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Research on Comprehensive Utilization of Construction Waste in Shandong Province

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Abstract. The primeval disposal ways of construction and demolition waste, including simple stacking and landfill, are not suited to the social and economic sustainable development and ecology civilization construction. Indeed, the comprehensive utilization has been considered as an effective approach to solving construction and demolition waste. According to the investigation research of the comprehensive utilization of construction and demolition waste in Shandong province, this paper summarized the current present status about the comprehensive utilization of construction and demolition waste and put forward some suggestions were given for the existing problems, which was expected to provide the reference for the comprehensive utilization of construction and demolition waste.

1. Introduction

With the rapid development of China's social economy and the continuous progress of urbanization, engineering construction and demolition and relocation have produced a large amount of construction waste. It is estimated that the annual production of construction waste in China has reached 2 billion tons, and the annual production of construction waste has accounted for 80% to 90% of the total amount of municipal waste. Although most provinces and cities have carried out the use of construction waste resources, the resource utilization rate is still less than 5%. How to deal with construction waste has become a key issue for government departments at all levels.

In recent years, in order to promote the comprehensive utilization of construction waste, universities and research institutes and resource utilization enterprises have carried out a large amount of research and exploration on the use of construction waste, including not only the analysis and summary of the experience of foreign resource utilization, but also research and discussion on the status quo of domestic resource utilization. Sun Lirui et al. (2012) proposed the development of construction waste resources in China from the source and application by analyzing the status quo of European construction waste resource utilization and its environmental and social benefits. Pu Yunhui et al. (2012) discussed the construction waste recycling situation in Japan from the perspective of management and technology and promoted the recycling of construction waste resources from the aspects of regulations and supervision systems, incentive policies, technologies and standards, and publicity. Li Ying et al. (2008) analyzed the situation and existing problems of construction waste utilization in Beijing and gave some suggestions for the utilization of construction waste resources. Cheng Jianwen (2011) reviewed and summarized the status of construction waste utilization in Shanghai, analyzed the existing problems and proposed countermeasures. Relevant research on the comprehensive utilization of construction waste in Zhejiang, Chongqing, Chengdu, Xi'an, Urumqi, Shenzhen and other provinces and cities have also been studied.

With the renovation of urban infrastructure, real estate development, renovation of old communities and urban rail transit, the production of construction waste in Shandong Province is also increasing. It is estimated that the annual production of construction waste in Shandong Province has reached 100 million tons, and a large amount of construction waste is still disposed of by simple stacking and land filling, which is no longer suitable for the current social and economic sustainable development and ecological civilization construction. In addition, in the disposal of domestic waste, Shandong has taken the lead in realizing the full coverage of urban and rural sanitation integration in the whole country, but it has made slow progress in the disposal and comprehensive utilization of construction waste and related research is also less carried out. Therefore, in order to promote the comprehensive utilization of construction waste in Shandong Province, this paper systematically sorts out and summarizes the current comprehensive utilization of construction waste in Shandong Province based on the investigation of the comprehensive utilization of construction waste, with a view to providing decision-making reference for the subsequent promotion of comprehensive utilization of construction waste.

2. Current Status of Comprehensive Utilization of Construction Waste in Shandong Province

2.1 Large Amount of Production, Low Comprehensive Utilization

With the gradual advancement of urbanization construction, the amount of construction waste generated in Shandong Province is also increasing year by year. It is estimated that the annual production of construction waste increased from 18.14 million tons in 2000 to 103.22 million tons in 2015, with an average annual growth rate of 31.6%. The comprehensive utilization rate of construction waste is only 8% which is slightly higher than the national average, but the comprehensive utilization rate is still very low.

2.2 Several Policies and Measures have been introduced

At the provincial level, in 2010, the General Office of the People's Government of Shandong Province forwarded the “Notice on Further Improving the Comprehensive Utilization of Construction Waste” by the Provincial Economic and Information Technology Commission, it is proposed that by 2011, all districts and cities will establish a comprehensive construction waste utilization enterprise, and the comprehensive utilization rate of construction waste will reach 60% or more; by the end of 2012, the comprehensive utilization rate of construction waste will reach 80% or above. In 2013, the Shandong Provincial People's Government issued the “Implementation Opinions on Promoting Green Building Actions”, proposed the implementation of the responsibility system for construction waste treatment, and accelerated the reduction and recycling of construction waste during construction, implement centralized treatment and grading utilization of construction waste, accelerate the use of construction waste resource utilization technology, equipment research and development, and support the development of construction waste recycling enterprises and other work requirements. In 2015, the Ministry of Housing and Urban-Rural Development of Shandong Province and other five departments jointly formulated and issued the “Implementation Plan for Energy-saving Actions for Saving and Building Buildings in Shandong Province”, calls for “green building materials promotion and construction waste resource utilization activities” to promote the reduction of construction waste and resource disposal.

