IABSE Conference – *Structural Engineering: Providing Solutions to Global Challenges*
September 23-25 2015, Geneva, Switzerland

Developing a Basis for Design – Embodied Carbon in Structures

Mark Sarkisian, David Shook, Devki Desai, Nicole Wang

Skidmore, Owings & Merrill, San Francisco, CA, USA

Contact: david.shook@som.com

Abstract

A basis for design must be established to account for the embodied carbon in a structure. Minimum acceptable goals must be created to encourage a responsible approach to structural design—one that accounts for carbon emissions from groundbreaking through the building's service life. This should be considered in parallel with carbon emissions resulting from operation of the building and embodied carbon of non-structural components.

An advanced methodology and tool termed the Environmental Analysis Tool™ has been published that evaluates embodied carbon of structural systems in buildings through construction and expected service life. An evaluation of embodied carbon of structural systems in over 200 built structures has revealed trends and correlations among common design parameters such as building height, occupancy type, seismic and wind conditions. Results such as these can be utilized by designers to set design goals, and to form a basis for incentive programs and codification.

Based on the investigation of the above mentioned data set and carbon accounting efforts of built structures, a proposal for embodied carbon limits of new and existing structural systems is proposed.

Keywords: Embodied carbon; LCA; carbon limits; construction; seismic damage.

1 Introduction

Millions of metric tonnes of carbon are emitted into the atmosphere during the extraction, refinement, and installation of structural materials such as steel, concrete, wood, and cold-formed metal framing. With the environment at risk, the structural engineering profession must carefully reconsider design approaches to structures. Embodied carbon of structural systems in buildings has been established to be considerable in the overall environmental impact of buildings. By some estimates, it could comprise 15-50% of the total life cycle carbon emissions buildings [8].

One could envision that in the near future, international building codes will not only address safety, but also life-cycle performance, imposing limits on carbon emissions attributable to building construction and lifetime use. As a profession, we need to create greater awareness of damaging carbon emissions resulting in global warming and embrace the most advanced systems available, creating a holistic awareness of their beneficial impact on performance, finances, damage, and environmental impact.

2 Environmental Analysis Tool™ methodology in assessing structural embodied carbon

https://doi.org/10.2749/222137815818359339