

## Measuring Sustainability: Tools for Transitioning to an Ecological Age

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### Summary

The paradigm of development in the twenty-first century needs to adhere to the principles and objectives of sustainable development. In particular, the built environment must shift to address environmental limitations and social aspects. Achieving sustainable development goals requires support and consensus among stakeholders and decision-makers. While this prerequisite has advanced rapidly in the past decade, it is the second phase, implementation and realization of sustainability goals, which is proving more challenging.

As such, the structural engineer working in concert with other building professionals is increasingly required to address issues of sustainable building. However, the actions required for a sustainable built environment are simultaneously neither readily apparent nor easily analyzed. Consequently, the research presents an analysis for measuring sustainability within the built environment with a specific focus on the role of the structural engineer. The work explores the tools currently available to measure sustainability impacts such as Life Cycle Analysis. Further, the challenges with competing sustainability goals are presented and possible solutions provided. The results suggest that sustainable development requires a more radical departure from the current means and methods of modern building practice and habit than initial thought necessary.

**Keywords:** sustainability, environment, structure, engineer, life-cycle assessment, life-cycle inventory, metrics

### 1. Introduction

The construction industry is no longer confined solely by local environmental limits. Rather, construction, and development in general, must now adhere to global environmental constraints in addition to traditional local limits (e.g. regional resource availability). Global environmental constraints (e.g. climate change [1] and ozone depletion) consequently necessitate that all development, regardless of locality, adhere to ever changing environmental limitations. As building professionals, structural engineers, similar to all parties involved in construction, are responsible for ensuring the appropriateness and sustainability of their work itself and with respect to the larger urban context.

### 2. Moving from Green Building to Sustainable Design

#### 2.1 Framework for Sustainable Design

The familiar working definition of sustainable development was formulated by The Brundtland Commission as “development that meets the needs of the present without compromising the ability