At the city level, in 2013, Qingdao issued the “Regulations on the Comprehensive Utilization of Construction Waste Resources”, becoming the third city of China to promulgate local regulations in the field of comprehensive utilization of construction waste. At the same time, the standards for measuring and charging construction waste and the management measures for collecting and using disposal fees have been formulated. Weifang, Jinan, Zaozhuang, Jining, Taian, Weihai, Linyi, and other cities have also issued guidance or management measures for the comprehensive utilization of construction waste in the name of the municipal government.

Despite the introduction of relevant policies and measures for the comprehensive utilization of construction waste, the comprehensive utilization of construction waste was initially promoted. However, due to the lack of special laws and regulations on construction waste disposal management,

the implementation of the policy lacks supporting implementation rules, and the policy has not been effectively implemented, resulting in the progress of construction waste utilization is still slow, and the level of comprehensive utilization is far from the expected target.

2.3 Some Practical Explorations have been Carried Out

*2.3.1 Established a Special Management Agency.*In order to promote the comprehensive utilization of construction waste, some municipalities have established special management institutions. Qingdao established the Qingdao Municipal Office of Construction Waste Resource Utilization Comprehensive Management Office; Weifang has established a leading group for comprehensive utilization of construction waste with the head of the mayor; Rizhao has established a construction waste management office composed of the municipal housing and urban construction, public security, administrative law enforcement, environmental protection, land, transportation, and other departments; Tai'an has set up a comprehensive construction waste treatment office. The Municipal Public Security Bureau, the Housing and Urban-Rural Development Bureau, the Urban Management Law Enforcement Bureau, the Traffic Police Detachment and the Sanitation Department have established a joint law enforcement system to implement unified management of construction waste.

2.3.2 Developed a Number of Resource Utilization Enterprises. There are 19 enterprises planning or constructing construction waste resource utilization in Qingdao, and all of them is included in the city's construction waste resource utilization supervision information platform. Since 2009, Weifang has supported 11 construction waste recycling products manufacturers such as Shandong Jinbao Group and Weifang Sanjian Group. Other cities have also established a number of resource-based enterprises, including Shandong Zhongrui Renewable Resources Utilization Co., Ltd., which uses mobile equipment disposal in Jinan; Shandong Tianyi Machinery Co., Ltd., which is dedicated to the comprehensive recycling of solid waste in Jining; and Lantai Environmental Protection Technology Co., Ltd., which has obtained the franchise of comprehensive utilization of construction waste resources in Linyi. At present, the formed construction waste resource products mainly include recycled aggregates, recycled aggregate concrete, masonry bricks, permeable bricks, self-insulating blocks, and extruded wall panels.

In summary, the achievements in the comprehensive utilization of construction waste in Shandong Province have benefited from the government's leadership and the active participation of enterprises. Although most cities have issued corresponding development policies, due to the lack of special support policies, the existing resource-based enterprises are running hard; although some cities have set up special management institutions, due to weak supervision and management, and lack of a sound evaluation mechanism, there is no real synergy in promoting the comprehensive utilization of construction waste.

3. Problems and Reasons Analysis

The comprehensive utilization of construction waste in Shandong Province has achieved some results, but there are mainly the following problems due to the late start:

3.1 The Policy and Regulation System is not Sound

In recent years, Shandong Province's attention to urban and rural waste is mainly concentrated on domestic waste, while construction waste is relatively less concerned, and the resulting construction waste is mainly used for landfill disposal as the final disposal target, and the comprehensive utilization method is single. At present, Shandong Province has problems such as the failure to support the relevant laws and regulations on the comprehensive utilization of construction waste, the imperfect standard system, and the lack of practical operability. At the provincial level, the special policies and regulations on the comprehensive utilization of construction waste and their standards in dismantling, sorting, collecting, transporting, processing and preparation of recycled materials are almost blank, which brought great difficulties to the management of construction waste in the province.

3.2 Regional Development Imbalance

Due to the differences in the level of economic and social development in the region, the promotion of comprehensive utilization of construction waste in Shandong Province is unbalanced between east and west. Qingdao, Weifang and other cities with better social and economic development, the comprehensive utilization rate of construction waste can reach more than 50%, but other cities due to the late start, the work promotion is not enough, the progress is slow, and the resource utilization rate is generally low.

