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Web Portal

"Modernization of existing buildings from the point of view of building physics"

WeBA

Short Report

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1. Introduction

According to the report on structural damage of the Federal Government annual structural damage which results from constructional activities in the field of new buildings as well as repair and modernization works, amounts to approx. € 3.5 billion. Approx. 80 % of these damages, which are most frequently caused by insufficient knowledge in the field of building physics of architect and planners, are of building physical nature. In practice and in case of primarily minor building measures thinking in interdisciplinary categories is often neglected, expert planners are rarely involved, most often craftsmen are ordered to perform appropriate works. Frequently, secondary damages occur as a result of inadequate if not inaccurate measures. Targeted knowledge transfer could prevent damage and improve the quality of buildings.

The objective of this research project is to offer planners and executing companies the basics and design tools by means of fundamental systematization of building physical problems in connection with modernization measures. It is intended to allow a more precise control of modernization measures and accurate implementation in the point of view of building physics. Within the context of this project a Web-based portal for this kind of knowledge management was developed offering support to planners, experienced engineers, architects and executing companies as well as young professionals and students. The most important principles of the portal are:

Targeted knowledge

In connection with an object to be modernized and related questions the user is offered targeted building physical knowledge and support in decision-making. The user can select the kind of knowledge and support or the methods necessary to solve his or her problems.

Networked knowledge

Since the modification of a singular design or constructional parameter has an influence on a variety of aspects, it is of special importance to impart knowledge of these interdependencies. The contents of the Web portal are divided into networked modules according to the kind and intensity of knowledge to be imparted.

Use of new methods of presentation

Influencing parameters and phenomena as well as their impact on other properties of the building are visualized. By entering constructional data, e.g. geometry and material parameters, or by selecting the parameters in the module „Calculation tools“ the user can experiment and learn from the diagrammed results in how far the selected modifications influence the building physical characteristics of the building component.

Selection of measures

It is possible to select adequate constructions by means of the catalogue of measures in the module „Building constructions“. This module is divided into two categories „Existing building“ and „Measures“. First of all the user selects the particular construction in already existing buildings according to the given structural situation, and the user selects the measures necessary or recommended from the point of view of building physics taking into consideration user-specific aspects.

Evaluation of results

The Web portal „Modernization of existing buildings from the point of view of building physics“ is a generally available tool for all participants in construction under the Internet homepage <http://www.bauphysikalische-altbaumodernisierung.de>. This Web portal allows the systematic, defect-free and practice-oriented progress of modernization measures in existing buildings in consideration of the entire scale of building physical knowledge.

2. Didactic concept and technical implementation of the portal

The essential concern of the project idea was to demonstrate the interactions of special sections of building physics. To cover all topics of building physics would go beyond the scope of this project. Therefore the three most important sections „Heat“, „Moisture“ and „Sound“ were selected with regard to structural damage.

The portal has a modular structure. The module „Building constructions“ comprises characteristic building constructions of already existing buildings as well as a catalogue of measures adequate to improve the building physical quality of these constructions. The module contains detailed drawings, a description of the construc-

tions and an analysis of the building physical aspects „Heat“, „Moisture“ and „Sound“.

Three further modules offer building physical knowledge which is networked with the module “Building constructions”. Most important is the module „Basics“ supported by the modules „Glossary“ and „Calculation tools“.

The technical realization of the modules of the Web portal was performed on the Open-Source Learning Platform ILIAS (Integrated Learning, Information and Working System) serviced by the electronic data processing centre of Universität Stuttgart. ILIAS is a Web application operable by http-browser which was developed for learning and teaching purposes. It offers the possibility for authors to update educational contents on their own. The individual units of learning are developed as so-called learning modules and can contain a variety of contents in a structured form. In accordance with this structure the Web portal „Modernization of existing buildings from the point of view of building physics“ was developed.

On the part of the electronic data processing centre of Universität Stuttgart there is an obligatory user administration to use ILIAS with the consequent limitation of access. For the open portal such as „Modernization of existing buildings from the point of view of building physics“ WeBA it was necessary to establish an access which was not subject to these limitations. Therefore a homepage with an own domain or sub-domain (Fig. 1) was established in the public section of the website of Universität Stuttgart from where access to the modules of the portal is possible.

This approach entailed the various design of the user interfaces (Fig. 2). Whereas the part in the public section of the website of Universität Stuttgart could be designed and implemented without any restrictions, the part in the public section of ILIAS was subject to the functional and design specifications of the electronic data processing centre of Universität Stuttgart. Since ILIAS as a system is permanently updated by the electronic data processing centre and thus technical support beyond project duration is secured, it seemed reasonable to accept the restriction of free design of the user interface.

