

A study conducted to reduce construction waste generation in Turkey

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Abstract

Waste occurs within the lifecycle of buildings, during the construction, modification and demolition phases. These construction wastes become serious environmental problems in many countries and in Turkey. However, no net data regarding the amount of construction wastes exist in Turkey. During its period of usage, frequent interior modifications are made for various reasons, particularly true for residences in Turkey, thus generating construction wastes. The primary environmental target regarding this subject should be the prevention and reduction of construction waste generation. The aim of this study is to provide suggestions regarding the prevention/reduction of waste generated due to modifications done for various purposes in residences in Turkey. To this end, a survey of homeowners in Istanbul was conducted to determine the nature and purpose of modification work done in residences. In order to come up with solutions towards reducing the construction waste generation, it is vital that these reasons are known. In light of the causes determined, suggestions for solving the problems have been developed.

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1. Introduction

The applications related to reducing of environmental problems that are progressively increasing these days make up a part of modern architecture agenda as well. Therefore, buildings that cause less environmental effects by generating less waste are defined as “environmentally friendly”.

Waste occurs within the lifecycle of buildings, during the construction, modification, and demolition phases. The construction wastes become serious environmental problems in many countries. According to one estimates of EPA (US Environmental Protection Agency), approximately 136 million tons of building-related construction debris was generated in the US in 1996 [1]. In the US, construction and demolition (C&D) waste represents about one-third of the volume of materials in landfills [2,3]. Stokoe et al. [4] reported that C&D waste took up about 65% of Hong Kong’s landfill space at its peak in 1994–1995. Thirty five percent of the space in Canada’s landfills is taken up with construction wastes and debris.

According to Ferguson et al. [5], over 50% of waste in a typical UK landfill could be construction waste. Craven et al. [6] reported that construction activity generates 20–30% of all waste deposited in Australian landfills.

One of the important environmental problems in Turkey is the pollution caused by municipal and industrial wastes. This problem is felt even more strongly in the Marmara region and Istanbul where the population and industrialization is denser. Marmara region occupies the northwest corner of Turkey. Because of its location connecting Asia and Europe, Istanbul Metropolis is the most crowded of the region. It has been reported that the amount of solid waste produced annually in Turkey is approximately 38 million tons [7]. The single day average garbage generation in Istanbul is approximately 10 000 ton, and this amounts to approximately one kilogram of residential and construction waste per capita per day. Until recently, solid waste was being stored using outdated methods in Istanbul. Therefore, explosions and fires due to methane gas build-up occurred in landfills, loss of lives and property took place due to garbage slides. Proper waste storage facilities have been built as a result of work begun in Istanbul in 1995. During the January–November period in 2000, it was

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determined that the amount of waste disposed off at proper waste storage facilities was 2 957 240 ton [8]. Berkun et al. [9] conducted a detailed study on the subject. However, no net data regarding construction waste amounts exist in Turkey. After the 1999 Marmara earthquake, a significant (approximately 13 million tons) amount of debris occurred [10]. As a result of the daily demolition of illegal construction, a continuous formation of waste occurs, also. Besides these reasons, during the period of usage of residences in Turkey, for various reasons quite frequent modifications are done to the building material and components, thus resulting in the formation of construction waste. This leads to not only economic and labor losses, but also can have a negative impact on the environment.

Construction and demolition debris that are dumped into forest, streams, ravines and empty lots causes erosion, contaminates wells, water tables and surface waters, attracts pests, creates fire hazards and detracts from the beauty of natural areas. In many countries, the large volumes of construction waste strain landfill capacities and leads to environmental concerns. It is also much more difficult to dispose off construction waste that may contain such hazardous matters such as asbestos, heavy metals, persistent organic compounds and volatile organic compounds (VOCs) than household waste.

The methods, which are the basis of sustainable development and cover subjects such as energy saving, natural resources saving and waste reduction, make up the agenda of modern architecture as well. Since 1970s, governments, practitioners, and academics have been advancing gradually in pursuance of efficient and cost-effective environmental management to reduce construction waste in a worldwide scope [11]. A regulation regarding the control and recovering of construction waste was recently issued in Turkey. This was the “Regulation on the Control of Excavation, Construction and Demolition Wastes” issued on March 18, 2004 by the Ministry of Environment and Forestry [12]. This regulation stipulates the general rules along with technical and administrative details that must be adhered to primarily regarding the reduction of, along with the collection, temporary storage, moving, recycling, using and disposal of excavation, construction and demolition wastes.

The primary environmental target regarding this subject should be the prevention and reduction of construction waste generation. In this study directed for this purpose, research was conducted on the usage period and the reasons for modifications made in residences in Turkey where, due to these modifications, large amounts of construction waste production occur. In order to come up with solutions towards reducing construction waste, it is vital that these reasons be known.

2. Study methodology

A survey was conducted in Istanbul to serve the purpose of this study. Fifteen percent of the population

(approximately 12 million) of Turkey resides in Istanbul. In addition, in terms of the number of buildings, Istanbul is the densest region (777 416 buildings) in Turkey with 70% of the buildings being residential buildings [13]. For these reasons it is believed that the results obtained from this study will reflect the general condition of Turkey. The surveys was conducted by interviewing 180 homeowners living in different parts of Istanbul that exhibit a homogenous socio-economic and socio-cultural make up and live in residences that were designed and built for non-specific dwellers. The more detailed data is presented in Section 5.

The aim of the survey is to determine information under the following topics:

- The kinds of modifications done during the usage period of residents that leads to the generation of construction waste.
- The kinds of building materials/components the modifications focus on.
- The reasons for the modifications.

The survey is made up of fifteen questions, and the first section contains questions aimed at defining the type of residence. The second section contains questions regarding the modification works done in the residences, specifically the types of materials used, the amount, the reasons of modifications and what was done with the old material. In order to evaluate the data, Microsoft Excel was used and the results can be seen in the corresponding figures and tables.

3. Reducing and recovering construction waste

The most effective method of reducing the environmental impact of construction waste is by primarily preventing its generation and reducing it as much as possible. This will reduce reuse, recycling and disposal needs thus providing economic benefits. The European Union Commissions have prepared detailed documents and reports on this subject [14,15]. A study was conducted by Ekanayake and Ofori to develop the building waste assessment score model for assessing building designs [16]. Because recovering of construction waste is not yet prevalent in Turkey, the primary environmental concern should be the prevention/reduction of the generation of construction waste. Turkey declared in the Eighth Five-Year Improvement Plan that the primary target for “controlling solid waste” is to “reduce the amount of waste generated” [10]. In order to prevent the generation of construction waste, it is important to first determine the reasons for the generation of waste.

If waste generation could not be prevented or only prevented to a certain degree, the next step should be to ensure that the construction waste is reused and recycled as much as possible. An analysis has shown that recovery reduces the amount of waste and Green House Gas (GHG)

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