Research on the Protection and Development of Industrial Heritage in China and Europe under the Background of Urban Renewal—the Case of Hanyeping Company

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Abstract
As the first steel and coal joint venture in modern China to use advanced machinery and equipment for large-scale production, Hanyeping Company is an important practical case for scientific and technological exchanges between China and Europe. Based on the research on the construction of industrial heritage systems in China and Europe, the paper sorts out the historical development background and actual protection situation of the Company, and analyzes the intrinsic connections and shared values of industrial heritage in time, space, function and cultural dimensions. It is of fundamental guiding significance for the renewal and development of China's industrial cities, and has important reference value for promoting the construction of a systematic and holistic protection and utilization system for world industrial heritage.

Keywords
Self-Strengthening Movement, Technical Import, Linear Industrial Cultural Heritage, Urban Regeneration and Development

Introduction
The 19th century was the period of the emergence of the first industrial revolution, when European countries represented by the United Kingdom began to replace the traditional handicrafts with mechanisation and large-scale production methods, which greatly improved production efficiency. The development of industry led to the migration of a large number of people from the rural districts to the cities, promoting the process of urbanisation in Europe, and realising the country's economic development and social progress. However, at the same time, China was suffering from the failure of the two Opium Wars[1] and the Taiping Rebellion[2], which opened up a number of trading ports, leading to the disintegration of China's natural economy as well as the emergence of the bud of capitalism. In order to cope with these internal and external challenges, the bureaucrats represented by the landlord class, realised that capitalism could be used as a means of developing industry and commerce to maintain the feudal rule of the Qing government, and initiated the Self-Strengthening Movement[3] under the slogan of "learn from the foreigners in order to gain command of them", introducing advanced Western science and technology on a large scale, and setting up a series of modern military

[1] The Opium Wars in the mid-19th century were a critical juncture in modern Chinese history. The first Opium War was fought between China and Great Britain from 1839 to 1842. In the second Opium War, from 1856 to 1860, a weakened China fought both Great Britain and France. China lost both wars.
[2] During the years from the first year of the Xianfeng reign to the third year of the Tongzhi reign of the Qing Dynasty (1851-1864), a peasant uprising war against the feudal rule of the Qing Dynasty and foreign capitalist aggression was initiated by a leading group composed of Hong Xiuquan, Yang Xiuqing, Xiao Chaogui, Wei Changhui, Shi Dakai, and others, starting from Jintian Village in Guangxi.
[3] It was a self-strengthening movement of the late Qing Dynasty from the 1860s to the 1890s, led by the Westernization faction, which utilized Western military equipment, mechanized production, and scientific technology under the slogans of "self-strengthening" and "wealth-seeking" in an attempt to salvage Qing rule.

industries and civilian enterprises, thus promoting the process of China's modernisation. With the construction of the railway, China's demand for iron was increasing day by day, the development of the iron industry has become a pressing task. In 1890, Zhang Zhidong[4] supervised the Lu-han Railway[5] and transferred to the Governor-General of Hubei and Guangdong Province, in Hanyang at the foot of Guishan to establish the Hanyang Iron Works. In 1893, Daye Iron Ore Mine was built as a large-scale open-pit iron ore mine, and began to be mined on a large scale, to provide raw materials for the Hanyang Iron Works. Due to the high phosphorus content of Daye iron ore, the steel produced was easy to be brittle and cracked. In 1896, Sheng Xuanhuai[6] took over the ironworks, and began to mine and refine a large amount of high-quality coal and coke in Pingxiang, Jiangxi Province, to produce compliant rails, which solved the problem of the shortage of raw materials. In 1908, in order to solve the problem of insufficient operating funds, he applied to the Qing government for a merger of the Hanyang Ironworks, Daye Iron Mines, and Pingxiang Coal Mines, to form Hanyeping Coal and Iron Works Co.

As the earliest iron and steel joint venture in China, Hanyeping Company spatially distributed across a number of cities including Wuhan, Daye, Pingxiang, Shanghai and Chongqing, the process involves important production steps such as coal and iron ore mining and iron and steel smelting, and the dissemination of technology involves the introduction of Western science and technology and machine production, and the promotion of advanced industrial production management systems. As a representative of large-scale linear industrial heritage, it has promoted the development of a transport system linking raw materials and products to multiple locations, driven regional economic ties in the central region, and had a profound impact on urban spatial landscapes, production and living patterns. The paper describes the historical development of Hanyeping Company using the methods of metallurgical development history and urban planning history, and analyses the current situation of Hanyeping industrial heritage. Combined with the current experience of industrial heritage protection system in China and Europe, it explores its historical and cultural value, lays the research foundation for the establishment of Hanyeping industrial cultural routes, and provides important reference value for the overall protection research of regional industrial heritage.

1. Historical Development of Hanyeping Company

As an important iron and steel joint venture in China, Hanyeping Company went through three periods of institutional changes: government-run, government-supervised and merchant-managed, merchant-run. With sufficient capital investment and government support, it introduced technological innovations and adjusted its institutional structure to adapt to changes in the global market and promote the development of national capitalism. By analysing the overall historical development of the company, we could better understand the development history and characteristics of modern Chinese industry in the context of the socio-economic environment of the late Qing Dynasty.

[4] A Chinese politician of the late Qing Dynasty and a prominent figure of the Westernization movement. He held various positions including tutor, reader, lecturer, cabinet scholar, governor of Shanxi, governor-general of Guangdong and Guangxi, governor-general of Hubei and Hunan, governor-general of Jiangsu and Zhejiang (acting on multiple occasions but never confirmed), and Grand Secretary of the State Council. He vigorously advocated for the integration of traditional Chinese studies with practical Western knowledge, emphasizing "Chinese learning as the foundation and Western learning for practical application." He placed great emphasis on education and law enforcement, spearheading the modernization of China's police system, which had a significant impact on education and social development in late Qing China. Additionally, he established the Hanyang Ironworks, Daye Iron Mine, Hubei Arsenal, and other enterprises.

