

# Recycling Possibility Of Buildings Destroyed In The Last 5 Years Due To Terror In Turkey And The War In Syria

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## Abstract

The most effective way to protect the environment and prevent pollution is saving non-renewable natural resources. It is possible to reduce both the products and the cost of contamination by recycling. The debris usually ensue from fire and earthquake disasters, wars, renovations and administrative decisions on urban transformation. The war in Syria and terror in Turkey are the major reasons of destruction for the last 5 years. This fieldwork has investigated the scale of destruction as consequence of war and terror after 2011 in Syria and near Turkey, and possible solutions to manage the construction waste.

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**Keywords:** Recycling, construction waste management, textiles

## Introduction

The Worldbank reported that 54% of the global population is located in urban areas, with an expected upward trend in the near future. Over 80% of the global GDP is generated in cities. Urbanization may contribute sustainable growth if managed well by virtue of increasing productivity, allowing for innovation and new ideas to emerge. Nonetheless, the speed and scale of urbanization brings challenges, including meeting accelerated demand for affordable housing, well-connected transportation systems and other infrastructure, basic services as well as employment particularly for approximately 1 billion urban poor who live in informal settlements for access to urban facilities. Development of cities brings along further exposure to climate and disaster risk. Almost half a billion urban residents live in coastal areas, increasing their vulnerability to storm surges and sea level rise (<http://www.worldbank.org/en/topic/urbandevelopment/overview#1>).

According to a study on green building rating system (GBRS) - a tool to assess whether a particular building is green and identify the

corresponding rank according to the detailed assessment requirements (Wu et al., 2016) - five GBRS's were selected worldwide and a comparative analysis was proposed with an attempt to suggest a comprehensive insight on the measures that assist in improving construction waste management. The research alluded that of the five rating systems studied, the highest relative significance index of waste management was given to Evaluation Standard for Green Building, while the lowest to Green Building Index. In relation to the 3Rs principle (reduce, reuse and recycle), Evaluation Standard for Green Building and Green Globes focused more on the reduce principle, while the other three systems proposed waste management measures largely based on the reuse and recycle principles.

Colossal construction waste generated in cities covers large areas in both developed and developing countries. The disposal of this waste stream results in various environmental impacts including soil pollution, air pollution, and water pollution, which entail developing strategies to manage construction waste, particularly in Turkey and Syria. One solution is considered as the green building concept which has gradually gained more popularity among the public; leading the building developers' eagerness to obtain green building certifications as a representation of added value of their buildings.

Having spoken to TRT News, Associate Prof. Dr. Ufuk Tutan (<http://www.trthaber.com/haber/turkiye/30-yilda-terorun-turkiyeye-maliyeti-239602.html>) said the total cost of terror for the last 30 years to the Turkish economy was US\$ 1.2 trillion according to the official numbers; in other words, its annual cost was US\$ 40 billion. Terror-caused cost on the economy may be calculated as US\$ 200 billion for the last five years; however, the cost in the last one year will obviously be much higher than this average, therefore managing the construction wastes caused by terror in Turkey is so important for country economy.

Syrian President Beşar Esad, who spoke to the Russian news agency Ria, said the cost of the clashes ongoing in Syria for the last five years was over US\$ 200 billion to the country. Esad noted that the infrastructure was severely damaged due to the civil war ongoing in the country for 5 years, and recovery would take many years ([http://www.bbc.com/turkce/haberler/2016/03/160330\\_esad\\_savas\\_maliyeti](http://www.bbc.com/turkce/haberler/2016/03/160330_esad_savas_maliyeti)).

According to another news article, the rate of poverty increased by 85% in Syria just in 2015. In the country, where approximately 14 million Syrians lost their jobs, the cost of the civil war is estimated as around US\$ 255 billion (<http://www.amerikaninsesi.com/a/suriye-de-savasin-aci-bilancosu/3211012.html>). Therefore for Syria it will be in big importance to rebuild the cities and managing the construction wastes caused by war in the future.

## **Building Materials**

Cement, sand, wood, steel, perlit, gypsum plaster, stone, ceramic, marble, glass, technical textiles, plastic and brick are among the most commonly used materials in the building industry. Most of the time, these materials can only be collected cumulatively after a disaster and under inconvenient conditions that prevent their segregation. Wooden, steel, plastic and big stone particles can be separated from building waste; however, cement, gypsum and bricks are difficult to separate as they are found stacked and mixed together.

