Analysis of the Construction Cost Management Based on the Perspective of the Construction Waste Recycling

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Abstract. With the rapid development of building industry, the number of construction waste is increasing. As we are paying more promotion in energy-saving low-carbon life, construction waste is paid more attention by society. In this paper, the existence of the construction waste paper expounds present situation and the present status of the processing, it analyzes the effect of the existence of the construction waste to the social environment, it is concluded that construction waste recycling is the most scientific, most effective, the processing method of green environmental protection, at the same time, through elaborating the status of construction waste and ways to dispose, this paper analyzes the impact from construction waste to social environment, and gets the solution that resources reuse is the most scientific, most effective and most environmentally friendly way to process construction waste. Meanwhile, from the perspective of construction waste reuse to analyze project whole life cycle cost, it is concluded that building enterprises should improve the utilization of construction waste, strengthen project cost management.

Introduction

Along with Chinese urbanization advancement speeding up increasingly and the continuous expansion of the city size, it is accompanied by the generation of a large number of the construction waste. By 2013, Chinese urban garbage is about 7.7 billion tons and construction waste accounted for 35% about 2.31 billion tons [1]. However, these construction wastes mainly exist in simple landfill, and are deposited in the open air. Only a small part of the wastes are recycled in construction engineering. A large number of construction waste pile up at will, and it is not only taking up land but also polluting the environment. So directly or indirectly affect the air quality. Construction wastes in the process of pile and landfill, as a result of the fermentation and rainwater leaching, scouring, as well as the surface water and groundwater soak and infiltration of sewage, will cause serious pollution of surface water and groundwater around. And construction wastes are not the real rubbish, but misplaced "gold". After sorting, eliminate and crushing, construction wastes are reused as a renewable resource, which is saving the cost of building materials to reduce cost. So it is more important to protect the environment. And this paper analyzes the cost of engineering construction and operation periods from the perspective of construction waste recycling, in order to strengthen the construction of the project cost management.

The Existing Status Quo of Construction Waste at Home and Abroad

With the acceleration of industrialization and urbanization, the construction industry is rapidly developing. At the same time, the companies and the construction wastes are keeping increasing, which are waste concrete, waste residue in the form of bricks and other wastes. Construction wastes can be divided by source classification, such as engineering, decoration waste, demolition waste, waste residue slurry, etc. According to the component classification, construction wastes can be divided into the sediment, concrete block, crushed stone, brick and tile fragments, waste slurry, slurry, asphalt block, waste plastics, scrap metal, waste wood and so on. According to the time classification, construction wastes can be divided into the demolition waste, construction waste.

And main sources of demolition waste were by the demolition of old buildings in the process of old city reconstruction, including due to natural disasters such as earthquake caused by building demolition. Besides this, it usually consists of a high composition of inert materials, such as brick, sand, concrete, metal, wood, paper, glass, plastic, etc. for example Construction waste is mainly produced in construction process and the rest of the materials, such as wood, stone, plaster, plastic, etc. Demolition waste and construction waste can be shown in the following table 1.

Table 1 Construction Waste Composition Table

Garbage Composition	Garbage Composition Scale(%)		Garbage Composition	Garbage Composition Scale(%)	
	Demolition Waste	Construction Waste		Demolition Waste	Construction Waste
Asphalt	1.61	0.13	Glass	0.20	0.56
Concrete	19.89	9.27	Plastic	0.63	1.23
Reinforced Concrete	33.11	8.45	Sand	1.44	1.70
Soil	11.91	30.56	Metal	3.41	4.36
Rock	6.83	9.74	Cable	0.09	0.28
Gravel	4.95	14.13	Massive Concrete	1.11	0.90
Wood	7.15	10.53	Fixing Device	0.04	0.03
Brick	6.33j	5.08	Other Organisms	1.3	3.05

However, most of the construction wastes without any processing are transported by the construction unit to the outskirts or rural, open-air pile up or landfill. Meanwhile, it takes a lot of tooling plant requisition, garbage freight construction funds so that the construction cost is increasing. Besides this, the pickup and piled up in the process of heritage and flying dust, causes serious environmental pollution.

Construction Waste Treatment Status at Home and Abroad

Construction Waste Disposal Policy Status Quo at Home and Abroad

In order to strengthen the management of construction wastes, the nations of the world for the processing of construction wastes formulated the related policy.

Overseas, the United States is the earlier proposed environmental protection country, enacted by the U.S. government's *Super Fund Law* regulation: "any production enterprises with industrial waste, must be properly handled, shall not, without approval, arbitrarily dump"[2]. Construction wastes are regarded as "building a by-product" in Japan and in 1974 they set up a "construction waste recycling committee" in the building society. In August 2002, Singapore began to promote "green future waste reduction action plan", regarding waste reduction as an important development goals periodically. There are a series of laws in Holland, establishing a limit of the waste dump processing and forcing recirculation run quality control system.