[5] The Lugou Bridge and the railway from Zhengzhou to Hankou were the first railways planned for construction by the Qing government of China after the First Sino-Japanese War. They were supervised by the Minister of Beiyang, Shen Xuanhuai, who oversaw the construction of the Luhan Railway. Construction began in 1897, with work starting simultaneously from the north and south ends by the end of 1898. The Yellow River Bridge in Zhengzhou was completed on November 15, 1905. The entire line was completed and opened to traffic on April 1, 1906, with a total length of 1214 kilometers, and it was renamed as the Jinghan Railway.

[6] A representative figure of the Self-Strengthening Movement, he was a renowned politician, entrepreneur, and philanthropist who founded the Beiyang College and Nanyang Public School.

1.1 Government-run Period (1890-1895)

In 1889, Zhang Zhidong planned to set up a factory in Fenghuanggang, Guangzhou under the support of the Qing government's grant, and purchased 2 blast furnaces with a daily output of 200 tonnes as well as machines and equipments for making clinker iron, steel, pressing plate, drawing bar from the Tee Sides Company in Middlesbrough, England[7]. After that, he transferred to Hubei to be the governor of Hubei and Guangdong province to supervise the southern section of Luhan Railway. and to facilitate the regional management, he asked the court to move the ironworks to Hubei. In order to facilitate the regional management, he asked the imperial court to move the ironworks to Hubei, decided to set up a factory in Hanyang area of Wuhan, and shipped the equipment ordered by Guangzhou Ironworks to Hubei instead. To facilitate regional management, he petitioned the court to move the ironworks to Hubei, decided to set up a factory in the Hanyang district of Wuhan and to ship the equipment ordered by the Guangzhou Ironworks to Hubei instead. In 1890, Hubei Iron Bureau was established, which undertook the three major tasks of iron development, coal mining and plant construction, and successively organised 15 batches of 30 people to explore coal and iron in Hubei, Hunan, Sichuan and other places, and hired some foreign mining engineers to explore the iron ore mine in Daye repeatedly, confirmed that Daye iron ore has abundant reserves and can be used as raw materials for smelting.

In 1891, the infrastructure project of Hanyang Iron Works was designed by British engineer Johnson[8] and supervised by Henery Hobson[9]. All materials were imported from Britain and Belgium, building construction and equipment installation were carried out alternately, which took two years and ten months to complete all the construction tasks. Walls were built around the factory, and four main gates were set up, namely, the main gate (facing the Han River), the Xingren Gate (facing the Yangtze River side), the Neode Gate (right side of the main gate), and the Dachang Gate (left side of the main gate). In order to facilitate the entry and exit of materials after construction and production, a pier was first built along the Yangtze River, all of which were made of red sandstone. A large gap was reserved in the middle of the pier, which can be made into a 300-foot-long ramp by steel and timber, and its inclination can be changed according to the rise and fall of the Yangtze River water level. There were large winches, cranes and other equipment on the shore, and a 6-kilometre-long light railway was laid from the bank of the Han River to the factory so that materials could be transported directly to the construction site, and facilities such as an unloading ramp bridge were established. The factory was divided into two types of industrial buildings and civil buildings, with six large factories, four small factories and residential buildings. The six large factories included pig iron plant, clinker plant, Bessemer steel plant (converter steel factory), Martin steelworks (flat furnace steelworks), rail manufacturing works, iron goods manufacturing works, and the four small factories included machine factory, iron foundry, blacksmith factory, fish fillet hook and nail factory. Civilian residences were mainly occupied by technical personnel and were divided into buildings or rooms. The general layout of the ironworks was designed according to the process, means of transport and the actual situation in Hanyang, and the work production lines were designed to avoid crossings and to be short. The building was always planned and comprehensively arranged in terms of energy supply, water supply and drainage, warehousing and transportation, equipment maintenance and administrative management.

[7] A large steelworks stretched from the town of Middlesbrough in North Yorkshire, England, to the town of Redcar along the southern bank of the River Tees. At its peak, there were 91 blast furnaces within a 10-mile radius of the area.

[8] The designer and draftsman of the Hanyang Ironworks.

[9] The Chief Engineer of the Hanyang Ironworks before 1892.

