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CONCRETE CONSTRUCTION AND ITS RESOURCE SAVING TECHNOLOGIES FOR SUSTAINABILITY

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The construction sector has a significant impact on the environment. These impacts are becoming more and more prominent as the years go by. Concrete construction throughout its life cycle presents it unique problems to the environment. This begins from the production of the various raw materials used in concrete up to the waste materials that come from structures after demolition. Some of the main environmental impacts that the concrete construction industry has on the environment are: resource depletion, emission of carbon dioxide into the atmosphere and massive energy consumption.

In this thesis, we are going to discuss the general life cycle of concrete and review some main sustainable concrete construction solutions from various earlier done researches.

The importance of sustainability research in the field of civil engineering is undeniable. In this regard, companies are progressively conscious that ensuring a competitive advantage is contingent on more than only client pleasure based on low costs and the quality of the product or service delivered [1].

Building in a sustainable manner and scheduling appropriate building maintenance are significant in the "new construction ideology" of this new century. In particular, to build in a sustainable manner means to focus attention on the effects on human health, energy conservation, and physical, environmental, and technological resources for new and existing buildings. It is also important to take into account the impact of construction technologies and methods when creating sustainable structures [2]. Owing to this and many more reasons, the concrete construction industry must be reviewed.

The material contained in this thesis was obtained through scientometric analysis of bibliometric data on sustainability in concrete construction.

The life cycle of concrete mainly comprises of the manufacturing stage, construction stage, life stage and demolition stage. We shall asses each of these stages to discuss their impacts and specific methods needed to be applied to deal with these impacts.

During the manufacturing stage, cement, aggregate and water are needed. Of these three raw materials, cement production consumes more energy. It is produced in a rotary kiln at a temperature of about 1450 c and carbon dioxide is also released as a by-product.

This process involves heating the slurry mixture which is fed into the kiln to produce clinkers. The clinkers are later on dried and ground into powder with the addition of special additives to produce cement of the required grade. This is an extremely energy consuming process. It is estimated that sand and aggregate account for approximately 30 % of all carbon dioxide emissions during the process of concrete production. Let us now look at the life stages of concrete and asses their various impacts and energy consumption. Each stage presents its own unique impacts. In the stage of construction, less amounts of greenhouse gases are released as compared to the manufacturing stage. The effectiveness of this stage cannot be neglected though. Onsite activities like pumping, vibrating, and finishing consume energy. During the life stage of properly prepared concrete, there is little to no emission of gases and energy consumption. But when it deteriorates, its repair requires energy and produces waste materials.

The demolition of concrete structures and its transportation can be an expensive process. It also consumes close to 0.2 percent of energy in the whole life cycle assessment.

To solve the above mentioned problems in concrete construction, the following solutions have been and can be implemented: *Use of blended cements*. As earlier stated, cement is produced by grounding clinkers produced in rotary kilns. Partially or fully replacing the clinker can reduce energy consumption and carbon dioxide emissions. Blended cements are produced by using industrial by products like slag in place of clinker. This decreases energy consumption and greenhouse emissions. *Energy efficiency improvement.* Decreasing emissions from electricity and fuel use can be achieved by the use of process control systems, use of raw meal homogenizing systems for storage and mixing of raw materials, converting from the wet to semi-wet process during clinker production when producing the cement. *Prolonging the service life of concrete.* When the concrete is durable, it decreases the amount of solid waste as a result of demolition, it also saves the virgin raw materials which would be needed to repair or replace the fractured concrete.

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