REFERENCE BUILDING PHYSICAL MODEL OF PANEL SYSTEM T06B

Roman Rabenseifer

Abstract

The presented contribution deals with a reference building physical model of panel system T06B. This model takes into consideration the two and three dimensional heat flow through the building envelope. A part of the model is a set of the most often used details of the building envelope created by the software WAEBRU and BISCO/TRISCO respectively. This set makes possible an accurate calculation of the transmission heat loss (H_T, thermischer Leitwert (A), Transmissionswärmeverlust (D)) while considering thermal bridging effect at the same time.

The model including the electronic details can be effectively used for the steady-state and/or dynamic calculations of the heating demand and/or energy demand for heating of all buildings built with the panel system T06B and for the optimization of the retrofitting design.

The final part of this contribution discusses the need for the assessment of the building envelope quality at the transmission heat loss level (H_T).

Keywords: Transmission heat loss (H_T), thermal coupling coefficient (L), multi-dimensional heat flow, heat and energy demand of buildings.

1 Introduction

The principle of the reference building physical model of the panel system T06B is detailed described in works [1], [2] and on the website [3]. The aim of the planned presentation is a visual introduction of the prepared electronic details (templates) and the description of the division of the building envelope into parts with expected one, two and three dimensional heat flow. For all these parts a highly precise examination of the thermal coupling coefficient (L) can be performed and the results used for the calculation of the overall heating demand of buildings built with the panel system T06B.

The advantage of this method is a direct consideration of the thermal bridging effect when calculating the overall transmission heat loss, which is the base for calculation of the heating demand of buildings.

2 Case study

The study which demonstrates the use of the reference building physical model is introduced in the works [1, 2] and [3] as well. However unlike these works the presentation under preparation uses the applications BISCO a TRISCO as they are more spread in the architects' and engineers' community.

3 Thermal coupling coefficient (L) and transmission heat loss coefficient (H_T)

The notions thermal coupling coefficient and transmission heat loss coefficient are relatively new (at least in Slovakia) though their calculation has been regularly performed in the building physics prior to their implementation into standards, e.g. in the course of the mean U-Value calculation. The thermal coupling coefficient (L) is characteristic property of the single fragments of the building envelope in a way the thermal conductivity coefficient characterizes single materials. Unlike the thermal conductivity coefficient the thermal coupling coefficient includes also the geometry of the single fragment and its material layers and elements respectively. It states the amount of heat transfer through the fragment at the temperature difference of 1K and its unit is W/K. In case of flat fragments with 1-D heat flow only its value is equal to the product of fragment's area and heat transfer coefficient (U-value). For fragments with 2-D or 3-D heat flow the thermal coupling coefficient can be calculated using numerical methods only. The transmission heat loss coefficient (H_T) is the sum of the thermal coupling coefficients of all fragments the considered building envelope (or its part) consists of.

The criteria for the assessment of the building envelope quality are in Slovakia set at the level of the heat transfer coefficients (U-value) of the main parts of the building envelope, e.g. the U-value of walls, windows, roofs, doors or floors, and indirectly at the level of heating demand. The first level neither takes the building geometry nor the geometry of many details into consideration. The second level considers them, however to certain extent only and in combination with other factors like the climate reference year (solar gains), the ventilation effect and the expected use of interior spaces (the indoor equipment gains and the gains from building occupants). So, these criteria levels do not express the "clear" overall building envelope quality. Hence, they do not allow mutual comparison of building envelope qualities between various buildings. Therefore countries like Austria, Belgium or Germany introduced the assessment of the transmission heat loss coefficient in relation to the building geometry. This contributes to the enhanced attention to the design and creation of the building details and to the higher precision in the calculation of the transmission heat loss coefficient and the overall thermal demand for heating or eventually cooling as well.

4 Conclusions

The presentation under preparation shall introduce the electronic details (templates) of the reference building physical model of the panel system T06B and the way they can be used in the calculation of the overall heating demand for purposes of the optimization of retrofitting and/or modernization design of buildings built with this system. The described method is based on the fact that many software applications for steady-state and even some for non-steady calculation of the heating demand accept building envelope fragments defined by the thermal coupling coefficient (L).

The presentation also shows the importance of assessment of the building envelope quality at the level of the transmission heat loss coefficient (H_T).

This work is originating with the support of the Marie Curie Actions of the European Commission within the project no. MTKI-CT-2006-042472.

References

[1] RABENSEIFER, R. *Das bauphysikalische Simulationsmodell des Fertigteilsystems T06B.* Dissertationsarbeit, TU Wien, 1997.
[2] Rabenseifer, R. *Computer Model of Apartment Building from the Panel System TO6B.* Proceedings of International Building Simulation '97 Conference (IBPSA), Prague, Czech Republic, September 1997, Volume 1, pp. 321-329 (Information: http://www.ibpsa.org/bs_97.htm)
[3] http://www.esru.strath.ac.uk/Courseware/Case-study/intro.htm
[4] *EN ISO 10211-1: Thermal Bridges in Building Construction - Heat Flows and Surface Temperatures, Part 1 – General Calculation Methods,* 1995.
[5] HEINDL, W., KREC, K., PANZHAUSER, E., SIGMUND, A. *Wärmebrücken.* Springer-Verlag, Wien, 1987.
[6] *WAEBRU Version 5.0. Programmpaket zur Berechnung von Temperaturverteilungen und Wärmeströmen in Bauteilen.* Benutzerhandbuch. Copyright Univ. Prof. Dr. E. Panzhauser, 1993.
[7] *BISCO, version 8.0w. Computer program to calculate two-dimesional steady state heat transfer in free-form objects.* Copyright 2006 Physibel.
[8] *TRISCO, version 11.0w, Computer program to calculate 3D and 2D steady state heat transfer in rectangular objects.* Copyright 2005 Physibel.

Dr.-techn. Ing. arch. Roman Rabenseifer
✉ KKPS SVF STU
Radlinského 11
813 68 Bratislava 1, Slovakia
☎ +421 903 552300
🗐 +421 2 52920482
☺ rabens@svf.stuba.sk
URL www.svf.stuba.sk