

2.ABRIDGED VERSION

The objective of this project was to elaborate the bases and analyse the basic data available for a development concept for a computer-aided evaluation and simulation methodology for designing buildings compatible with recycling and the environment as well as the preparation of a grant application to finance the project from a suitable development programme.

Analysis of the starting position

The development of a concept for a computer-aided evaluation and simulation methodology for designing buildings compatible with recycling and the environment is based on the construction industry's regulatory framework which consists of laws and construction-specific standards to be complied with. Important examples of such standards are

TC 350 Sustainability of buildings (still in draft form)

TC 59 Building Construction

in which part of the methodology to be applied is stipulated to some extent through the relevant requirements and bases are laid down for subsequent evaluations.

In addition to this regulatory framework, existing software tools and data systems are also important since links to existing interfaces and data systems play a crucial role in the acceptance and spread of a software tool. In recent years, various successful building evaluation systems have been developed throughout the world and circulated under the umbrella organisation of the World GBC. These include (Braune et al., 2007)

BREEAM Building Research Establishment Assessment Method (England)

CASBEE Comprehensive Assessment System for Building Environmental Efficiency (Japan)

HQE Haute Qualité Environnementale (France)

LEED Leadership in Energy & Environmental Design (USA)

LEED Canada (Canada)

Green Star (Australia)

Green Star NZ (New Zealand),

TGBRS TERI'S (The Energy and Resources Institute) Green Building Rating System (India)

In the area of ecological assessment, the LEGEB software for methodical issues constitutes an important source of information. This software allows the impacts of a building's erection and running to be determined. These contents in conjunction with interfaces to existing data landscapes and the needs of future users are the basis for the development of new concepts.

Development of an integrated concept for building design compatible with recycling and the environment

An integrated system for designing buildings compatible with recycling and the environment has to take into account on the one hand the various players in a building project (building-industry process chain) and on the other the information levels connected with the buildings themselves. Therefore, the flows of and/or needs for information were considered and integrated into the partial models required for building analysis and assessment.

Building model

The building model forms the basis of simulation and calculation. It consists of information on the building's components, the types and quantities of materials, the content of hazardous substances as well as geometric information on accessibility and connection technique.

The building structure is illustrated with the description of connections between structural elements and the connection techniques used and priority relations between structural elements. Different scenarios regarding materials, design of structural elements or connection technique can be calculated for these structural elements and the impacts of recyclable product design on the rate of recycling and degree of dismantling computed.

Logic model

The software calculation module computes the optimal degree of dismantling based on the building model, the chosen optimisation criterion (e.g. costs, rate of re-use), defined general conditions (pollutant separation), on labour, market data regarding achievable recycling revenues or costs of disposal of materials as well as a model of reprocessing and re-use processes.

The software calculation thus simulates not only the dismantling process of the modelled building but in particular also the reprocessing and re-use processes and computes, depending on optimisation target and the selected general conditions, the requisite degree of dismantling and the material fractions generated. This determines the following results for a building:

Dismantling sequence including the tools used and the time required

Type and material composition of the dismantled structural elements

Channels of re-use and disposal of the dismantled structural elements and the remainder of the building (post-shredder technologies)

Achievable rates of recycling and re-use on the basis of accepted and available recycling technologies

Dismantling and disposal costs or recycling revenues as well as an evaluation of end-of-life costs and/or profit

Environmental impact model based on life cycle inventory analysis

Environment-related data bases form the basis of a calculation of environmental impacts. A variety of criteria allow the multitude of data bases to be categorised for use in a software tool. In addition to the size of the data base (number and coverage of different areas of the various data sets) and data quality (degree of detail of meta data and topicality of data) its ease of implementation is also an important factor. The Swiss data base Ecoinvent with more than 4000 data sets, a data standard in Ecospond format for simple implementation and detailed documentation for subsequent transparency of the results has proved to be particularly suitable.

Implementation plan and prospect

Further development and implementation of the concepts developed are to take place under the 'Haus der Zukunft Plus' development programme line. This programme line of the Federal Ministry for Transport, Innovation and Technology (administered by the FFG Österreichische Forschungsförderungsgesellschaft and ÖGUT Österreichische Gesellschaft für Umwelt und Technik) aims to introduce above all energy-relevant innovations in the building sector and/or push their market launch or preparation through basic research work, cooperative technological developments and accompanying measures as well as by supporting their industrial implementation.

Development is to take place through a syndicate, including also IBO, Ecotech / Builddesk and Ennovatis as partners, in the following phases:

Phase 1: Concept

01.06.2008 to 31.12.2008

(i.e. this report)

Phase 2: Development of methods and software 01.08.2009 to 01.08.2011

Project application in a development programme

Phase 3: Pilot project

01.08.2010 to ...

Developers' competition together with implementation of the results of phase 1 and 2

Phase 4: Monitoring and evaluation

01.08.2009 to ...

Collaboration in the invitation to tender and implementation of the housing project, improvement of method and software tool on the basis of practical experience, evaluation of results.