Though cement, sand, steel and brick are the main materials for buildings, textile components have also been used in the building industry for many years. Particularly, they are frequently used in the places such as airports, stadiums, fitness centres, fairs and showrooms, arsenals and industrial stores. Some building examples with technical textiles are shown in pictures 1, 2 and 3. There are many advantages of using these materials in buildings. A sheath of fabric is about 1/30 of the weight of brick, steel or concrete (Can, 2008). While some textiles involve water vapour permeable membrane to protect the walls against humidity, nonwoven fabrics and glazing are rather used for the roofing. Fibres and textiles have important roles in isolation of buildings and equipment as well. Fibreglass is currently preferred and employed instead of asbestos fibres. (Ucar, S., 2006)



**Picture 1.** Finland International Airport (Can, 2008).



**Picture 2.** San Diego Convention Centre (Can, 2008).

### **The Reasons of Demolishing Buildings in the Case of Turkey and Syria**

The main reasons for demolishing buildings with furniture and other goods inside include natural disasters like fires and earthquakes, bombing as a consequence of wars and terroristic actions, destruction of the buildings with a weak infrastructure endurance by the authorities.

For instance, in the past, urban problems were solved with solutions such as planning new urban sites. However, the limited new sites likely to be opened for settlement, the consumption of these sites as they were opened for settlement, and the problems experienced as regards the need for the development of new settlement areas in the city brought to the agenda the requirement of providing the city with the existing depressions again through planned interventions, in other words, urban transformation (Karadağ and Mirioglu, 2011).

Divisional, social protests and armed conflicts have been experienced in the Middle East and North Africa since 2010 as a result of the Arab Spring. Refugee rush started to Turkey after the defection demand of Syrians who ran away from the conflicts in April 2011 from our Turkey's frontier country Syria.

Atilla Toros, the President of Migration Administration under the Ministry of Interior said there were 2,255,299 registered Syrians in Turkey as of January 2016 (<http://www.posta.com.tr/turkiye/HaberDetay/Iste-Turkiye-deki-son-kayitli-Suriyeli-sayisi-Ocak-2016-.htm?ArticleID=321871>).



**Picture 3.** Denizli Synthetic Ice Rink

Republic of Turkey Prime Minister’s Disaster and Emergency Management Authority (AFAD) conducted a questionnaire study to learn the refugees’ profiles in 2013. 32.8% of the 7,860 refugees who responded the questionnaire at 1,420 housing units in the temporary shelter area said their houses were completely damaged/demolished, and 17.1% said they were massively damaged; while 28.7% of 7,320 people who are staying at 1,160 housing units outside of the shelter area said their houses were completely damaged/demolished, and 14.9% said they were massively damaged. It can be inferred from the answers “completely damaged/demolished” and “massively damaged” that approximately half of the people’ who live in shelters (49,9% and 43,6% respectively) have houses which became uninhabitable in Syria (2).

The report of the Republic of Turkey, Prime Minister’s Disaster and Emergency Management Authority (AFAD), the average number of household members among the refugees in shelter area is 5,6, while that of the people outside of the shelter area is 8,6. Thus the average number of household members among Syrian refugees may be estimated as 7. Based on a calculation considering the number of household members as 7, the registered 2,255,299 Syrian refugees had 322,186 houses. If, according to AFAD’s questionnaire, the houses of 46% of the Syrian refugees are demolished or massively damaged, then the number of required houses may be calculated as  $322,186 * 0,46 = 148,205$ . Various TV channels have reported that for the last 5 years, more than 10 million Syrians left Syria and sought refuge in the surrounding countries such as Jordan, Turkey and the EU, which implies that the number of damaged buildings in Syria may even exceed one million.

The terror in the South-eastern part of Turkey caused not only thousands of people to leave their homes and immigrate to the surrounding cities but also damaged and destroyed an indefinite number of houses.

The damage identification studies in Silopi district *per se* indicated that 342 buildings and workplaces, and 2 mosques were severely damaged; 6,352 buildings and workplaces, and 17 public buildings were moderately damaged; 27 buildings collapsed completely and the cost was 82 million Turkish Lira (<http://www.milliyet.com.tr/az-hasar-goren-eve-10-bin-liraya-gundem-2208217>).

The Turkish Government's Spokesman Numan Kurtulmuş explained that the total number of collapsed buildings in five districts including Sur, Silopi, Cizre, İdil and Yüksekova was 6,320. The total cost foreseen during the demolition and reconstruction of these buildings is approximately 855 million Turkish Lira (<http://sehirmedya.com/siyaset/teror-operasyonlarinin-bilancosu-aciklandi/>).

### **Recycling and Management of Construction Wastes**

Recovery and recycling activities require an extensive improvement in Turkey as they constitute the backbone of resolving the issues of waste and turning them into new resources. Recovering the wastes after the buildings are demolished is very important for many reasons related with the reduction of the environmental pollution and contribution in the economy.

