Service-life and Sustainability of Concrete Structure in Tropical Condition

Bishwajit Bhattacharjee

Indian Institute of Technology, Delhi, India

Contact:bishwa54@gmail.com

Abstract

Concept of service-life is elaborated at the outset in the realm of life of structure, which includes terminologies such as, intended design life and physical life etc. Implication of service life and consequent repair frequency on life cycle performance of structure is highlighted. Annual bio-capacity (BC) of the earth although has been increasing, but at a much slower rate than annual global ecological foot print (EFP) of human consumption. As a result human being, as a species, has been consuming the reserved resources available in the mother earth at a faster rate. Hence at current consumption rate human needs more than one earth annually to sustain itself, thus throwing serious challenges to future generations on their sustenance. Contribution of concrete in structure to EFP during its life includes the land, i.e., crop land the structure occupies, forest land used up for mining the raw material and fossil fuel for energy and the land attributed to carbon foot print etc. The structure would contribute to EFP of construction year(s) and later, on recurring basis during repair whenever undertaken. Service-life implies repair age, hence contributes to recurring EPF, thus to sustainability. Satisfactory functional performance throughout intended design life of structure without repair or with less frequent repair may need higher effort during construction but shall lessen the overall life cycle EFP. The importance of life cycle analysis in this context is highlighted. Taking the issue forward, in the tropical climatic condition of Indian subcontinent with marine environment of long coastline and varying rainfall induced wetting and drying, an approach to service life estimation is presented for sustainability at the and conclusions are summarised.

Keywords: service life, concrete, sustainability, ecological foot print, bio-capacity,

1 Introduction

Serviceability limit states are important concerns for structures like bridges and buildings, in addition to limit state of collapse. Repair and rehabilitation can often take care of serviceability limit failures without complete replacement or reconstruction of structures. Repair and rehabilitation may be undertaken several times during the period when structure remains functional. Each time when such an exercise is undertaken, there is consumption of resources and generation of wastes. Both consumption and waste generation leave a foot print on ecology, i.e., repair and rehabilitation for maintaining functionality of structures leaves an ecological foot print (EFP). The earth has a fixed bio-capacity (BC), bounded by fixed surface area comprising of land mass plus oceans and annual energy budget it receives from the sun. There is a natural annual balance of energy with net zero deficit and surplus [1]. Maintaining this balance is a necessity for mankind to avoid detrimental consequences. In this article concepts of life of structure are elaborated in the next section, with the focus on service life of structures. Sustainability is linked to ratio of EFP to BC, and this linkage is

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