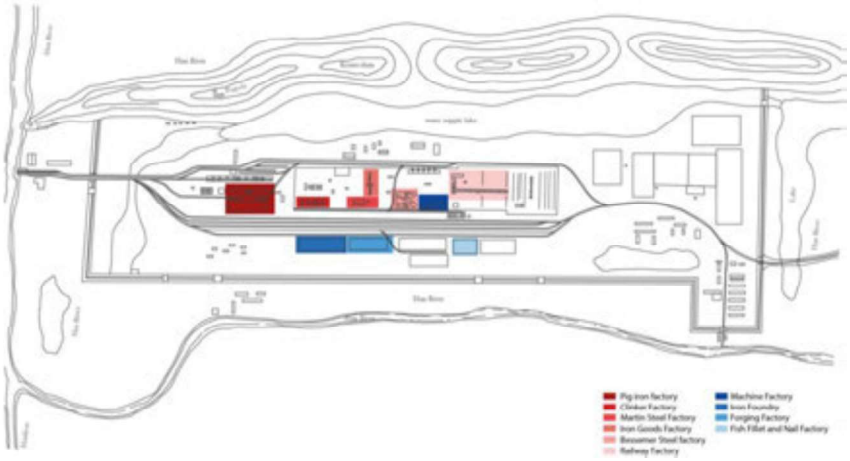

Fig.1: Layout of Hanyang Ironworks

At the same time, with the technical assistance of Belgian and German mining engineers such as Max[10], Gustavus Leinung[11] and Parkinson[12], the exploration and exploitation of the Daye coal and iron ore mines was carried out, while the mining works and the construction of the railway to transport the ore from the Daye mine were actively promoted. The project took one year and four months to complete, with the construction of a large open-pit iron ore mine and the establishment of an iron smelting plant, a depot and accommodation for technicians. A 35-kilometre-long railway from Tieshan to Shihuiyao was equipped with four stations, namely Tieshan, Shenghongqing, Xialu and Shibao, and transport infrastructure such as Shihuiyao Ore Transportation and Loading Terminal was constructed to facilitate the supply of raw materials for the Hanyang Iron Works, such as iron ores.

[10] German, Chief Mining Engineer of the Ma'anshan Coal Mine.
[11] German, Engineer of the Daye Iron Mine, Chief Engineer of the Pingxiang Coal Mine.
[12] Mine engineer

Fig.2: Location Map of Daye Iron Ore Mine Site

In 1894, Hanyang Iron Works was officially put into operation. No.1 blast furnace, churning and clinker furnaces, steel making and steel rolling were operated at the same time, and soon there were problems such as high phosphorus content in pig iron smelted and insufficient supply of coke, which led to several stoppages of the ironworks, and the operation of the factory under the constraints of the government-run management system resulted in a relatively serious loss.

1.2 Government-supervised and Merchant-managed Period (1896-1907)

In 1896, in order to maintain the production of the ironworks, Zhang Zhidong recommended Sheng Xuanhuai take over the Hanyang Ironworks, adopted investment promotion and undertaking to solve the problem of ironworks losses. Therefore, it entered the period of government-supervised and merchant-managed.

In the same year, Sheng Xuanhuai sent Max and Leinung to Anhui, Henan, Jiangxi and other places to explore coal resources. Two years later chose to open Pingxiang Coal Mine in Pingxiang, Jiangxi Province, and set up the "General Administration of Mines in Pingxiang", to refine a large number of high-quality coal and coke, and to produce compliant steel rails, which solved the shortage of raw materials for the ironworks. Pingxiang coal mine to Anyuan coal mine as the main mine, at the same time in Tianzishan, Zijiakeng, Xiaokeng, Longjiakeng, Wangjiayuan, Tielukeng, Shanzhuling, Zhanggongtang, Gaokeng, Xikeng, Nanmukeng, Bashanchong, Wupixia, Taipingshan and other mines, the construction of 14 earth shafts. The mine is divided into two parts: ground constructions and underground constructions. The ground constructions were divided into three parts: the mining production area, the living service area and the product transhipment and distribution area. The mining production area consisted of modern infrastructure facilities such as power equipment, machine repair equipment, large and small coal washers, coke ovens, machinery plants, power plants, etc., while the living service area consisted of the surveying and mapping office, the construction office, the telegraph and telephone room, the hospital, the mining school, the employees' primary school, the printing press and other living service support facilities. Hanyang Transportation and Marketing Bureau, Changsha Distribution Bureau, and Yuezhou, Zhuzhou and Xiangtan Transfer Bureau were added to the mine to adapt to the multi-channel transport

of iron and steel products, to improve the quality of transport and to drive the economic development along the routes of Hanyang, Daye and Pingxiang. The underground constructions consisted of the large coal chutes, the straight shafts and the flat alleys.

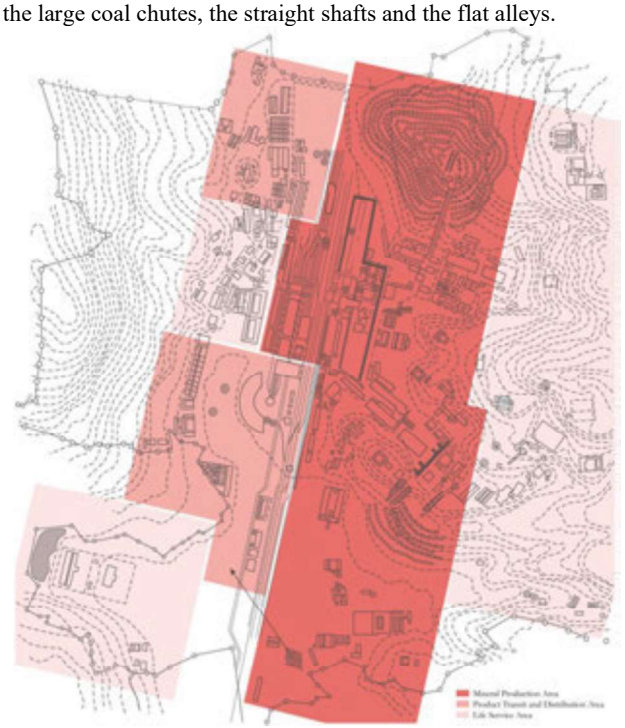

Fig.3: Ground Constructions Map of Pingxiang Coal Mine

Under the management idea of government-supervised and merchant-managed, Sheng Xuanhuai began to raise commercial shares to expand the production scale of the ironworks and reduce production costs, while appointing European engineers such as Gustavus Leinung and Eugène Ruppert[13] to assist the iron and steel industry in realising technological innovation, installing and applying a variety of production equipment for the iron and steel industry, and promoting the systematic innovation of coal and iron enterprises, which helped to establish China's modern company system in China. In 1905, the expansion and renovation project of Hanyang Iron Works was carried out. Due to the problem of matching the Martin furnace with the ore and coal coke, the quality of some of the iron and steel products of the ironworks was not up to the standard, therefore, new machines and equipments were investigated and purchased, and the alkaline Martin furnace was renovated and introduced. Newly built and replaced the equipment and facilities of the steel mill and rolling mill[14], and constructed the wheel plants, cargo completion plants, expanded the machine repair plants, and

[13] Luxembourger, served as the Blast Furnace Engineer at Hanyang Ironworks from 1894 to 1898, and as the Chief Engineer of Hanyang Ironworks from 1905 to 1912.