The homepages and supplementary pages developed by the Department of Building Physics are marked in red-brown in Fig. 2. The blue symbols characterize the modules available in ILIAS. The homepages (red-brown) as well as the pages of the ILIAS modules are linked. Two levels must be generally distinguished:

- Level 1: access to the portal (characterizing colour: red-brown)
 sub-levels: internal navigation site
 external linking
- Level 2 contents of the portal (module in ILIAS, characterizing colour: light blue)

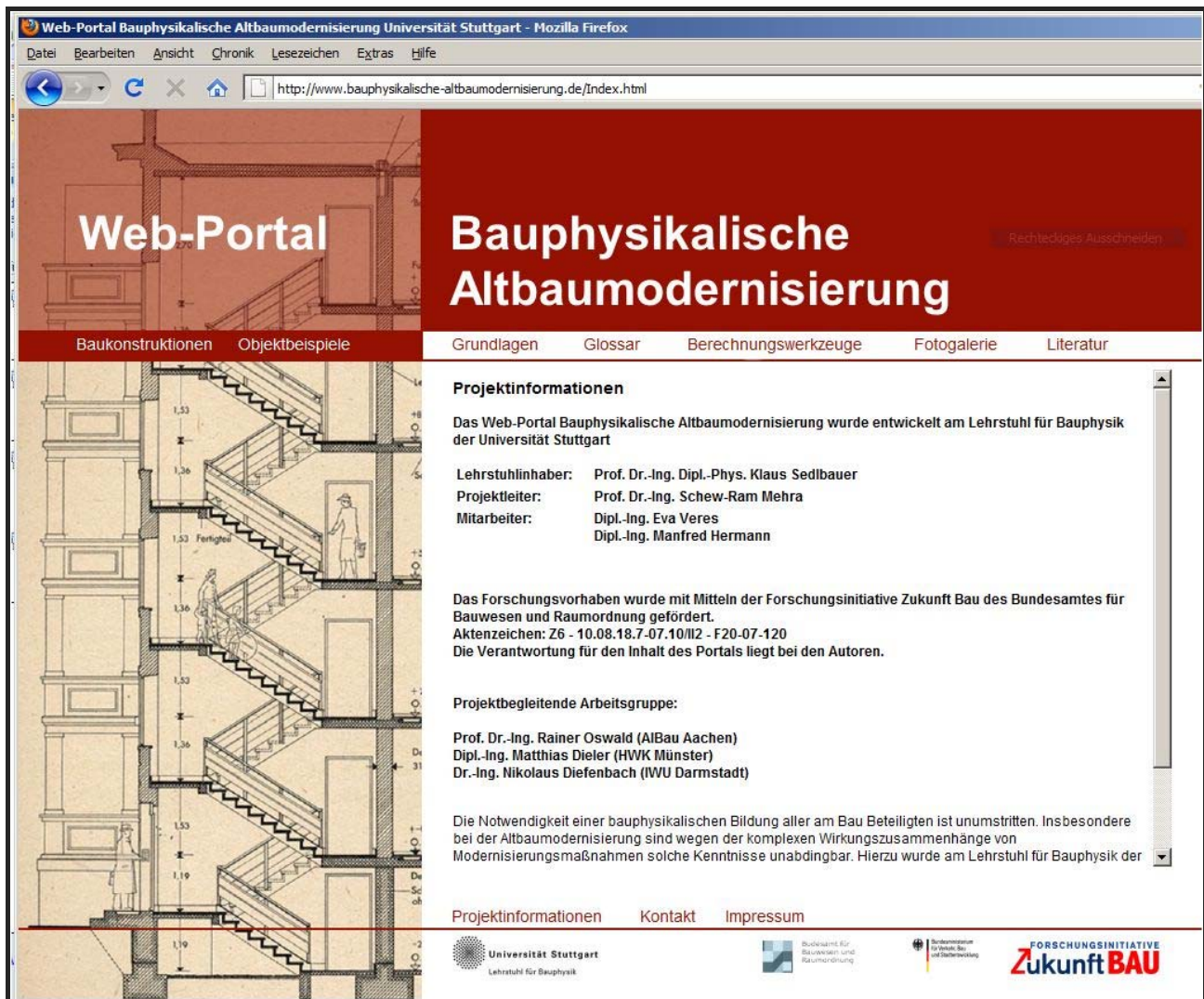


Fig. 1 Screenshot of the public section of Universität Stuttgart of freely designed homepages of the Web portal “modernization of existing buildings from the point of view of building physics”

