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Autor: Dreyer, Jürgen
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Thermal Protection and Moisture Proofing of Exterior Walls of Existing Buildings

Jürgen DREYER
Prof. Dr
Techn. University
Vienna, Austria

Jürgen Dreyer, born 1941, graduated (Dr.rer.nat,Dr-Ing.habil.) at the Technical University Weimar, worked at the Universities in Dresden, Cottbus, Wismar and Vienna. His field of research is heat and mass transfer in building construction.

Summary

In this paper possibilities are represented to receive in situ data of the current thermal protection level. In the practical part several checkups of buildings and measurement data of elements and materials are figured out the level of heat and moisture protection and the strength of existing buildings in Mecklenburg/Vorpommern. .

Keywords: in-situ-testing, thermal resistance, moisture content, mechanical strength

1. Introduction

The thermal properties of building materials are of great importance for many technical questions, like utility value, running costs in housing and public buildings and so on. The moisture content, the strength and other qualities point to the general state of constructions.

2. Steady-state methods

Steady state methods to measure the thermal resistance are well known and described in standards. In this paper further possibilities are represented to obtain thermal properties of used buildings. This methods work with a heating system transmitting a definite steady heat flux through the object. The generated temperatures determine the thermal resistance and conductivity. In this way the determination may be carry out independent from climatic condition in a relative short time period.

3. Determination of the Thermal Resistance with Unsteady Methods

The measurement of thermal properties in the steady state mode of heat transfer is a method of high accuracy, allowing an easy utilization of the measured data. Unsteady state or transient methods have the advantage of shorter measuring times. Furthermore it is important to determine the state of a wall more exactly to get information of the distribution of thermal qualities in the cross section of the wall respectively about the properties of each layer of a multi-layered construction. Supplementary it is possible to determine the thermal diffusivity and the thermal capacity of heat storage. Figure 1 shows measuring results of two constructions.

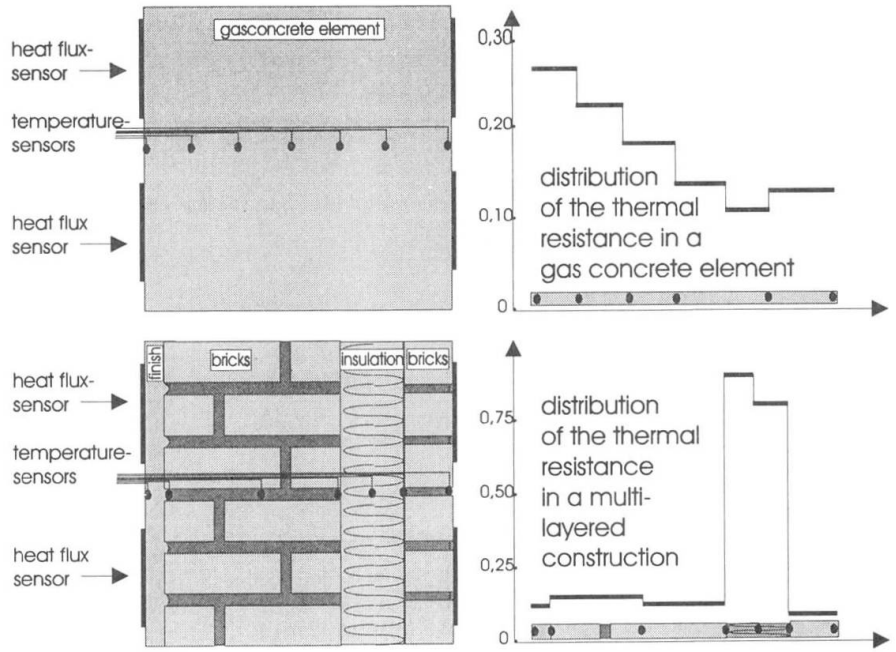

Fig. 1: Measuring arrangement for the determination of the distribution of thermal resistance in constructions

4. Evaluation and Analysis of Existing Buildings

The described methods were applied for measurements at existing buildings needing to be reconstructed in Germany, especially Mecklenburg/Vorpommern.. Additional to the thermal quality the mechanical and moisture qualities have been determined to select the right method of reconstruction. Table 1 shows results gained at several buildings describing some essential properties during the life cycle of these buildings and materials.

Table 1 : In-situ-data of exterior wall construction

number and product	wall construction	compression strength	k - value	moisture content
6 brick walls	plaster 24 und 36 cm brick plaster	15 - 25 N/mm²	1,71-2,48 W/m²*K	1,0-4,0 M-%
11 gas concrete blocks or panels	plastic finish, 24 und 30 cm panel, plaster	1,4 - 3,6 N/mm²	0,73 - 1,63 W/m²*K	1 - 40 M-%
7 panels of Light Weight Concrete	cement-lime finish, 28 cm panel, plaster	4,2 - 23,7 N/mm²	1,21 - 2,54 W/m²*K	1,7 - 5 M-%

The heat protection of these wall constructions in the analysed buildings varies a lot and is often very bad. The gas concrete elements have high moisture contents and low strength. The analysis shows that a lot of exterior wall elements have to be reconstructed due to the bad physical state the weathering process will be accelerate. A lot of these damages may advantageous and complex be repaired by extra heat insulation at the outside of the constructions.