Our country government enacts a long-term strategy relying on science and education and the social sustainable development strategy, and encourages waste regeneration technology research and application. The ministry of construction included "building comprehensive utilization of waste residue" in the key to promote projects of scientific and technological achievements in 1997. On 1 June 2005, the ministry of construction carried out *the Urban Construction Waste Management Regulations*, which cleared construction waste disposal reduction, recycling, harmless and the principle of " whoever production responsible for disposal ". On 1 January 2009, the ministry of

construction carried out *the Circular Economy Promotion Law of The People's Republic of China*, and listed the harmless disposal as well as comprehensive utilization of resources as priority investment areas, giving preferential loans and other credit support, carrying out the system waste discharge fee.

Construction Waste Treatment Status at Home and Abroad

There are three main ways of processing construction waste at home and abroad at present that are: Piling up, land filling, recycling.

Piling up. With the continuous development of city, a large number of construction waste piled up at random, which not only takes up land and pollutes the environment but also affects directly or indirectly air quality. In the process of piling, because of the fermentation, rainwater leaching, flushing, surface water , groundwater soak and infiltration of sewage will cause the serious pollution around the surface water and groundwater. At the same time, the harmful material wastes by waste leach ate will seep into the soil. After a series of physical, chemical and biological reaction it will cause the suburban of soil pollution and reduce the soil quality.

Landfilling. At present, the main processing method of construction wastes is the landfill underground. Though it is very low for this method of construction waste disposal cost, construction waste will produce a lot of harm. Firstly, it takes up a lot of land. Because of the limited land resources, a large number of landfill will cause the increase of land use pressure. Secondly, it causes serious environmental pollution. It is not only hard to biodegradable polymer materials for construction of construction waste rubber, coating, paint, but also contains harmful heavy metal elements. These wastes are buried in the ground, which causes the pollution of groundwater and harms to around people's life directly. Finally, it destroys the soil structure, which causes the surface subsidence.

Recycling. Compared with the previous two kinds of construction waste processes, recycling is the most scientific, the most effective, and the most environmental protection green processing method. In today's advocate energy conservation and environmental protection low carbon life, this method is widely supported and applicated.

Recycling has become a common research topic in the developed countries. Developed countries have implemented source reduction strategy for construction waste processing on the whole; meaning that before the construction wastes it reduces construction wastes by means of scientific management and effective control. Taking effectively means present construction wastes, which makes it a renewable resource. The United States, Germany, Japan and other developed countries after a long period of practice have formed a set of advanced scientific construction waste resource utilization techniques and equipment, achieving a higher degree of construction waste recycling.

Compared with the developed countries, there are gaps in comprehensive utilization of construction waste resources in our country. Recycling is far lower than in the developed countries, and a large number of construction waste has not been used efficiently, both wasting resources and polluting environment. Therefore, our country should strengthen the construction waste recycling and raise the utilization rate. It is the inevitable trend of sustainable development strategy pushing forward the construction waste recycling.

Recycling in the Engineering Construction

Construction waste is made up inorganic substances like broken, broken bricks and concrete, with strong strength, hardness, wear resistance, frost resistance, water resistance, etc. And their performance is better than that of clay, powder soil, even sand and lime soil.

In engineering construction, more and more construction wastes have been processed by recycling. And it takes advantage of the abandoned buildings and abandoned brick concrete aggregate production thickness and can be used in the production of the corresponding strength grade of concrete, mortar or preparation, such as block, wall, floor tile and other building materials products. After adding weight aggregate curing materials, it can be used for highway pavement base. Using waste aggregate of brick production, it can be used in the production of renewable brick,

block, wall, floor tile and other building materials products. Waste residue can be used in road construction, fillers, pile foundation, etc. For waste wood construction waste, not obvious damages of wood can be directly used for reconstruction of building again, seriously damaged the wooden components can be used as the regeneration of wooden plate of raw materials or paper. Abandoned pavement asphalt mixture can be directly used for regeneration in certain proportion of asphalt concrete. Abandoned roads can be processed into recycled aggregate concrete is used to make recycled concrete. For scrap steel, waste steel and other metal scrap materials, if it can be used in construction, they will be used to locate tendons, horse stool, cooking lintel reinforcement measures, etc, if it cannot be used in the construction, they will be recycled steel. For waste glass, waste plastics, waste ceramic construction waste, etc, plastic containers can be used to hold fasteners and garbage, ceramic can be reinforced cushion block, or can be recycled to qualification units to reinforce reuse [3].

