

# RESEARCH ON THE PRESENT SITUATION AND THE RECYCLED METHOD OF CONSTRUCTION WASTE

Qiushuang HUANG, Hongyong LIU, Jinyi SHEN  
Southwest Petroleum University, Chengdu, 610500, CHINA

**Abstract:** Recently, the increasing of urban construction waste has caused a lot of serious problems to the social environment. This article focus on the problems of construction waste in Mianyang and intends to provide corresponding countermeasures such as "source separation in site", "recycled products quality certification", "circulation subsidy policy" for construction enterprises, resource industries and the government by analyzing and studying on the issues of construction waste recycling in Mianyang.

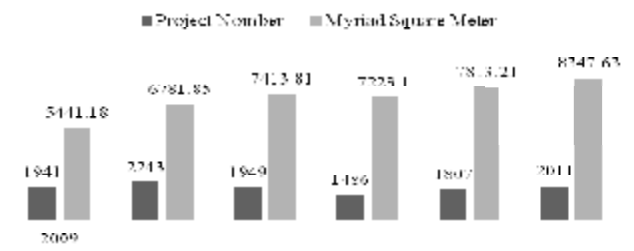
**Keywords:** Recycling; Construction Waste; Recycled Brick ; Recycled Concrete

## 1. Introduction

At present, the national annual output of construction waste is nearly 300 million tons, accounting for about 40% of the total output of urban wastes [1], which unfortunately, is lagged in management. In China, most of the construction wastes are still disposed by simple and temporary storages and landfills [2], obviously such disposing method not only occupies a lot of land, but also seriously affects the environment. There are a huge number of construction wastes in Mianyang, especially after the earthquake, which produced copious construction wastes. Construction wastes can be subdivided into three categories. One is from the demolition of old houses, including bricks, cements, concretes, steels and so on. Due to its complex composition, most of them are dismantled, classified and recycled by some special demolition companies. The second is considerable earthwork from new housed when digging its foundations, which is singly composed and with great quantity, and mainly transported to some "field". The third type of construction waste is underground sand pebble digging out by large engineering projects. Mianyang is abundant in underground sandy pebbles, especially during the construction of the subway, which are in a great need to be disposed. According to the information released by the Housing Authority of Mianyang, each year, the area of old city reconstruction is more than 300 square meters (not including commercial projects demolition area). As calculated at 10000 tons/square meter, it will generate nearly more than 3 million tons of construction wastes, which are about 2.3 million cubic meters.

According to the rough statistics of construction material wear and tear such as brick structure, full cast-in-place structure and frame structure made by national department of construction energy conservation and technology in construction ministry, during the demolition of old buildings, it will generate 7000 ~ 12000 tons of construction wastes of the first class per square meter. And during the construction of new buildings, it can produce 500 ~ 600 tons of wastes of the second class per square meter [3].

In recent years, the approved construction projects within the administrative area of Mianyang are as follows:



**Figure 1. Approved Construction Projects within the Administrative Area of Mianyang from 2009-2014**

In 2014, the approved construction projects within the administrative area of Mianyang increased to 204, and the construction area has reached an increase rate of 6.83% when compared with last year; if calculated at 500 ton/myriad square meter and estimate conservatively, there will generate nearly 4.17 million tons of garbage of 4 million cubic meters. Each year in Mianyang, the third class of construction waste generated from excavation, underground pipe network construction, landscape gar-

dening shall be not less than 10 million cubic meters if estimate conservatively.

To sum up, every year in Mianyang, construction wastes from the city construction are not less than 16.3 million cubic meters. Huge construction wastes have bought a huge challenge to the comprehensive utilization of construction waste. Therefore, the comprehensive utilization of construction waste in Mianyang has become an important issue now.