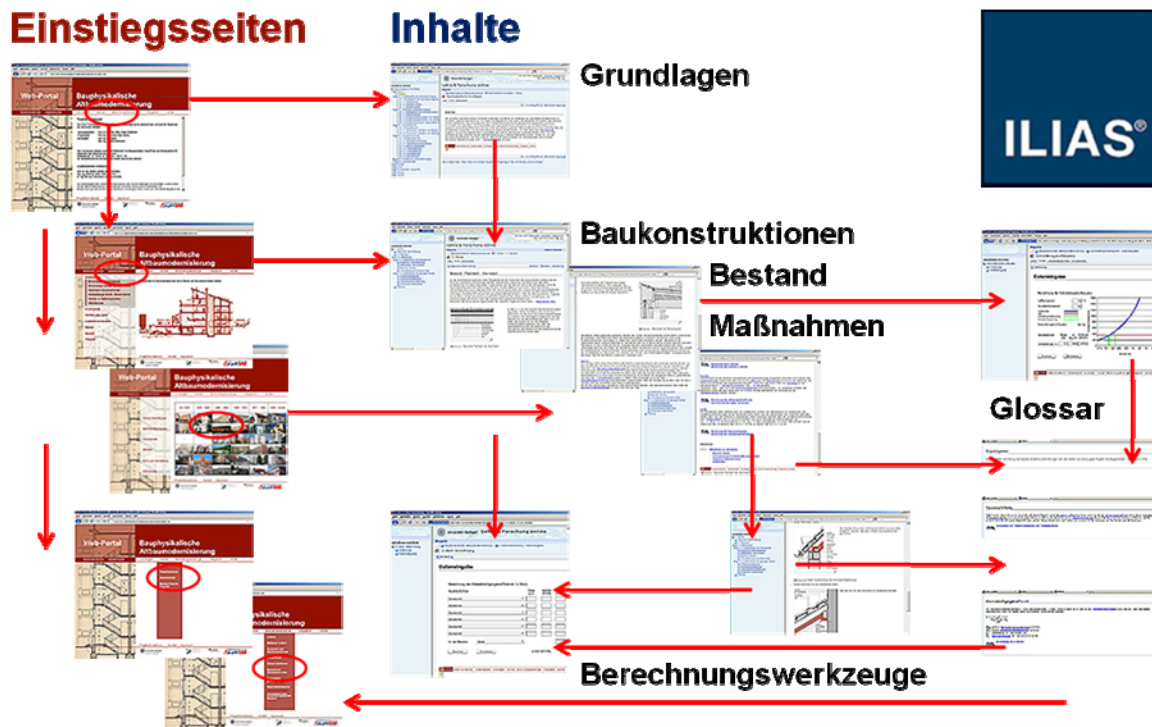


Fig. 2 Schematic representation of possible links within the portal.

The individual pages of the various modules are directly linked to the respective terms of the homepages (Fig. 2). Moreover, all homepages are linked to the current Internet presence of the promoters of the portal as well as to the homepages of Universität Stuttgart via the logos at the bottom of the page (Fig. 1).

3. Configuration of the portal

The modules described in the following were developed for the didactic implementation of the previously defined aims.

3.1 Basics

Knowledge of building physical phenomena and principles is indispensable for accurate completion of constructions from the point of view of building physics. Therefore this knowledge is presented in a generally understandable way on the WeBA platform. The module with the basics is divided into the sections „Heat“, „Moisture“ and „Sound“. A list of symbols and an annex complete the module. The annex – also divided into the previously mentioned topics – contains various data tables with significant building physical parameters.

3.2 Glossary

The module „Glossary“ is a reference book of more than 700 terms in combination with illustrative material and examples as well as information on material properties and references to guidelines, regulations and standards. The user can always look up unknown terms due to the linkage of glossary entries with other modules of the portal. Thus the interested reader can acquire the essential knowledge on topics which are relevant for building physics in a compressed way. The module „Glossary“ is divided into five parts:

- heat
- moisture
- sound
- terms concerning construction
- standards and guidelines

A list of references is added at the end of each chapter in the module „Basics“ as well as in the module „Building constructions“. Individual references can be reached by mouse click. Notes on the literature used can be found in brackets in appropriate sites within the portal. The lists of references are arranged in chapters and can be seen on the homepage „References“.

