IMPACT OF LIFE CYCLE ASSESSMENT IN CONSTRUCTION COST AND ENVIRONMENTAL IMPACTS

Seyed Mohammad Amin- Noori , Mohammad Taghi Banki, Saeed Kia

Department of Civil and Environmental Engineering, Amirkabir University of Technology

Corresponding Author's E-mail: bankimt@yahoo.com, IRAN

Abstract

Life Cycle Assessment is a tool to assess the environmental impacts and resources used throughout a product's life cycle, In spite of this progress in developing methods and tools to support sustainable building design, there is still a lack of a formal approach to bridge gap between the traditional building engineering disciplines, and between these and the architecture, to achieve the level of building integration required for sustainability. This paper presents an integration framework that aims at facilitating the inclusion of life-cycle considerations in the design process from the outset, so that materials and systems are selected not only from environmentally friendly resources, but most importantly, to match service life performance expectations. The iterative methodology to evaluate these expectations in practice which is based on an understanding and modelling of the dynamics of the built environment to materials, components, and systems are exposed. Quantitative methods and test protocols can be incorporated into the framework for assessing function-performance aspects of alternative solutions. Due to its complexity stemming from its inherent exposure to variable environmental loads and its multi-functionality, the framework focuses on addressing the life cycle of the building enclosure system. It is expected that the organization of the underlying principles of building life-cycle performance described in this paper will become a knowledge core that will impact of human life-cycle assessment to building architecture design for reduced embodied traditional and environmental impacts.

Key Words: Architecture, Traditional, Environmental, Life-cycle, Service life, Building science

1. INTRODUCTION

The quest for sustainability has raised awareness of the role of buildings as major direct and indirect stressors of the natural environment, bringing new challenges for engineers to come up with creative approaches for minimizing the use of natural resources and maximizing the use of renewable resources, while optimizing whole engineered system's long-term functionalities. These challenges are forcing engineers to leave their discipline silos and collaborate with complementary disciplines in a search for positive synergies between systems and minimization of the impact of the negative synergies with the common goal of sustainability. As a cornerstone to sustainability, a life-cycle approach to buildings is now being promoted; which although far from formal practice uncovers building dimensions that were overlooked in the past. Consequently, project teams have become larger and project requirements have become broader and more difficult to fulfill due to a lack of a solid foundation to connect the traditional building engineering disciplines, while relevant vast knowledge accumulated in the fields of environmental ergonomics, building materials, and durability analysis is not applied consistently during the building process.

Frameworks are qualitatively organized principles for analyzing a system. A framework to be used by integrated building design teams to facilitate the systematic assessment of lifecycle priorities during the design process from the outset, so that materials and systems are selected not only to use environmentally friendly resources, but most importantly, to match service life performance expectations. The framework emphasizes whole building performance from a building enclosure perspective. It helps identify the primary cause effect interactions that describe the dynamics of enclosure systems as part of the built environment, and make these explicit to support an integrated assessment of the building enclosure life-cycle performance. These relationships have been formalized in the field of building science. Unfortunately, they are not systematically applied during the building process with numerous negative consequences to building service life performance. The framework is therefore founded on the principles of building science, or building physics under the premise that every design strategy proposed to improve building performance needs to pass through the filter of building science to uncover possible positive synergies, as well as negative ones.