3.3 Social Enthusiasm is generally not high

Due to the lack of understanding of the comprehensive utilization of construction waste, most cities still consider the construction of construction waste dumps, rather than the construction of resource treatment plants. Due to the lack of awareness of the comprehensive utilization of construction, demolition and transportation enterprises and the lack of supervision by the competent authorities, the random dumping of construction waste often occurs, resulting in a serious waste of resources. The comprehensive utilization of construction waste projects generally covers a large area and has a large investment. Due to lack of relevant special policies such as land concessions, fund awards, and industrial support, there are still fewer enterprises entering the comprehensive utilization of construction waste, even if the intentional enterprises are mostly holding a wait-and-see attitude, or stagnation in the market research stage, the industrialization scale development trend has not yet formed. In addition, due to insufficient publicity, the whole society has not formed an atmosphere to support the comprehensive utilization of construction waste.

3.4 Lack of Technological Innovation

The existing production equipment and production lines of construction waste resource enterprises have few independent production processes and equipment with independent intellectual property rights. Due to the lack of financial support, most of the universities and research institutes have insufficient scientific research strength in the comprehensive utilization of construction waste, and there are few published research results. Construction waste utilization enterprises also lack the motivation and enthusiasm for technological innovation.

3.5 Bottlenecks in the Promotion and Application of Recycled Products

Although the products produced by construction waste enterprises have met or exceeded the relevant standards, their application in practical engineering is still blocked. The main reasons are as follows: First, the existing policies for the use of construction waste recycling products in engineering construction are only encouraged to use and lack of compulsory; Second, the public's recognition of construction waste recycling products is generally not high; third, the recycled products on the market are mostly recycled aggregates and recycled bricks, and the added value of recycled products is low; Fourth, due to raw materials, production technology and other factors, compared with the products produced by natural raw materials, the price of recycled products did not form an advantage, or even at a disadvantage, resulting in product sales blocked.

4. Suggestions

4.1 Improve Relevant Policies, Regulations, and Standards

In order to promote the comprehensive utilization of construction waste from the top design, it is recommended to formulate the “Guiding Opinions on Accelerating the Utilization of Construction Waste Resources in Shandong Province” and the “Regulations on the Management and Comprehensive Utilization of Construction Waste Disposal in Shandong Province” and other relevant regulations as soon as possible. Study and explore the charging standards for construction wastes by referring to the charging method for domestic garbage disposal fees. Establish a complete system of standards for the recycling and comprehensive utilization of construction waste, and provide technical standards for the promotion and application.

4.2 Scientific Development Planning

Further carry out investigations and studies to find out the information on the quantity, composition, treatment methods and utilization of construction waste all the province. According to the existing stock and incremental forecast of construction waste, according to the principle of near-use of resources, compile the construction waste comprehensive utilization development plan, reasonably plan and layout the number and the scale of the construction waste transfer and distribution field and resource utilization plants, to promote the harmless and resourceful disposal of construction waste. Under the guidance of the province's planning, cities should also prepare regional construction waste comprehensive utilization development plans.

4.3 Increase Policy Support

First, explore the support policies for promoting the comprehensive utilization of construction waste, focusing on supporting the development of key technologies for the comprehensive utilization of construction waste and the upgrading of production technology and equipment.

Second, the construction waste recycling products will be preferentially included in the new wall material energy-saving technology product certification scope and government construction project procurement catalog, and the proportion of recycled products will be clearly defined in the government-invested public buildings, urban public facilities, and municipal projects. Third, study and formulate policies for tax relief and site concessions for construction waste recycling products.

4.4 Pilot Demonstration

Select some cities with a certain working basis, and carry out pilot construction cities, demonstration parks, and demonstration projects for the comprehensive utilization of construction waste. Support and encourage a group of large-scale key enterprises, introduce advanced and mature technology and equipment, establish a demonstration park for the production of building waste recycling products; organize the construction of demonstration projects for the application of construction waste recycling products. Explore the working mechanism for the generation, disposal and reuse of construction waste, and promote the comprehensive utilization of construction waste by point and face.

4.5 Innovative Work Management Mechanism

The first is to introduce a franchise model, study and formulate industry access conditions and exit mechanisms, and explore the PPP operation mode based on cities or urban agglomerations. Second, relying on the universities or research institutes with good working conditions, established the Shandong Provincial Construction Waste Resource Disposal Application Centre and the Construction Waste Resource Utilization Technology Industry Alliance to provide technical support for the comprehensive utilization of construction waste. The third is to establish a provincial construction waste information platform system. The fourth is to study and establish a work assessment system for the comprehensive utilization of construction waste and strengthen supervision duties.

5. Conclusions

The comprehensive utilization of construction waste is a systematic project involving all aspects such as production, classification, transportation, treatment, and reuse, and requires close cooperation between various relevant departments of the government. In the future, with the continuous development of urbanization, the continuous improvement of old residential areas and the construction of key urban projects such as sponge cities and underground integrated pipe corridors, the amount of construction waste generated in Shandong Province will remain high. In order to promote the comprehensive utilization of construction waste, it should be strengthened in policy support, management work mechanism innovation, technology integration innovation research and promotion and application of recycled products.

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