

CONSTRUCTION WASTE IN VIETNAM: ESTIMATED AMOUNT AND RECYCLING PRACTICES

Han Hoang¹, Tomonori Ishigaki¹, Rieko Kubota¹, Masato Yamada¹, Ken Kawamoto², Giang Nguyen³, Kien Tong³

¹*National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan*

²*Graduate School of Science and Engineering, Saitama University, Saitama 338-8570, Japan*

³*National University of Civil Engineering, 55 Giai Phong, Hai Ba Trung, Hanoi, Vietnam*

The construction industry contributes to more than 5% of the national GDP and attracts over 6% of employed population in Vietnam. The industry, however, has reportedly caused a wide array of health issues and environment pollution due to its increasing amount of waste generated. Whereas, current construction waste (CW) management activities are not well documented. No official statistics are available regarding CW generation and handling practices including reuse, recycling and disposal rate, creating constraints on developing an adequate CW management system. This study addresses this issue by determining CW generation rate, identifying CW flows and estimating CW quantity in five years in Vietnam.

The research was conducted in five residential building construction projects including three high-rise buildings and two single detached houses and apartments. According to General Statistics of Vietnam (GSO), high-rise buildings are defined as apartment buildings containing nine stories and above. Waste amount was measured according to waste piles' layout as suggested by Lau, Whyte, and Law (2008). Image analysis was implemented to identify CW composition, of which photos of waste piles were captured and superimposed by 11x11 dot grids to determine waste components. Face-to-face interviews using semi-structured questionnaires were conducted with site managers and contractors to identify recycling practices, final destinations of CW, and so on. The amount of CW generated in the selected five years in Vietnam was estimated by multiplying the surveyed waste generation rate with total construction floor areas provided by GSO.

Table 1 illustrates average waste generation rates (WGR) of different CW components in the projects investigated. Soil is the major waste generated in construction sites, high-rise buildings (851.83 kg/m²) and houses/apartments (71.79 kg/m²) alike. Soil is created during excavation process for building foundation. The amount of excavated soil is remarkable in the high-rise building sites due to basements constructed for vehicle parking. Followed is concrete (32.83 kg/m² on average) and wood (18.66 kg/m²). Concrete waste is mostly remaining materials at the bottom of concrete mix trucks' pipes. Wood is often used for scaffolding and discarded after it can no longer be reused. Observed paper waste at sites is mainly cement package.

Brick is wasted largely due to careless handling of construction workers. Miscellaneous CW includes glass, tile, rock, etc.

Recycling practices in the investigated construction sites is described in Figure 1. Recycling rate on site is high in house and apartment construction projects given reuse of soil for levelling. In contrast, excavated soil is often disposed of at landfills in high-rise building projects due to cultural reasons that new large-scaled buildings should contain new materials only and old soil could cause "bad luck". Broken brick is often reused for walling, contributing to 95.65% and 3.80% of on-site reuse rate in house/apartment projects and high-rise buildings respectively. Recyclable CW with high market value is often sold, including metal, paper and PVC. The rest is often disposed of. In house/apartment construction sites, it is usually illegally mixed with and discarded as domestic waste, accounting for 0.11% of disposal rate. Most of respondents are loath to providing exact CW flows, leading to about 30% of unknown final destination for all sites.

Figure 2 demonstrates estimated quantity of CW generated in Vietnam in selected five years when data on construction floor areas are available. The average amount is 9.25 million tons, equaling about 995 tons per million USD of construction GDP, which is higher than other Southeast Asian countries including Singapore (84 tons/million USD) and Malaysia (638 tons/million USD) as well as other more advanced economies such as Japan (281 tons/million USD) and the United States (839 tons/million USD). This indicates a great waste burden that the construction industry in Vietnam has created and raises an urgent need for more proper and sustainable construction technique, and more importantly, for technologies and systems to recycle CW, especially soil generated in high-rise building construction.

Reference

Lau, H. H., Whyte, A., & Law, P. L. (2008). *Composition and Characteristics of Construction Waste Generated by Residential Housing Project*. *International Journal of Environmental Research*, 2(3).

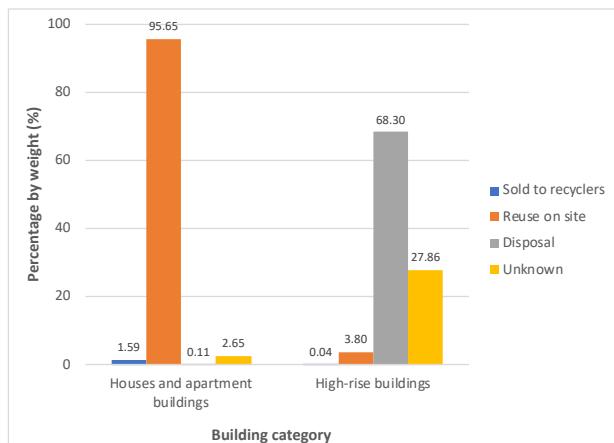


Figure 1: CW handling practices (%)

Table 1: CW generation rate (kg/m²)

	Houses and apartments	High-rise buildings
Brick and building block	0.37	11.04
Concrete	2.88	62.79
Metal	2.05	2.66
Paper	0.45	26.04
Plastics	0.01	10.07
Soil	71.79	851.83
Wood	0.04	37.27
Miscellaneous	1.66	25.53
Total	79.25	1,027.24

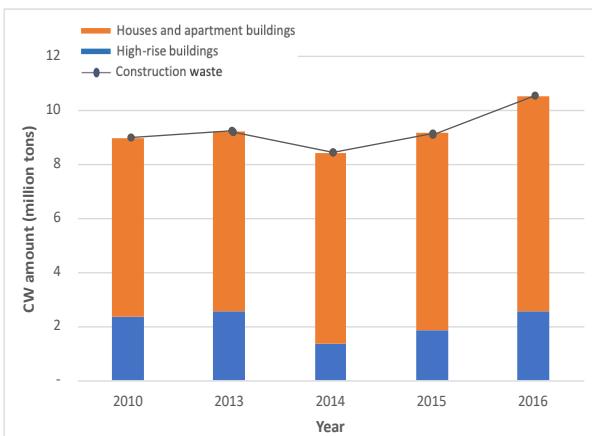


Figure 2: Estimated CW generation (million tons)