Sustainability of Steel Structures

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Summary

This paper focuses on steel structures and their performance in view of sustainable requirements. To this purpose, relevant approaches for the evaluation of sustainable (steel) structures are presented. Among others, these include the environmental product declaration (EPD) according to ISO 14025 and ISO 21930 as well as the new certification system in Germany (DGNB). In the next step, the sustainable performance of steel as structural material is analyzed. To this purpose, respective data bases for Life Cycle Assessment (LCA) are discussed. Finally the procedure and the results of a case study with three one-family-houses, representing steel, solid and timber architecture, are presented.

It can be summarized, that evaluation methods as well as data bases need further development and harmonization. Nevertheless, steel provides much potential for sustainable structures. This is mainly based on its properties influencing the whole life-cycle, such as flexibility, durability and a high level of recyclability.

Keywords: sustainability, steel structures, tools and approaches, evaluation, LCA, case study

1. Introduction

Due to limited resources and climate change, sustainable development emerges as a formidable challenge for society in the 21st century. Due to its social, environmental and economic impact, the building sector has quite an important position. As a consequence of that, construction industry as well as built environment must be counted as two of the key areas if we are to attain a sustainable development. Especially since the building sector is one of the largest waste producers and consumes high amounts of energy and natural resources. Consequently, structures have to be functional and efficient during their lifetime while fulfilling high economic, social, technical and ecological requirements. Engineers and architects have the task to take into account all of these different aspects, when planning, building, operating and rebuilding a structure. For realizing this in practice, many approaches, tools and evaluation methods have been and are being developed. However, a common procedure has not been established yet.
Also in respect to the building materials many different recommendations, data bases and studies can be found, sometimes providing results being contrary to each other. T

The question now is, how will perform steel within the discussion about sustainability? In the following, relevant evaluation methods are presented and the state of the art of steel structures in respect to sustainability is investigated. The results are underlined by a case study with three one-familiy-houses, representing steel, concrete and wood architecture.

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