## 2. Comprehensive Utilization of Construction Wastes in Mianyang

### 2.1. Construction Wastes Disposal in Mianyang

At present, the basic method for construction wastes disposal in Mianyang is direct loading for outbound without any processing. During the overload transportation, it will generate a large amount of dust, and the last procedure is dumping to the nearest sites available, which are mostly illegal open-air dumping sites and low-lying grounds. It will not only affect the surrounding soil, air and water environment, but also cause serious security hidden dangers. Only when the construction site is close to the legal absorptive field of low cost, construction wastes will be sent to the legal absorptive field. There, construction wastes will be recycled, the specific methods of which are shown in table 1[4]. However, the methods being used in the existing legal absorptive fields are only simply landfill or burning, without no harmless controls or resource-oriented utilization measures.

**Table 1. Construction waste recycling method**

Garbage Composition	Recycling Method
Excavation of earth	Piled Mountain Landscape, back-fill
Broken bricks and tiles	Block, sub-grade layer of wall materials
Concrete block	Recycled Concrete aggregate, subgrade layer, sidewalk brick, building block
Glass	High temperature melt, subgrade layer
Steels	Reuse, melt down
Wood, cardboard	Composite board, burning for electricity
Plastics	Smashing, thermal decomposition, landfill
Asphalt	Regeneration asphalt concrete
Mortar	Building, packing

### 2.2. Research and Development of Comprehensive Utilization of Construction Waste in Mianyang

The Institute of Building Materials Industry of Sichuan Province began to use off-scum (including construction wastes) for producing wall materials in the

1980s. Mianyang scientific research institutions of urban construction has made achievement in the usage of construction wastes for producing recycled concrete; In addition, there are enterprises using construction wastes for producing concrete hollow blocks in construction engineering in Sichuan.

After "5.12" wenchuan earthquake in 2008, according to incomplete statistics, Mianyang has produced about 10 million tons of construction wastes[5]. If being disposed with traditional methods of landfill after sorting and bio-safety disposal, one or two large dumping ground should be built, and 200 to 300 million yuan are expected to be cost for transporting, sorting and sites construction. This will not only take up a lot of land resources, but also influence the environment greatly. Mianyang is responsible for the fund auxiliary of production facilities and workshop etc. The production line is designed for processing 350000 tons of construction wastes annually. A project of production line for processing 350000 tons of construction wastes has been completed and put into operation in Mianyang, which has effectively solved the garbage disposal problem cause by collapsing houses after the earthquake, properly disposed and maximized the reasonable utilization of the wastes in the post-disaster reconstruction, reduced the land resources being occupied by waste piling up for a long time, prevented the secondary pollution to the environment, and thus greatly promoted the construction process of post-disaster reconstruction work. The project can made construction wastes into recycled sandstone by smashing for the reproducing of concretes and building walls. In addition, wastes can also be directly pressed into baking-free bricks, and at the same time, the remaining scraps can be made into mortar, thus this method basically achieved the full utilization of construction wastes[6]. Due to the demonstration effect caused by the project in Sichuan, this method for garbage disposal has achieved generalization in the whole country.

## 3. Problems in the Recycling of Construction Waste in Mianyang

### 3.1. Insufficient Government Support funds and Low Benefit of Recycled Products

According to the information published by Environmental Protection Agency of Mianyang, the total expenditure account is 121.55 million yuan in 2013. Among them, the expenditure for special spending of energy conservation and environmental protection accounted for 78% of the total. It mainly includes expenditures in: environmental management, environmental monitoring and supervision, prevention and control of environmental pollution, ecological protection, pollution abatement. The actual expenditure for construction wastes disposal is bare.

The price of products made of renewable materials tends to be lower than that of products made of natural material

in the market. Due to the slim corporate profit, a certain amount of subsidies and tax incentives support are needed to arouse the enthusiasm of more companies to enter this industry. Besides, the raw materials and transportation of recycled products has a certain economical requirement to the processing field, but during urban construction planning, there is no enough land space for reproduction enterprises. As a result, when selecting the site, enterprises can only look for lands to build factories in city suburbs. Thus, the increased cost by long transport distance will weaken the profitability of the product.

