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A Study on the Mixed Construction Waste Generated at Demolition of Buildings [1]

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Abstract. From the perspective of a city, demolition of a building is a point when the building's life ends and, at the same time, a point when a new building's life starts. Since construction waste is generated in large volume during a short period of time, GHG emissions in the demolition phases should be considered to be significant. In Korea, mixed construction waste, in which at least two types of waste are mingled, is the second largest waste among construction wastes. In this regard, this research aims to identify the cause of the generation of mixed construction waste and seek for measures to lower the waste.

Keywords: Construction Waste, Building Demolition, Mixed Waste, the Unit

1 Introduction

In Korea, where there is little abandoned or unused land owing to the quantitative growth in the 1970s to 1980s (period of industrial growth), an increasing number of buildings have been demolished for renovation or being newly built in response to economic devaluation of buildings and users' changing demands due to rapid changes of people's lifestyle and infrastructure systems [1].

From the perspective of a city, demolition of a building is a point when the building's life ends and, at the same time, a point when a new building's life starts. Since construction waste is generated in large volume during a short period of time [2].

In Korea, mixed construction waste, in which at least two types of waste are mingled, is the second largest waste among construction wastes.

In this regard, this research aims to identify the cause of the generation of mixed construction waste and seek for measures to lower the waste.

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2 Definition and Status of Construction Waste

In Korea, a total of waste generated in 2013 was 382,081 ton, out of which construction waste was 183,538 ton, accounting for 48.0% [3].

According to Article 2 of Construction Waste Recycling Promotion Act, construction waste means five tons or more of waste generated from a construction site from the commencement and completion of construction works as defined in subparagraph 4 of Article 1 of the Framework Act on the Construction Industry. Construction waste only includes the waste determined by Presidential Decree, so designated waste does not fall under this type of waste [4].

Therefore, the actual amount of construction waste generated from the construction site is expected to be more than recorded.

The construction waste generated in 2013 consists of demolition waste (81.9%), flammable waste (1.3%), inflammable waste (0.6%), waste soil (2.8%), and mixed construction waste (13.4%). Out of the demolition waste, waste concrete accounts for 60.8%, taking up the largest share in construction waste, followed by mixed construction waste.

Mixed construction waste is discharged in a mixed form of at least two kinds of construction waste that cannot be separated from each other by their characteristics and natures. The waste in which construction waste soil is mingled is not considered to be mixed construction. Any person or entity that performs demolition work for a building should remove waste inside the building so that it is not mixed with construction waste. Under Construction Waste Recycling Promotion Act, a construction waste discharger should collect, transport, and store the waste by sorting it. However, if waste cannot be discharged separately in the construction site (i.e. the case where wallpaper is attached to the concrete wall, or window frame is attached to the structure), it is considered to be mixed construction waste. If a construction waste discharger did not separate waste that can be separated for time or economic reasons, the waste is not regarded as mixed construction waste [5].

However, it is hard to apply to actual demolition sites.[6]

3 Contents of Survey

This research assumed two cases: one case where theft of construction materials from empty houses is prevented by increasing the patrols in the district and the other case where it is failed to prevent theft. And the amounts of the mixed construction waste are compared and analyzed.

Two Residential Environment Improvement Districts were selected for investigation. Since it was hard to select districts with the same conditions due to characteristics of Residential Environment Improvement Districts and demolition sites, two districts with similar conditions and characteristics were selected. They were deemed to be appropriate to compare and analyze the amount of construction waste based on generation ratio and basic unit.

Investigators performed measurement for 349 buildings except unmeasured buildings among about 350 buildings in District D located in Buk-gu, Daegu Metropolitan City, calculate the amount of each material of buildings by using integration, and predicted the amount of construction waste to be generated during demolition.

Investigators also performed measurement for buildings in District M located in Buk-gu, Busan Metropolitan City and estimated the amount of construction waste by using integration method.

In District D, empty houses and buildings were neglected, while in District M, the redevelopment union established voluntary crime prevention guards to avoid theft. Therefore, theft of construction materials did not occur in District M. By comparing those two districts, correlation between district management and the generated amount of mixed construction waste was deemed to be identified.

In the next step, workers performed demolition for the buildings in each district and discharged construction waste to the intermediate disposal company, which weighed the amount of the waste. The entire process was observed by ten researchers who resided on the sites.

Table 1. States of Buildings in District D and District M

District	Structure	Usage	Average area (m^2)	Building number
D	Wood	Residence	90.36	87
	Masonry	Residence	92.185	232
	RC	Residence/commerce	122.08	30
M	Masonry	Residence	169.04	22
	RC	Residence/commerce	253.30	40

4 Results and Discussion

As the total amount of construction waste for each district is not effective for comparative analysis of the two districts, the construction waste amount was divided by gross area of buildings in each district to calculate basic unit of the generated construction waste.

In terms of the basic unit of the construction waste by characteristic, District D had 39 times more waste per unit area than District M. This is significant difference when compared to demolition waste (1.32 times), flammable waste (0.71 times), and inflammable taste (0.12 times). It is also 13 times the error tolerance of general Residential Environment Improvement Districts (3.00).

This shows that the ratio of mixed construction waste is about 10% lower than that of other construction wastes generated across the country, which means the generated mixed construction waste is not high compared to that of the country's total construction waste.

This is a graph showing distribution of construction waste types from District M. In

this district, generation rate of mixed construction waste is almost 0%, which indicates that it is possible to reduce mixed construction waste to 0% if buildings are well controlled before demolition.

A total amount of construction waste by district is as follows.

Table 2. The Amount of Construction Waste (unit:ton)

Waste type	District D	District M
Construction waste	54,400	16,381
Flammable waste	496	280
Inflammable waste	230	791
Construction waste soil	0	0
Mixed waste	5,500	56

5 Conclusions

While the generation rates of demolition waste, flammable and inflammable waste, and waste soil can change depending on a number of variables, mixed construction waste is significantly affected by how structures are managed from the point when residents move out to the point when demolition work is commenced. To lessen mixed construction waste and recycle the waste properly, household waste shall not be neglected, theft of construction materials shall be prevented, and appropriate control for illegal disposal shall be performed from when residents start to move out.

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