3.3 Building constructions

The module „Building constructions“ is the largest module of the Web portal with regard to the contents. It is a kind of catalogue which compiles characteristic building constructions of existing buildings and potential measures to improve these constructions. Each page of the catalogue deals with a particular building construction either as „Existing buildings“ or as „Measures“. In the process, special importance was attached to a precise representation in the form of detail drawings. These must be understood as schematic preparation of contents to be provided and not as instructions. It is not the objective of the portal to give instructions on how to perform modernization measures. The supplementary texts of the drawings explain procedures of completion. In this case too, references are given to various building physical problems by linkage.

The module „Building constructions“ consists of seven main chapters dedicated to a particular category of building components, e.g. external walls, internal walls etc. The seven main chapters contain several pages to represent existing building con-

structions. From these pages links lead to the categories of measures for the respective building components which are reasonable and can be recommended from the point of view of building physics. The catalogue of measures is divided into 33 categories of measures which are composed of further selective measures according to the complexity of the building component. The particular measures are presented on separate pages, if - from the point of view of building physics - they are clearly different. If the building physical behaviour of alternative measures is not significantly different, they are presented on a common page.

Each main chapter is introduced by a page where basic explanations for the different types of building components can be found. The main chapter is divided into two chapters. The first chapter contains the descriptions of existing building constructions, and the second chapter contains the list of measures. From the pages of the first chapter, i.e. existing building constructions, the user can directly reach measures which are reasonable for the particular existing buildings. Moreover, due to the linkage of the modules Basics, Glossary and Calculation Tools he or she can clarify potential problems immediately.

3.4 Calculation tools

Computer-aided calculation programs facilitate the control, quantification and demonstration of many building physical parameters and processes. Simple and intuitively operable tools are available on the Web portal for this purpose. Calculations can be repeated as desired and with various data sets.

The tools can be selected directly on the homepages of the Web portal by the menu bar (Fig. 3), or the user can find a note in the modules „Building constructions“ and „Glossary“. The note occurs by a recurrent symbol and direct linking to the calculation tools. By means of drop-down menus the user can generate own constructions and carry out adequate calculations.

Fig. 3 Screenshot of the access pages of the public section to select calculation tools and of a page to enter data.

4. Summary and outlook

Building physical knowledge transfer for all participants in construction is necessary without any doubt. As concerns the modernization of existing buildings this kind of knowledge is indispensable due to the complexity of interdependencies of modernization measures. The Web portal „Modernization of existing buildings from the point of view of building physics“ is intended to make a contribution. Since the end of 2009 it has been available for all participants in construction, from craftsmen to interested builder-owners. The Internet and related services offer the opportunity to present contents in a multi-medial way.

The Web portal „Modernization of existing buildings from the point of view of building physics“ has a modular structure meaning that according to the task the user is

guided to various solutions which are adequate from the building physical point of view. The user is given explanations and advice which building physical phenomena must be observed in the context of solving the given constructional tasks. The intensity and complexity of investigations within the various modules of the portal is dependent on the user's problems and concerns.

A catalogue of measures is available in the module „Building constructions“ to facilitate the search for adequate measures due to the constructions of already existing buildings. If the constructions of existing buildings are not entirely known, the user can restrict possible measures on the basis of age-and-use categories. Moreover, the user can take further steps by using other modules to deepen the knowledge in the field of building physics and to better understand the efficiency of the selected measures. To explain questions concerning technical terms or simple facts the pages of the module “Glossary” are available. This module comprises the most important terms of the sections “Heat”, “Moisture” and “Sound”, a collection of constructional terms and a list of relevant standards and guidelines. The “Glossary” provides short versions of definitions. For a more detailed knowledge in the particular topics the module “Basics” was developed. The user can apply this module as a reference book.

In many cases the user is interested in concrete numerical values, e.g. to compare the variables of implementation of measures. To determine building physical characteristics without calculation and rapidly, some tools are available for the user in the module “Calculation tools”.

Two essential sections of building physics „Fire protection“ and „Daylight“ are not at all or only marginally discussed. So far it was impossible to include a variety of topics in the portal. Within the context of the project it was observed that only insufficient information was available on some old building components. It is planned to close this gap now. During the first phase it is intended that the portal does not comment the economic efficiency of the measures described, and that it does not explain how the various measures can be combined. Guidelines must still be developed for a substantial extension of the practical use of the portal.

All in all, the Web portal “Modernization of existing buildings from the point of view of building physics” provides a practical tool for users to answer as many building physical questions concerning the modernization of existing buildings as possible.