

A study regarding the environmental management system of ready mixed concrete production in Turkey

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Abstract

The construction industry as one of the leading industries of the Turkish economy makes up approximately 60% of total investments. Because of the widespread use of concrete building systems used in construction work in Turkey, concrete production is also quite high. In this study, the application levels of the methods of environmental management in regards to the ready mixed concrete production in Turkey were determined. In Turkey a wide ranging environmental laws about this subject exists. However, it is known that there are problems in its implementation. As a result of this study, it has been determined that there are differences between plants in their environmental applications of the ready mixed concrete production in Turkey, and despite the strides taken in this area; it has not achieved the desired levels. Therefore, inspections must be increased in order to strengthen the enforcement of the rules and regulations of the environmental laws in Turkey.

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1. Introduction

Turkey is a developing country with one of the fastest population growths among European countries [1]. Due to this rapid growth, urbanization in Turkey is rapid and the need for housing is increasing. Turkey's largest city, Istanbul, is also growing and receiving heavy migration. According to the results of the 2000 general census, 15% of the total population and 11% of the total number of buildings in Turkey are in Istanbul [2].

The construction industry is one of the leading industries of the Turkish economy. This industry makes up approximately 60% of the total investments [3]. Because of the widespread use of concrete building systems in construction work in Turkey, concrete production is also quite high.

The production of ready mixed concrete in Turkey began in the late 1970s, and after 1987 began to spread to areas with a high rate of urbanization such as Istanbul, Ankara, Izmir and Adana. With the increased use of ready mixed concrete, the quality and reliability issues of concrete gained importance. Because a large part of Turkey lies within an earthquake zone, the quality of concrete in relation to structural integrity has become an issue of utmost importance. Attempts to start a trade organization were begun in 1988 within the ready mixed concrete industry and the Turkish Ready Mixed Concrete Association (TRMCA) was formed to facilitate technical coordination between producers, provide guidance and ensure production be done within the framework of public safety and Turkish standards [4].

According to 2003 data, with a 28.2 million m³ concrete production capacity, Turkey is seventh among European Ready Mixed Concrete Organization (ERMCO) member states [5]. Despite the slowdown in the construction industry after the earthquakes in 1999,

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there has been an increase in the number of ready mixed concrete plants. According to TRMCA data, in 2004 31,590,886 m³ concrete was produced by 245 companies and 473 plants. Forty percent of the plants are located in the Marmara region, while 50% of these provide service to Istanbul [6].

As we feel the negative results of environmental problems even more so today, it is known that buildings and building materials contribute to these in various ways. That is why it is vital to research the environmental impact of this material in Turkey where the use of concrete is quite high. A study evaluating the quality of the ready mixed concrete industry has been previously done in Turkey [7]. In this study, research was conducted in regards to applications that would minimize the environmental impact of the ready mixed concrete production in Turkey. The purpose of this study is to determine the implementation levels of the procedures as to its environmental management, recognize the problems and provide solutions to overcome them. There are sufficient environmental laws that encompass these implementations [8–15]. However, it is well-known that there are problems regarding their execution.

With efficient environmental management, the negative effects of the ready mixed concrete production are reduced and the material is considered more environmentally friendly. Turkey became a signatory of the *UN Global Compact Programme* signed at the 1999 Davos Summit which encourages the development and diffusion of environmentally friendly technologies. In this context, just like any industrial production in our country, it is expected that building material production technologies be ecological, environmentally friendly and a process that inflicts minimal damage to environmental values.

2. The environmental impact of the ready mixed concrete production

Because concrete is a sturdy material, and does not require a lot of care and maintenance at use phase of buildings, it has gained an ecological property. However, during the production process of ready mixed concrete, the polluting of the air, water and land, along with the use of energy and natural resources are considered to be negative properties [16].

The dust emissions that form during the transportation, storage and transfer of raw materials to the plant lead to air pollution and the returned concrete by becoming solid waste, causes water and land pollution [17]. Leaks from chemical material and fuel tanks lead to land and water pollution while the cleaning of truckmixers causes water pollution. For example, the pH value of the cleaning water used in the ready mixed

concrete plant can be as high as 12 [18,19]. The *suspended solid matter* density and cloudiness of the cleaning water are also quite high [20].

When concrete waste is dumped on land, materials such as cement, chemical additives, etc. in the mixture, harm the natural structure and destroy habitats. Known negative impacts of these are the unbalancing of environmental values, thus the adverse effects on human health.

The amount of energy used during the production process becomes an important criterion in the ecological evaluation of building materials. To accomplish this, first of all the production process of the building materials themselves must be energy efficient [21]. The energy efficiency of the building materials strongly determines the energy efficiency of the building they are used in. Since cement is used as a constituent material in the ready mixed concrete and because it has an energy dense production process, this negatively impacts the energy efficiency of concrete materials. Also the equipment used in the ready mixed concrete production uses up energy.

According to the Turkish Building Industry's 2003 Report [3]: in 2001 approximately 65 million tons of aggregate were used in the ready mixed concrete production in Turkey. In the 2004 report [22], it is reported that the aggregate needs for ready mixed concrete production are rising and the aggregate sources are diminishing. The rapid diminishing of a natural resource in this fashion is an important problem. Also during the removal of aggregate from its source, an environmental impact of the changing of the natural properties and contours also occurs. During the ready mixed concrete production, the consumption of another important natural resource—water—is quite high because the outside of the truckmixer must be washed before and after transportation, and the inside must be washed at the end of the day. Removing the residual cementitious material adhering to the drum and blades of a single truck unit can require approximately 150–300 gal of water [23]. The "Environment Canada" group estimates that approximately 500 gal of water are used on a single truck [19].

3. Study methodology

In this study, the environmental management application levels related to prevent/reduce the environmental impact of ready mixed concrete production in Turkey were researched. To this end a field study encompassing ready mixed concrete plants in Istanbul was realized. In the field study conducted at the beginning of 2004, a face-to-face poll was conducted with 24 ready mixed concrete plant managers and on sight observations were noted. The questionnaire was made up of 26 questions

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