[14] The ironworks will construct a new No. 3 blast furnace with a daily output of 250 tons of pig iron, dismantle two Bessemer acid converters, and initially replace them with four 30-ton basic Martin furnaces and ten 10-ton small Martin furnaces until seven Martin furnaces are built. Additionally, a new 150-ton mixed iron furnace, two 35-ton electric steel ladle cranes, one 10-ton electric overhead crane, two 50-ton electric traveling cranes, and one vertical steel ingot stripping machine will be installed. The steel rolling mill will include a new 80-ton reheating furnace, one 4-ton electric overhead crane, one fully steam reversible primary rolling mill with a roll diameter of 1016 millimeters and its auxiliary facilities, and one fully steam reversible steel plate rolling mill with a roll diameter of 760 millimeters and its auxiliary facilities.

motor plants. Renovation of the loading and unloading wharf on the river bank, installation of electric loading and unloading devices and a railway line. The railway in the factory area was increased from 6 kilometres to 34 kilometres. The entire expansion and renovation project lasted three years.

During this period, Daye Iron Mine opened up the Shizishan Mining Area in Dedaowan, further expanding the scale of production and increasing the output of iron ore year by year. At the same time, Japan Yawata Iron Works and Sheng Xuanhuai signed the "Coal and Iron Mutual Sale Contract", through the sale of Daye iron ore to the Japanese Iron Works, to raise funds for the Hanyang Iron Works. Although the contract was not in the nature of borrowing, it laid down the mode of capital export from Japan to Hanye Ping Company thereafter.

1.3 Merchant-run Period (1908-1937)

In order to solve the problem of insufficient funds, in 1908, Sheng Xuanhuai petitioned the court to form the Hanyang Iron Works, Daye Iron Mine and Pingxiang Coal Mine into the "Hanyeping Coal and Iron Works Co., Ltd". The company formally entered merchant-run period, with "mining, ironmaking, coal mining" as the main business. According to the joint-stock commercial operation model, it has gained more corporate vitality and gradually improved its economic benefits. Compared with the period of government-supervised and merchant-managed, The company has integrated various factories and mining enterprises, the jurisdiction of the enterprise throughout Hubei, Hunan, Jiangxi, Anhui, Jiangsu, Hebei, Liaoning provinces, to further expand the scale of production, increase the installation of machinery and equipment, and enhance the strength of industrial technology. The rapid development of the company's European engineers into the enterprise's technological innovation and production operations, the company's steel production reached 170,000 tonnes in 1910, the quality of steel broke through the previous technical deficiencies, gained the affirmation of the purchasers and assisted the company in improving the management system and production norms, formulated the Technical Standards and Acceptance Criteria for the production and manufacture of rails, and assisted China in realising the short-lived glory of the coal and iron industry.

With the outbreak of the First World War in 1914, the price of international iron and steel raw materials skyrocketed, and there was a brief boom in Hanyeping, with the production of pig iron, steel, iron ore and coal and coke increasing dramatically, and the company began to purchase some subsidiary enterprises, invested in some joint ventures, and opened a special line of water transport to ensure the company's energy supply and product output.

After the post-war world economic depression, the price of steel plummeted. Due to the severe constraints of Japanese debt contracts, Hanyeping declined rapidly. In 1921, the Republic of China (Beijing) government changed the standard of rails, which caused the company nearly 50,000 tonnes of rails with no sales, and a large number of rails were backlogged, which led to the complete shutdown of Hanyang Iron Works in 1924, and the company couldn't maintain the operation of Pingxiang Coal Mining in 1928, and it was taken over by the Jiangxi Provincial Government. Only one iron ore mine in Daye was left to continue production, and it was reduced to a supply unit of Yawata Iron Works of Japan[15]. This large-scale iron and steel joint venture was basically disintegrated at this point.

[15] Established in 1901, the steelworks located in Kitakyushu City, Fukuoka Prefecture, began operations during the Meiji era in 1903. It was Japan's second steelworks after the Tanaka Factory of the Kamaishi Mining and Smelting Company, which commenced operations in 1887 (Meiji 20) in Kamaishi City, Iwate Prefecture. Prior to World War II, it was Japan's largest steelworks, producing over half of Japan's steel output. In 2015, four assets including the former head office, repair factory, former blacksmith factory (Kitakyushu City, Fukuoka Prefecture), and the Mogagawa water source pump house (Nakama City, Fukuoka Prefecture) were designated as Japan's Meiji Industrial Revolution heritage sites. As part of the "Iron and Steel, Shipbuilding, and Coal Mining Industries" (totaling 23 sites), it was selected as a UNESCO World Heritage Site.