The inclusion of the recycled wastes in production will contribute economic activities, preserve natural resources and reduce the footprint of wastes on the environment. (Kactioğlu and Sengul, 2010).

### **Using the Building Wastes in Industry**

One of the type of waste materials obtained from buildings is plastics. These are PET and PES sort of materials used for floor and furniture, as well as from textiles.

Rebeiz and Fowler (1994) *et al.* investigated the flexibility of polyester reinforcement produced from the PET.

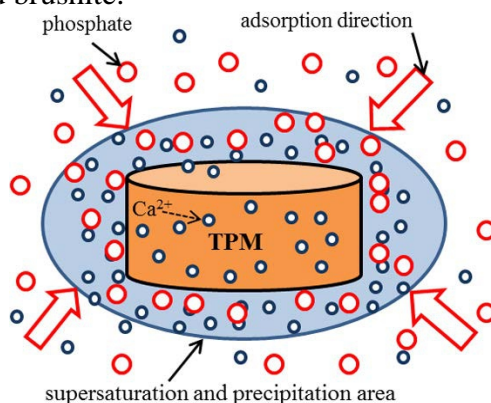
Hon and Buhion (1994) studied penetrability of PET and HDPE at various admixture rates in composite materials. They found that PET and HDPE were uniform in composite, with mechanical and mouldable characteristics.

Masaiko (2005) confirmed that it is possible to obtain 1 kg of PET dunnage out of 1.246 kg bundle of PET bottles, and 1 kg PET polymer out of 1.133 kg of bundle of PET bottles by chemical recycling method. Thus, the natural resources used for producing 1 kg of PET are offset and the footprint of packing wastes on the environment are reduced.

A project of Prof. Veena Sahajwalla from the University of New South Wales in Australia revealed that plastics which expose carbon at a high degree can be used for enhancing the endurance of steel. A huge

reduction of plastic wastes is anticipated after the implementation of the project (Anonymous, 2007).

Various laboratory studies have also been realized on producing new materials from solid building waste. In a study (Yang at al., 2016 ), phosphate was precipitated and recovered through a tablet precipitation material (TPM) which was developed from used white cement (see Scheme 1). The development of TPM provided an alternative for the management of building waste. The results showed that TPM could effectively recover phosphate from aqueous solution; the final precipitates consisted of hydroxyapatite and brushite.



**Scheme 1.** Production of phosphate recovered tablet precipitation material (TPM) developed from used white cement (Yang at al., 2016 )

PET bottles are commonly used in beverage industry and can be reused after physical and chemical recycling processes. Usage areas of recycled PET have been developed rapidly. Although recycled PET is used in plastic industry, composite industry also provides usage alternatives of recycled PET. Textile is a suitable sector for recycling some plastics made of polymers, too. In this study, the recycling technologies and applications of waste PET bottles have been investigated and scientific works in this area have been summarized (Tayyar and Ustun, 2010).

Yulong Eco-Materials Limited, an eco-friendly building products and construction waste management company, announced that the Department of Transportation of Henan Province, China gave final approval for the Company's provincial technical code established to govern the use of recycled construction waste materials in the production of roadbed – a road's foundation. Mr. Yulong Zhu, Yulong's CEO, noted, that they received positive feedback from all road and highway construction companies they were negotiating with, and believes that they can sell all of their current recycled waste inventory before 2016 fiscal year-end. They estimate that revenue generated from the sale of the recycled construction waste in fiscal 2016 will contribute more than \$5 million to their top line, in addition to

revenue they already generate from the hauling and recycling of construction waste (BusinessWire , 2016).

## Conclusion

Many home textiles and garment textiles mix in the debris after demolition caused by war. In addition to the foregoing information about PET and PES, they can also be used for the production of textile materials such as blankets and floor textiles after the materials are separated and recovered (i.e. the cotton) in recycling facilities.

The activities about separating solid wastes in Turkey are run by the conglomerates which focus on domestic wastes in the big cities. On the other hand there are landfills for building wastes near big cities. It is possible to use them as sealant of the potholes during the modifications of sewer systems. For example, rocks were used in the infrastructural sewer system work in Denizli. Evaluating this kind of possibilities in such circumstances would contribute to the economy and reducing the waste areas. The furniture or the floor materials which can be found in the buildings might be converted into the raw materials used in the furniture industry and building insulation.

Because of continuing war in Syria, it is very difficult to suggest solution for management of building wastes. The problems of this area can only be resolved with governmental projects and international support for rebuilding damaged cities after stop the war. As a result, recycling construction wastes will continue to be problem for Syria for an indefinite period in the future.

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