22nd November, 2001, but Hanqiao mine is still operated up to now.