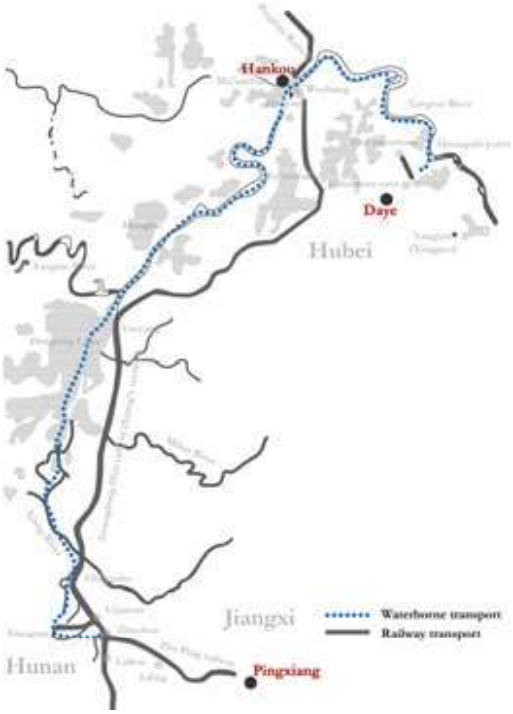

Fig.4: Traffic map between Hanyang, Daye and Pingxiang

2. Status of Hanyeping Industrial Heritage

The development of Hanyeping Company spanned across important industries such as coal mining, iron ore extraction, and steel smelting, exerting profound influence on multiple cities along its route, including Wuhan, Daye, and Pingxiang, from spatial landscapes to production and lifestyle patterns. As a typical representative reflecting the modern industrialization process in China, an analysis of the company's retained industrial heritage and its current status of preservation and utilization is conducted. Furthermore, the relationship between urban development and the conservation and utilization of industrial heritage is explored, delving deeper into its historical significance and cultural connotations, thereby promoting the development of urban clusters in the central region.

2.1 Hanyang Iron Works

From 1927 to 1937, the factory remained abandoned. During the period of the War of Resistance against Japan, all machinery and equipment of the ironworks were relocated to Chongqing, and the factory buildings were entirely destroyed by explosives. It wasn't until 1958, as a continuation of the history of the Hanyang Ironworks, that the Hanyang Steel Works was established on the site of the former Hanyang Gunpowder Factory. Later, the Hanyang Rolling Mill and the Hanyang Steel Works were merged into the Hanyang Steel Works.

The factory is located in the central urban area of Wuhan, bordered to the north by the Han River and to the south by the Beijing-Guangzhou Railway. The division of Qintai Avenue

creates a spatial layout of one factory and two zones[16] within the factory area. In 2000, due to the operation of Wuhan's land reserve system, the northern zone was included in the demolition scope by the government and auctioned off to the real estate developer China Resources. It was swiftly demolished and the land was reorganized.

In 2011, the Hanyang Steel Works was designated as a key construction project in the "12th Five-Year Plan" of Wuhan City. At the same time, the Wuhan Municipal Bureau of Culture established clear protection levels for the cultural relics and buildings within the factory area. With active promotion from the Wuhan municipal government, Wuhan Iron and Steel Group, in conjunction with Vanke Group, initiated the "One Museum, Two Parks" development project[17] for the factory area. During the construction of the Zhang Zhidong and Wuhan Museums by American architect Daniel Libeskind[18], Vanke[19] hoped to acquire further development rights for the factory area by purchasing land. However, the owner of the land use rights, Wuhan Iron and Steel Company[20], firmly opposed this proposal. Due to the lack of capacity and funding to develop the factory area and the government's lack of sustained updates to policies regarding the protection and reuse of the Hanyang Steel Works area, the factory area could only be utilized in an inefficient manner under the game-playing of various stakeholders. Historic buildings with cultural value could only be used as warehouses.

Currently the Zhang Zhidong and Wuhan Museum has been established around the factory, which narrates the life and achievements of Zhang Zhidong as well as his activities and influence in the Wuhan region through narrative design. They utilize a combination of physical artifacts and historical photographs related to the history of the Hanyang Ironworks and Hanyang Manufacturing for exhibition. As a result, an increasing number of people are beginning to pay attention to the significant historical importance of the Hanyang Ironworks in China's modernisation process.

The industrial buildings within the factory area are in relatively good preservation condition and generally follow the layout of the Hanyang Iron Works. The buildings are categorized based on their functions, including production facilities, storage warehouses, office buildings, and dormitories. Most of the buildings were constructed between the 1980s and 1990s. The most distinctive and well-preserved industrial heritage within the factory area is the electric furnace sub-plant converter workshop[21]. It features a red brick facade, reinforced concrete frame structure, single-story layout, with a span of 30 meters, a depth of 90 meters, and a height of 23 meters. The roof is made of prestressed large roof panels supported by truss steel structures. Additionally, there are five historical buildings with modern industrial characteristics, including the electric furnace sub-plant maintenance spare parts room, electric furnace sub-plant smelting workshop, electric furnace sub-plant production workshop, sewage treatment workshop, and industrial oxygen plant workshop. Other remnants such as water towers, chimneys, railways,

[16] The northern section of the plant is dedicated to the rolling mill area, comprising the billet mill workshop, wire mill workshop, universal section mill workshop, special-shaped section mill workshop, and transportation workshop. The southern section of the plant is dedicated to the steelmaking area, including the converter workshop, electric furnace workshop, oxygen-making workshop, and lime workshop, among others.

[17] Zhang Zhidong Museum, Creative Cultural Industry Park, Headquarters Economic Park

[18] A Polish-American architect, artist, professor and set designer. Libeskind founded Studio Daniel Libeskind in 1989 with his wife, Nina, and is its principal design architect.

[19] Vanke Corporation Limited was founded in 1984 and is a leading urban and rural construction and life services provider in China. Its business focuses on the three most dynamic economic circles and key cities in the central and western regions of the country.

