



International Conference on Sustainable Design, Engineering and Construction

Life Cycle Assessment Applied to Green Building Certification in South Korea

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Abstract

The purpose of this study is to apply life cycle assessment (LCA) methodology for green building certification in South Korea. The method of environmental assessment in the field of building materials was examined using United States' LEED, and the United Kingdom's BREEAM building certification systems. Life cycle data and assessment methods were established on major categories of materials through theoretical consideration on life cycle assessment.

Building materials, assembly methods, and building use considerations were used to develop an assessment model to evaluate the environmental performance of a building. Numeric values for use in the developed model were established for concrete, rebar, gypsum board, steel, cement brick, glass, and insulation materials to potentially reduce greenhouse gas (GHG) emissions by 95% or more. An assessment method and LCA database were established. The model will be used to show that the choice of building materials can affect the GHG emissions during the construction phase of a building.

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Peer-review under responsibility of organizing committee of the International Conference on Sustainable Design, Engineering and Construction 2015

Keywords: Life Cycle Assessment; Green Building Certification; Major Materials

1. Introduction

As environmental issues have emerged as a global agenda, studies to reduce the burden on the environment have been actively made at the national level in South Korea. Also in the construction industry, the opinion that suggests quantitatively evaluating the environmental load coming from construction materials and buildings in advance by life cycle assessment method has been advanced. Therefore, each country is developing building life cycle assessment techniques that are tailored to the individual country situation and can evaluate the environmental impact of construction materials and buildings, and in recent years, a tendency to revise the certification criteria is seen to

apply the LCA results to the green building certification system. However, in South Korea's green building certification system G-SEED, the eco-friendly evaluation of buildings based on life cycle assessment has not been applied, and the score has only been given by whether or not to use the product which acquired an environmental product declaration (EPD) in materials and recyclable content. Such evaluation methods have the limitation that it is difficult to determine quantitatively the effect that the selection of eco-friendly building materials brings to the environmental performance of buildings. Therefore, the approach where building materials, construction assemblies and environmental impact assessment results of buildings are organically linked to each other and evaluated in the certification system is required. Thus, this study has a goal of suggesting a LCA method for buildings in Korea's G-SEED through the integrated assessment model. For this, the building life cycle assessment methods and the certification standards which are being reflected in international green building certification systems (LEED, CASBEE, and BREEAM) were analyzed. Also an integrated assessment model that can be linked to a green building certification system in construction material level, construction assembly level and building level based on the analyzed evaluation method was established, and the evaluation method and database which are required in each level have been established.

2. Analysis of Environment Assessment Method for Green Building Certification System

Recently, when it comes to the international green building certification systems, the LCA certification standard of buildings has been introduced and revised to reduce the environmental burden of buildings in the country. Therefore, representative international green building certification systems were analyzed as shown in Table 1 for the introduction of LCA in the construction sector of G-SEED. Major Green building certification systems are the LEED of US, the BREEAM of UK and the CASBEE of Japan. In LEED V4 which was recently revised, an assessment of the life cycle can be done by choosing one of Materials and Resources category Building Life-Cycle Impact items. The assessment method is to evaluate three certification systems including a global warming aspect using a LCA tool which gives a score based upon a reduction of more than 10% compared to the standard building. Also, the item gives an assumed improved score when using the EPD material. In BREEAM, the evaluation of building materials is being applied in detail since the initial version and the environmental performance assessment and information on building materials has been shared using its town building material information site called Green Guide. Also, the LCA programs such as ENVEST 2 and IMPACT have been used. By linking the evaluation results with the BREEAM, the environmental performance evaluation results of buildings have been reflected in the green building certification system. The CASBEE in Japan is a comprehensive performance assessment tool of buildings for the realization of the

Table 1. Overview of domestic and international green building certification system LCA.

Item	US LEEDV4	JAPAN CASBEE	UK BREEAM2014	KOREA G-SEED
Evaluation Item	MRC1. Building life-cycle impact reduction	Resources and Materials	Mat 01 Life Cycle Impacts	-
Scope of Evaluation	Cradle to Grave with Options	Cradle to Gate	Cradle to Grave with Options	-
Scoring	Up to 3 points	BEE	Up to 6 points	-
LCI DB	Ecoinvent	In-house DB	DB by individual company UK Trade associations Ecoinvent	-
Building Material Evaluation	EPD	ECO MARK, Eco friendly Products	Green Guide, EPD	EDP, GR Mark, Carbon Labeling, etc.
Evaluation Program	any LCA program	In-house Spread sheet	Mat Calculator or any LCA program	-
Standard Building	Set	Set	Set	-
Impact Category	GWP,ODP,AP,EP,	LCCO ₂	11 kinds including GWP	-

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