The influence of recycling for Project Whole Life Cycle Cost

The Influence of Construction Waste Recycling for Engineering Construction Cost

In the process of engineering construction, construction waste use most is waste residue, waste concrete, waste brick, in the face of three kinds of construction waste recycling to analyze the influence of the engineering construction cost.

Waste Residue. Waste residue is one of the most common of construction waste, they are widely used in the site of foundation pit backfill, municipal road bed of earth, filling behind the building, municipal road body formed, rivers dam, artificial landscape, fill in the roadway, etc. Generally using modified cement, fly ash cement or lime fly ash composite modification of construction waste residue, it is with high strength, good water stability and can meet the requirements of relevant technical indexes. Using HEC consolidation with material instead of conventional residue in road in Shanghai the world expo park road engineering, pavement structure and roadbed treatment before and after adjustment are shown in table 2.

Table 2 Pavement Structure and Roadbed Treatment Before and After Adjustment

Structural Hierarchy	Before the Adjustment	After the Adjustment
surface layer	12~15cm Asphalt Mixture	12~15cm Asphalt Mixture
Up Basic Layer	15~20cm Cement Stabilized Macadam	15~20cm Cement Stabilized Macadam
Down Basic Layer	20cm Cement Stabilized Macadam	20cm HEC Consolidation Residue
Cushion Layer	15cm Graded Gravel	—
Roadbed Reinforcement	80cm Calcareous Soil	50cmHEC Consolidation Residue

It can be concluded from table 2, on the premise of meeting the requirements of subgrade reinforcement, before and after the adjustment, it is 80 cm calcareous soil and 50 cm HEC consolidation residue, after the adjustment quantity obviously less than before the adjustment. Looking from the cushion level and the supply structure, 20 cm HEC consolidation residue in the performance of the supply is equal to 20 cm cement stabilized macadam and 15 cm graded gravel, which reduces the construction process and the quantities, reducing engineering cost.

Waste Concrete. The waste concrete after crushing, screening, cleaning can be used as mixing of new concrete aggregate, which not only can be used for processing various kinds of lightweight block and pavement brick, but also can be directly used for housing construction and municipal road bed, or after screening as the aggregate at the grass-roots level of the road. In the construction project, construction waste residue concrete porous brick are more used , it is a waste concrete construction waste residue as raw material, after crushing, screening treatment as aggregate, join the cement, additives and other admixture, add water mixing, forming machinery vibration molding

pressure after a concrete products. Construction waste residue concrete porous brick is a kind of concrete small hollow block, its appearance, performance; construction process is similar to clay porous brick, widely being used in frame structure wall. Comparing with the performance of the porous brick, the construction cost is low.

It is not only can reduce the emissions of waste concrete, and the secondary pollution to the environment to applicated waste concrete recycled aggregate, and save a lot of garbage disposal costs, but also reduce the consumption of natural sand and protect the natural resources and human survival environment, which will produce good economic benefit, social benefit, environmental benefit.

Waste Brick. It generated a lot of waste brick in housing demolition waste, brick waste recycled aggregate after processing as small concrete hollow block is widely used in the wall, which will reduce the concrete block production cost. For certain nonbearing wall of quantities, concrete hollow block weight is lighter than those of normal concrete, with good fire prevention, impermeability, and seismic performance. Concrete hollow block not only can be used for the main wall and part of the high strength grade of concrete block can also be used for load bearing wall of multistory buildings.

The Influence of Construction Waste Recycling for Engineering Operation Period Cost

It not only can produce economic benefits in the engineering construction for construction waste, but also save construction cost and impact operating costs in the operation period of project.

Construction waste residue concrete porous brick are used in frame structure wall, for a certain volume of masonry construction, waste residue concrete porous brick compact volume ratio of clay porous bricks of dense small volume, according to the formula of porosity in the material, $p = \frac{v_0 - v}{v_0} * 100\% = (1 - \frac{v}{v_0}) * 100\%$ (v_0 is the shape of the volume under the natural state; v is the material absolutely solid volume) which can be concluded that waste concrete porous brick porosity is bigger than general clay porosity of porous brick, greater the porosity, lower thermal conductivity, heat preservation and heat insulation performance increasing. Due to waste brick coarse aggregate porosity is larger; The heat transfer coefficient of waste recycled aggregate concrete hollow block brick is higher than ordinary concrete block, the wall heat preservation performance better. Therefore, it can reduce using heat preservation and heat insulation electrical appliances in the operation period of project, reducing energy costs and reducing the cost of projec8t operation period.

Conclusion

In conclusion, the construction waste has been applicated in the engineering at present, it is not only beneficial to the whole life cycle cost management reusing construction waste, but recycling, we should strengthen the recycling of construction waste and use more and more construction waste in the engineering construction, its operating period of engineering construction cost and project cost has a positive impact, construction waste recycling is beneficial to strengthen the management of the project whole life cycle cost.

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