[20] Established in 1955, it is the first super-large-scale steel joint venture constructed after the founding of the People's Republic of China. Completed and put into operation on September 13, 1958, it is a centrally administered state-owned key enterprise under the supervision of the State-owned Assets Supervision and Administration Commission of the State Council.

[21] Established in 1965, it was designated as a key project of Wuhan City from 1976 to 1984 and underwent two expansions during this period. Utilizing the three-phase electric arc furnace steelmaking method, it primarily produces high-quality steel. In 2011, including oxygen supply and dust removal pipeline facilities, it was listed in the first batch of industrial heritage sites in Wuhan. In 2017, it was included in the first batch of national industrial heritage sites.

industrial pipelines, and gateways collectively form the historical spatial environment of the Hanyang Steel Works.

Fig.5: Zhang Zhidong and Wuhan Museum
Fig.6: Electric Furnace Sub-plant Converter Workshop

2.2 Daye Iron Mine

During the period of Japanese occupation from 1938 to 1945, the mining area was under Japanese control, and extensive construction was undertaken, resulting in the formation of production and residential zones. It wasn't until after the liberation war that the Daye Iron Mine gradually resumed production and completed infrastructure projects such as water and electricity supply, transportation, industrial plant areas, and worker living quarters for the mine. Roads were constructed from the city to Tieshan, forming the initial grid pattern of roads within Tieshan district.

In the early 21st century, the mineral reserves in the mining area gradually decreased, prompting the government to propose the development of mining culture and tourism industries. In 2006, the Daye Iron Mine Museum was established, featuring multiple exhibitions including mineral displays, ancient mining practices, and modern mining methods, reflecting the entrepreneurial and developmental history of modern mines. In 2007, the Daye Iron Mine Park and the Tonglushan Ancient Copper Mine Site were combined to form the Huangshi National Mine Park. The park's landscape design integrated the reuse of industrial heritage from the Daye Iron Mine, greatly enhancing the public nature of the mining area. In 2012, it was selected "Huangshi Mining and Metallurgical Industrial Heritage" on the UNESCO World Heritage tentative list for China.

Currently, the main industrial relics of the Daye Iron Mine include mining remnants, constructed structures, and mining equipment. The mining remnants constitute the core landscape resources of the Daye Iron Mine, consisting of a 440-meter open-pit mine and underground mines. Constructed structures encompass factory dormitories located in urban areas and buildings in the mining area, such as fortification ruins and ore dressing workshops built by the Japanese. Mining equipment imported from Europe showcases the production process from mining to ore dressing and transportation. Due to the unique production methods in the mining area, the production and residential areas are closely linked, but the lack of spatial boundaries leads to a dispersed spatial layout of industrial heritage, preventing the formation of a systematic and complete spatial form, which is difficult to meet the current needs of urban development.

Fig. 7: Ancient Mining Scene


Fig. 8: Open-pit Mine

2.3 Pingxiang Coal Mine

In 1939, due to wartime reasons, the Pingxiang coal mine was relocated and damaged by the Nationalist Government. It wasn't until 1954 that the Anyuan coal mine resumed operations at the original site and, through renovation and expansion projects, became the largest coal mine among the seven mines under the Pingxiang Mining Bureau. Although the Pingxiang coal mine is still in operation, coal resources are showing a trend of gradual depletion.

During the construction and development of the Pingxiang coal mine, various distinctive architectural heritages were left behind, including production facilities of the coal mine and buildings from the red revolutionary era[22]. Presently, the production facility buildings mainly include mineral offices, dormitories, coal mine passages, coal mining and washing facilities, etc. The buildings from the Red Revolutionary era mainly consist of revolutionary remnants such as the Workers' Club established to lead workers, night schools for guiding workers' learning, consumer cooperatives serving workers' lives, and revolutionary sites like the Autumn Harvest Uprising[23]. In recent years, the Pingxiang coal mine and relevant government departments have been continuously engaged in the conservation of architectural heritage and have collaborated on the development of Anyuan Red Tourism, constructing a scenic area integrating industrial heritage, urban tourism, and the inheritance of the Anyuan spirit. Due to the government's emphasis on the cultural significance of the Red Revolutionary spirit, the investment and effectiveness in the construction of buildings from the Red Revolutionary era have been significantly higher than those of the coal mine production facility buildings, leading to an imbalance between the development of scenic area infrastructure and regional development.

[22] These are buildings primarily used by leaders of the Communist Party of China (such as Mao Zedong, Liu Shaoqi, Li Lisan, etc.) during the period of 1920-1921 to lead workers' production and movements at the Pingxiang Coal Mine, as well as during the guidance of the Red Revolution era.

[23] During the Land Revolution War, the Chinese Communist Party led armed uprisings by peasant self-defense forces, worker patrols, and revolutionary soldiers in the border regions of Hunan and Jiangxi provinces.


Fig. 9: Anyuan Coal Mine Shaft Entrance - Zongping Tunnel
Fig. 10: Anyuan Historical and Cultural District

3. Protection and Reflection on Hanyeping Industrial Cultural Route

Based on theoretical literature on the conservation of world industrial heritage and the experiences of the European Industrial Heritage Route, combined with the practical situation of industrial heritage conservation in China, comprehensive protection of Chinese industrial heritage holds significant guiding significance. It has important foundational research value for the establishment of cultural routes for the Hanyeping industrial heritage and the corresponding development of tourism routes.

