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Option2-extended abstract

Material Flow Analysis of Construction and Demolition Wastes in Taiwan and their Sustainable Management

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Abstract: Construction is like a symbol of social development. Buildings and public infrastructures are required to support people's lives and a country's development. With the increasing construction, the waste of construction increases as well. Demolition wastes from existing buildings or urban renewal plans also increase the waste quantity. Construction and demolition wastes (CDW) are majorly inorganic materials and have high recycling potential. However, the recycling rate of CDW is not 100% and needs more methods to raise the rate. In Taiwan, the CDW has two authorities, one is CDW waste managed by the Ministry of Environment (MoE), and the other is construction spoil soils managed by the National Land Management Agency, Ministry of Interior. In 2022, the CDW waste is 2.12 million tons, and construction spoil soils are around 43 million m^3. In this study, the current status of CDW in Taiwan was reviewed and material flow analysis was applied to link the materials sources to CDW. The results showed that 35% of waste concrete flowed back to the source materials and 65% was disposed of or used as secondary materials. However, 95% of waste steel was used back as raw materials and only 5% was disposed of or used in other materials. To increase the recycling of CDW, the priority method is to force the material separation onsite. Mixing CDW would increase the cost of recycling and decrease the market competition ability. New technology to collect and recycle the CDW as a new material is also recommended. Finally, a new law, the Resources Recycling Promotion Law, is coming in this year, 2024, which is expected to turn the waste into resources in Taiwan.

Keywords: construction and demolition waste (CDW), material flow analysis, recycling, zero waste.

1. INTRODUCTION

Construction and demolition waste (CDW) is increasing with social development. The CDW is an inorganic material and good to recycle. Without recycling, the treatment of CDW is landfill. However, the space in landfills is very limited and nearly full. Therefore, the recycling of CDW is crucial. The average life span of buildings is 23.31 years [1]. The waste tracing and monitoring in Taiwan is complete. Nowadays, raising the recycling rate of waste is the major objective. Material flow is a systematic method to demonstrate the material flow from raw to end place [2]. Therefore, this study used the material flow analysis to demonstrate the CDW flow and to suggest methods to increase the recycling rate.

2. Methodology

The import and local generation of construction materials were collected from official databases. The products and their components were cited by different agencies. The output, which is the waste concrete

and waste steel was collected from the authority administrations. Finally, the material flow of concrete and steel was integrated as a Sanky diagram.

3. Results

The material flow of concrete and steel is shown in Fig. 1. The raw materials of concrete are cement, sand, gravel, and waste concrete. The product is concrete, and the final step is disposal and recycling. The data showed that the total concrete is 88.54 million m^3 and 65% of them are disposed and 35% of them are recycled. There are many types of steel products and 95% of them are recycled. Interestingly, the raw materials of these steel products are all from waste steel, no matter whether they are imported or locally manufactured. Because the material database, product database, and final product database are all different. The definitions of them are different too. Lacking a consistent data source makes building the material flow difficult. Subjective interpretations are assumed. For example, the component of the products and their recycling rate is cited by some local reports and might not represent the whole situation. The products, concrete and steel, are assumed to be used in construction. In addition, illegal raw materials aside from the official reports did not be accounted in the analysis.

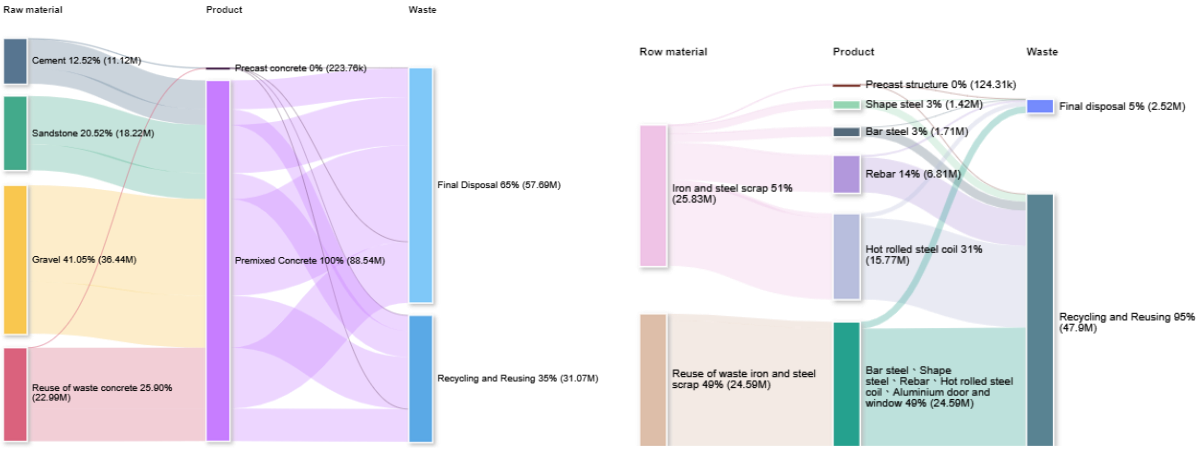

Figure 1 The material flow of concrete and steel in Taiwan in 2022.

3. Conclusions

The results of material flow of waste concrete and waste steel are different and the waste concrete is required to increase its recycling rate. Steel has high value and the recycling technology is mature so the recycling rate is up to 95%. Reviewing Taiwan's condition, there is no regulation for onsite separation and the mixing of waste concrete leads to the extra cost of recycling. Therefore, the help of the material separation on site is a priority need. In addition, most waste concrete is used as secondary material but not raw material, which means that new technology is also important. In Taiwan, to enhance the waste recycling and circular economy, a new Resources Recycling Promotion Law, is coming this year, 2024. After long debate and preparation, this law is expected to turn the waste into resources. It not only helps to reduce waste but also to reduce carbon emissions.

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