Chapter 4
Environmental Analysis of Construction Materials:
Material Specifications for Green Built Environment

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ABSTRACT

There is a growing universal awareness of protecting the living and non-living environment and making enlightened decisions to achieve a sustainable development without destruction of the natural resources. In this point of view, selecting building materials according to their energy and health performances gains importance in sustainable design. 3Rs (reducing, reusing, recycling), and supplying a healthy, non-hazardous indoor air for building occupants are two important parameters of environmental life-cycle assessment for materials. Information on exposure to gases and vapors from synthetic materials made from petrochemicals, to heavy metals and pesticides, and to some combustion pollutants that cause acid rain should be determined by analyzing environmental product declarations or material specifications. After studying on building materials individually, they are analyzed in the form of tables for four different stages; manufacturing, application, usage, demolition phase. Consequently, this chapter can guide the designer and engineer to think on the elements of design and construction activity.

INTRODUCTION

Buildings are considerable exporters of pollution. Polluted wastewater, indoor air, smoke and vehicle exhaust gases, rubbish, garden pesticides and nitrate fertilizers are all emitted from the buildings and gardens. (Quadrennial Technology Review, 2015) Sustainable design methods offer the architects the opportunity to integrate design skills that overcome damaging consequences. The effects of climate on the energy systems of buildings; collection and storage of heat, use of natural light, control of air movement and generation of power; should also be expected. (WBDG Sustainable Committee, 2011) Use of locally produced materials will combine with regional responses to climate and produce regionally

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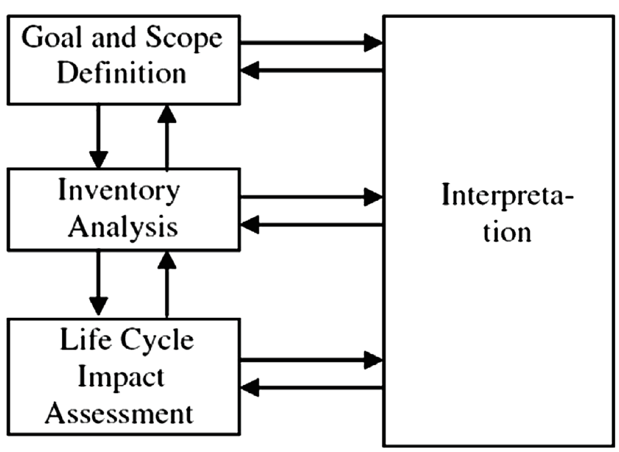
based architecture. The determined policies of international resource use and regulations are necessary or sufficient to achieve global sustainability of economic growth (Adeyeye et al., 2007). The fundamental strategy is using less amount of natural resources and constructing less via renewable materials and renewable sources; thereby reducing indoor and outdoor pollution, waste production and embodied energy. Recycling is another approach to waste reduction that has been strongly advocated by many environmentalists. It is a "cradle to cradle" analysis of all building decisions considering not only the extracting phase, but also construction, usage and disposal phase. (Saghafi et al., 2011) The structural complexity made recycling more difficult in many cases like recycling of textiles because of the prevalence of blends of natural and synthetic fibers. (Adeyeye et al., 2007)

The major concepts that guide the selection of materials and components include energy efficiency, sustainability, transferability, cost, aesthetics, availability and mostly human and environmental health. The technological developments create modern constructions and surfaces. (DPTI, 2017) These constructions and surfaces make human life easy in most areas, but they create many problems about environmental and human health. While choosing surface materials, besides the appropriateness of the design, energy, health and economy criteria should be considered carefully. Health and pollution should be of growing concern. (Ragheba et al, 2016) As buildings becomes more complex, liability and responsibility upon the shoulders of the designers and to some extent the constructors of buildings also increase. Risks should be identified at the design stage and appropriate action should be taken to minimize the environmental damage.

BACKGROUND

Life-cycle assessment is defined as "*a system for analyzing environmental aspects of products or processes through their life cycle, from raw material extraction to recycling, which includes manufacturing, use, and end-of-life (EOL) disposal*" (ISO 14040: 2006). While assessing the impacts, first environmentally relevant inputs and outputs are compiled, and then evaluated in order to interpret the results in four interrelated phases; "goal and scope definition phase, inventory analysis phase, impact assessment phase and interpretation phase" as highlighted in Figure 1. (ISO 14040: 2006) (ISO 14044: 2006)

Figure 1. LCA methodology and relationships (ISO 14040: 2006)



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