### 3.2. Illegal Dumping and Burning that Influence Ecological Environment

The construction waste processing pattern of Mianyang is shown in figure 2. Path one can lead to the occurrence of secondary pollution. Some harmful heavy metal elements in construction wastes such as rubber, coating and paint have large amounts of high polymers that are hard to be degraded by using biological method. These substances will cause air pollution and be harmful to human bodies. As for Path two, although it avoided the secondary pollution, this method of construction waste processing is not scientific, because it is unable to make full use of effective resources for recycling the construction waste. Path three is the ideal path, but the useless wastes may repeat the disadvantage of Path one, that is illegal dumping.

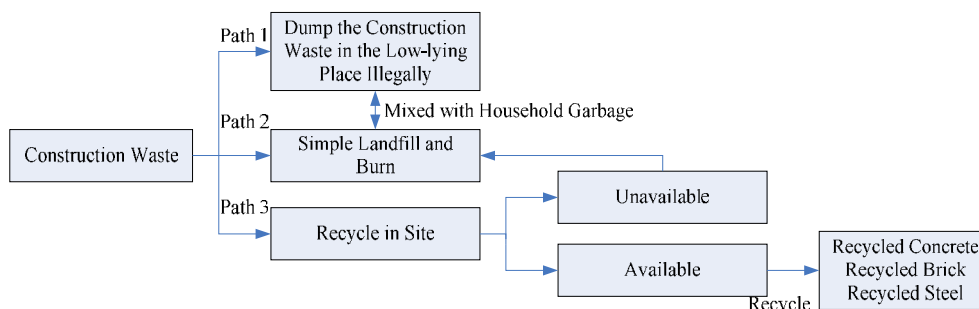


Figure 2. The construction waste processing pattern of Mianyang

### 3.3. Lack of Supporting Regulatory and Industrial Policy

As for enterprises engaged in the construction waste recycling industry, in addition to national preferential policies in finance and tax for the building energy-saving materials, there is no actual local fiscal, taxation and other powerful incentives. The pioneering enterprises have been operating difficultly, and are waiting for national relevant supporting policies. The following difficulties exist mainly in these companies: such as the minimum return of investment, the lacking guarantee of enterprise developing accumulation, the instable supply of raw materials for productions etc, and in order to solve all of these problems, the actual support of policies are needed. Therefore, for promoting the development of the construction waste recycling industry, the perfecting of relevant regulations and industrial policies is the top priority.

### 3.4. Lack of Industrial Quality Standard for Renewable Products as well as customers' Low-trust

Due to the concept of construction waste, two obstacles appeared in construction waste recycling industry chain in the aspects of raw material acquisition on and sales channels. On the one hand, due to the lack of quality standard, construction enterprises dare not boldly use recycled bricks and recycled concretes made from construction wastes, worrying about the quality of the prod-

uct; on the other hand, clients usually have psychological fear and rejection to recycled products made from construction wastes.

## 4. Countermeasures of Construction Waste Recycling in Mianyang

### 4.1 For Government

(1) Increasing the Intensity of Administration and Penalties

In practice, one of the causation of failures to prohibit illegal disposal of construction waste is the higher income and lower cost of illegal disposal. According to the management experience of developed countries in Europe [8], in the transition from simple landfill to the comprehensive disposal, illegal dumping rebound may occur in the short term. Therefore, to change the status of construction wastes dumping at random, and to get successful transformation of construction wastes from disposal at the end to resourceful comprehensive disposal, management and penalties for behaviors of illegal dumping and transportation should be strengthened [9].

(2) Introduction of Construction Waste Recycling Subsidies

National series of construction waste recycling supporting policies should be developed, such as charging lower fees in terms of land leasing. Construction waste charging legislation should be made for the subsidies of con-

struction waste recycling projects; Policies should be introduced to reduce interests and taxes of construction waste recycling companies within the scope of policies. In terms of enterprise project financing, some certain preferential policies should be introduced.

(3) Encourage the Prior Utilization of Re-cycled Products in Construction Projects.