3.1 World Level

The attention to industrial heritage conservation originated from industrial archaeology in Britain in the 1950s. With the gradual rise of industrial heritage conservation and research in countries such as Germany, France, the United States, and Japan, it has increasingly become a trend in cultural heritage protection. In 1973, the first International Symposium on Industrial Monuments was held at the Ironbridge Gorge Museum in Britain. At the third International Symposium on Industrial Monuments held in Sweden in 1978, the International Committee for the Conservation of Industrial Heritage (TICCIH) was established. Entering the 1990s, with the acceleration of the post-industrial era, the position of industrial heritage in the world cultural heritage became more important. The World Heritage Committee of UNESCO entrusted the International Council on Monuments and Sites (ICOMOS) to conduct studies on various types of industrial heritage, such as "World Heritage Bridges" (1996), "Railways as World Heritage Sites" (1999), and "International Coal Mining Studies" (2002). Of particular note in international activities was the 12th International Conference on the Conservation of Industrial Heritage held in Nizhny Tagil, Russia, from July 10th to 17th, 2003. The conference formulated the "Nizhny Tagil Charter" for the conservation of industrial heritage, which became the most authoritative document on industrial heritage conservation theory and a guide for conservation activities in various countries. In October 2005, at the 15th ICOMOS General Assembly held in Xi'an, China, the theme of "International Day for Monuments and Sites" on April 18, 2006, was designated as "Protecting Industrial Heritage," marking a new stage in international industrial heritage conservation. As of 2024, there are 50 industrial heritage sites listed on the World Heritage List, distributed across 28 countries.

The concept of cultural routes in the field of cultural heritage originated from the "European Heritage Plan" in 1987. In 2005, the "Operational Guidelines for the Implementation of the World Heritage Convention" introduced the concept of cultural routes for the first time, proposing to rediscover shared heritage through tourism, promote cultural interaction, interreligious dialogue, and landscape conservation and development, thereby enhancing cultural cooperation. The emergence of cultural routes reflects the innovation and

breakthroughs in the concept of cultural heritage conservation, where cultural heritage is no longer considered as isolated "heritage points" separate from historical and natural environments. Among them, the European Route of Industrial Heritage, as the only thematic route showcasing industrial and scientific heritage, currently includes over 1,850 industrial heritage sites from 26 countries such as Germany, Belgium, the United Kingdom, France, Poland, Spain, and Italy. It has established a cultural route system composed mainly of 100 important industrial heritage anchor points, 20 regional industrial routes, and 13 European thematic routes, linking industrial heritage sites through natural and artificial geographic factors such as rivers, railways, mines, and industrial areas. With the promotion of international industrial heritage conservation organizations, more countries have formulated policies for the protection and utilization of industrial heritage, clarifying protection objectives, measures, and responsible entities, providing a solid foundation for cooperation and exchange among countries.

3.2 National Level

In 2006, the "China Industrial Heritage Protection Forum" convened by the State Administration of Cultural Heritage, along with the resulting "Wuxi Proposal," marked the formal inclusion of industrial heritage conservation and development into the national policy protection framework. In the same year, in response to the industrial heritage protection work plan, the State Administration of Cultural Heritage issued the "Notice on Strengthening the Protection of Industrial Heritage." From 2017 to 2021, the Ministry of Industry and Information Technology successively announced five batches of national industrial heritage lists, with 11 industrial heritage projects from 13 units selected. In 2018, the "Interim Measures for the Management of National Industrial Heritage" were introduced. In 2022, the "Implementation Plan for Promoting the Development of Industrial Culture" was launched. In 2023, the Ministry of Industry and Information Technology issued the "Management Measures for National Industrial Heritage," implementing General Secretary Xi Jinping's important instructions on the protection and inheritance of historical and cultural heritage, strengthening national industrial heritage management, promoting industrial spirit, developing industrial culture, and enhancing China's industrial soft power and cultural influence.

In recent years, the country has continuously strengthened its emphasis on the protection of industrial heritage, issuing corresponding protection documents and management systems. However, a complete industrial heritage management system has yet to be established, which makes it difficult to provide clear guidance for the planning, construction, and implementation of industrial heritage development and utilization projects. This situation needs to be improved to address the practical contradictions between the cultural value of industrial buildings and the scarcity of land resources.

3.3 Regional Level

In 2007, Huangshi City collaborated with Daye Iron Mine to organize the Mining and Metallurgy Cultural Festival. In 2008, the Zhang Zhidong Memorial and Hanyang Ironworks Museum initiated the commemorative seminar for the 100th anniversary of the founding of "Hanyeping Company" and the protection and utilization of "Hanyang-made" modern industrial heritage. In April 2010, the Chinese Urban Planning Society organized the "Symposium on Urban Industrial Heritage Conservation and Utilization" in Wuhan, resulting in the "Wuhan Proposal on the Conservation and Utilization of Urban Industrial Heritage during the Transition Period." The "Wuhan Master Plan (2010-2020)" explicitly proposed the need to further investigate and excavate industrial factories and blocks reflecting the modern industrial development history of Wuhan, incorporating them into the scope of historical and cultural protection as modern industrial heritage. In 2017, the Pingxiang Municipal Bureau of Culture and Tourism held a conference on the protection and utilization of Pingxiang coal mine

industrial heritage, emphasizing the significant role of industrial heritage in promoting urban transformation and tourism economic development.
In recent years, Wuhan, Daye, and Pingxiang have each introduced corresponding industrial heritage protection policies and management systems. However, due to the dispersed locations and lack of unified protection, utilization, and development policies among the three places, it has not been possible to promote regional connectivity and development. This has resulted in the collaborative form of reshaping the Hanyeping industrial heritage cultural route not yet being realized.