In fact, the production technology of construction wastes regeneration is quite mature, and products qualities are able to meet the requirements of most engineering constructions. They are not only better than products made from natural building materials in term of environmental protection index, but also unique in the heat insulation. Therefore, all construction projects should give priorities to the utilization of recycled products on the premise of meeting the requirement of structure safety[10] [11]. In large engineering projects that can use renewable building products such as cushion concrete of highways, retaining barriers of high-speed railways, filler walls of government housing projects, recycling building products should be used in priority. At the same time, governments at all levels should strengthen the publicities for social recycling benefits and ecological benefits of recycled products made from construction wastes. By reasonable utilization of radio and television, newspapers, periodicals, network, leaflets and other media, comprehensive propaganda and education should be carried out to encourage the prior adoption of renewable products in construction engineering.

#### 4.2. For Construction Enterprises

We should promote source separation of construction waste, namely the Path three in figure 2. In recent years, Mianyang has been vigorously carrying out wastes sorting work mainly for household garbage. But in real life, household garbage is often mixed with construction wastes. And because of being lacking of bio-safety disposal measures, they are potentially risky in contamination. Therefore, it is recommended that the project construction unit carries on classification in producing construction wastes, and thus avoid of mixing them with household garbage. As a result, not only the cost of the construction waste recycling but also the risk of pollution can be reduced.

#### 4.3. For Resourceful Disposal Companies

Quality certification should be operated for recycled products in order to build consumers' confidence for buying. Besides, propaganda work should be done for recycled products to open the market channels. Factories can also work in alliance with the government to promote recycled products made from construction wastes through the publicity of demonstration project. By this way, the public's trust to renewable products could be

enhanced, and their fear, misunderstanding and resistance of recycled products made from construction wastes could be eliminated, so they will accept and use the recycled products consciously.

### 5. Conclusion

Nowadays, governments at all levels and relevant departments of Mianyang have been paying more and more attentions to the disposal of construction wastes, and thus great achievements have been made. But along with the advancement of urbanization, the disposal of construction wastes is still a very serious problem that has drawn great attentions of the government and related departments. Only when construction waste management realizes actual transformation from the terminal disposal management to the whole process reduction and recycling management, the problem of low rate of construction waste recycling can really be solved.

### References

- [1] Hu Mingming. Analysis on Construction Waste Management Cost\*-Select Chongqing City as the Example [J].Energy Saving and Architecture Economy, 2011 (4).
- [2] He Qiong. Contemplation of Problems in Building Energy Conservation of Our Country [J].Journal of Engineering Design and Research, 2009(1):25-29.
- [3] Research Report of Urban Construction Waste Processing Concessionary Project in Mianyang. 2010.6.
- [4] Shi Jianying. Construction Waste Minimizations Design in China—Select Xian City as the Example [J]. Journal of Northwest University(Natural Science Edition), 2012(5) :187-189.
- [5] Huang Luhong. Construction Waste Recycling and its Management Strategy in Wenchuan Earthquake Affected Areas in Sichuan. [J]. Sichuan Construction Science Research. August 2010, No. 4.
- [6] Chen Jianglong, Zhou Wenjuan. Research on Building Waste Treatment Technique in Earthquake Disaster Area. [J]. Architecture Technology.2009(9):822-824.
- [7] Yang Weiguo, Wang Jing, Bao Lei. Study on Comprehensive Utilization of Construction Waste. [J]. Architecture Technology. August 2011(12):100-102.
- [8] US EPA. Full cost accounting for municipal solid waste management: a handbook [R].EPA530-R-95-041.US EPA,Office of Solid Waste Management Response,1997,7.
- [9] Wu Shengli. The Perfection of Legal System of Construction Waste Disposal in the process of urbanization. Urban Management .1006—3862(2012)08—0120—05.
- [10] Sun Lirui. Analyze on Status and Benefits of European Construction Waste Recycling. [J].Architectural Technology. July 2012, NO7.
- [11] Cheng Jialong. Research on Construction Waste Disposal Technology in Earthquake Affected Areas. Construction Techniques on September 9, 2009.
- [12] Jia Dongdong.Classification Method of Urban Building Waste by Mobile Construction Activities.[J]. Environmental Protection Engineering.2013(4):117-120.