Conclusion

Industrial heritage, as an important component of human cultural heritage, records the trajectory and achievements of past industrial development and serves as a witness to urban history and culture. The Hanyeping cultural route, representing modern industrial heritage in China, introduced advanced Western science, technology, and machine production, spanning multiple cities and involving various smelting processes, thus exerting a significant influence on the economic and urban development of the central region. In the process of its protection and utilization, it is necessary to draw on the rich experience of European cultural routes, combined with the actual situation of industrial heritage conservation in China, to protect and preserve industrial buildings and their historical landscapes through policy guidance, planning recommendations, and design practices based on conservation principles. This transformation of industrial resources into cultural resources enhances cultural cooperation between cities, drives urban regional transformation and development, and provides theoretical references for the protection of industrial heritage in China.

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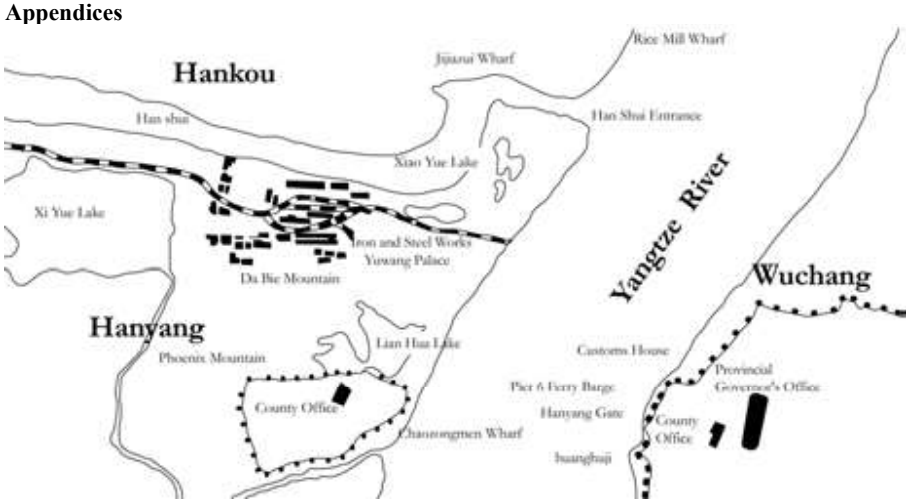
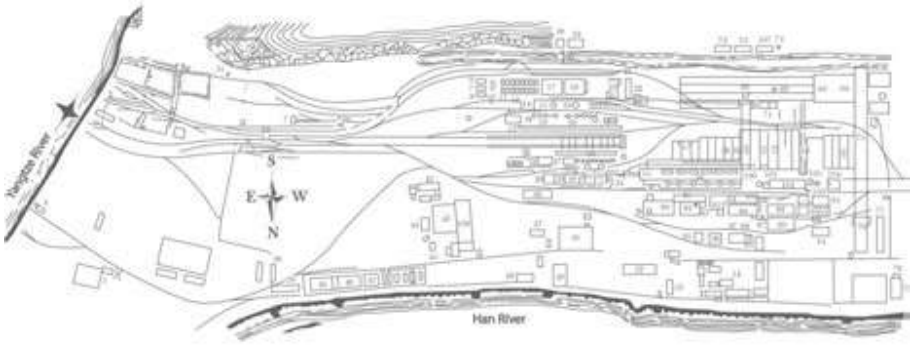
Appendices



Map of the Location of Hanyang Ironworks



1. Briefing room
2. Horsepower Stables
3. pound house
4. stack house
5. Wholesale hall
6. Repair room
7. stack house
8. Pumping house
9. backstops
10. Coal storage area
11. heating furnace
12. steam furnace
13. Blower's room
14. Blower's room
15. iron furnace
16. Iron-carburising furnace
17. Iron dump
18. Iron leaving yard
19. Lift
20. Lift
21. stack house
22. Repair shop
23. Repair room
24. Pumping Station
25. Iron Carbide Unit
26. steam furnace
27. Blower's room
28. Cleaning room
29. Lighting house
30. Blower's room
31. ironmongery
32. Ironing house
33. lift
34. ash-cleaning furnace
35. Ash Cleaning Furnace
36. Iron Outhouse
37. Iron leaving yard
38. stacks
39. stacks
40. Stores
41. Material Unit
42. Police Patrol Office
43. Pharmacy
44. Supervisory Service
45. Pumping Station
46. Carriageways Division
47. coal office
48. telegraph office
49. Hospitality Centre
50. Head Office
51. Scrap Iron Machine
52. Iron foundry
53. Mould House
54. Civil Engineering Service
55. Blending Furnace
56. Steelworks
57. Laboratory Unit
58. Iron stores
59. Weighbridge
60. 3 tonne crane
61. 3 tonne crane
62. 20 tonne crane
63. Steel-drying furnace
64. Steel drying furnace
65. 30 tonne crane truck
66. Finishing plants
67. Teppan Stacks
68. 5-tonne crane
69. Pumping house
70. Completion plant
71. official's office
72. stacks
73. stack house
74. Pumping plant
75. 20-tonne crane
76. Steel rail plant
77. 30 tonne crane year
78. Pumping house
79. Pools
80. Sand tilling plants
81. boiler plant
82. Iron foundry
83. steam furnace
84. repair works
85. Copper works
86. Hook and nail factory
87. Asphalt wok
88. Brick factory
89. Brick-making factory
90. waterworks
91. electric light house
92. Electricity works
93. Repair house
94. motor stack
95. steel test house
96. stack house
97. Machine Hunt Unit
98. Plotting room
99. Bricklayers
100. Lifting stacks
101. Tubes
102. Stoves
103. Taps
104. Furnace
105. Furnace
106. Money Unit
107. Laboratory Unit

Site Plan of the Expanded Hanyang Ironworks

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