THE APPLICATION OF TRANSPARENT HEAT INSULATION ON THE FACADES OF PANEL BUILDINGS

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SUMMARY

The aim of this paper to prove that the widespread use of Transparent Heat Insulation System could be advantageous both from an economic as well as an environmental viewpoint when renewing panel buildings. The result of my research is that Transparent Heat Insulation System developed for conventional buildings can be applied for panel buildings, as well. The application of that radically new heat insulation can be done simultaneously with the fastening of loosened panel crusts.

Keywords: absorbing plate, anchor, crust, mortar, panel

1. INTRODUCTION

According to 1995 data approximately 1.350.000 people live in panel houses in Hungary. These 508.000 flats constitute 12.8% of the total number of houses. The condition of these flats is just suitable but renovation on large scale can hardly be postponed. Renovations are needed because of the amortisation of their mechanical and structural conditions as well as a considerable waste of energy. Housing estates are situated on valuable areas, so that preserving their value on the housing market is only possible if reparations are executed.
This intervention can be a value-preserving or a value-increasing one. In the case of the latter better technical, practical and comfort increasing structures are built in which differ from the original solutions. When talking about the renovation of panel houses, both from structural and economical reasons only an energy-conscious, value-increasing approach is reasonable.
The external structure of panel houses is insulated reinforced concrete sandwich panels. In spite of continuous development, panel houses have remained heat-bridged. The present structure and state of facades generates further economic, static and aesthetic problems, so the following aspects should be taken into consideration:

-the protection of breaches in panels, therefore the prevention of the corrosion of structural joints,
- fastening the loose or cracked panel crust back to the load bearing part,

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- a follow-up insulation of heat-bridges as well as the entire external wall in order to improve the energy consumption of the building and putting an end to moisture condensation and mould,
- creating aesthetical, weather resistant appearance.

2. FASTENING PANEL CRUSTS

When renovating facades the panel crust has to bear extra load. From the former German Democratic Republic cases of fallen panel crust have been reported. No such accident has happened in Hungary so far, nevertheless examination and prevention should be considered. To fasten panel crusts several witty solutions have been worked out. In the solution of the firm FISCHER a hole is drilled by a crown drill through which stainless elements are placed in to support the loosened crust. The fastening of stretching cantilevers is done by a stainless Zykon anchor (Fig.1).

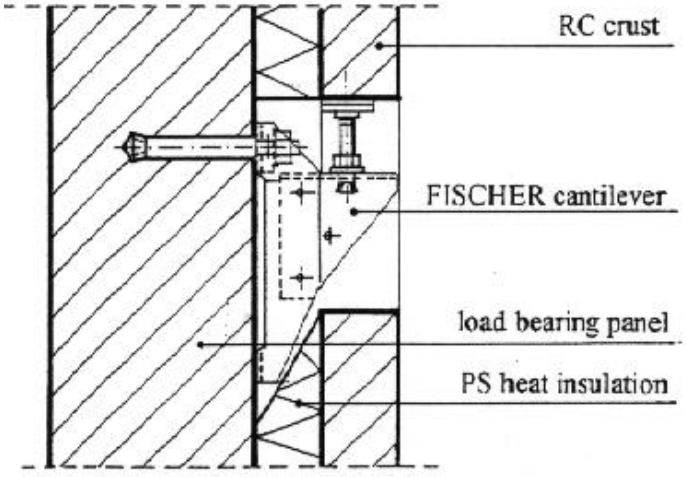

Fig. 1 FISCHER stretching cantilevers

The speciality of the method is that it provides great vertical stiffness and a flexible support horizontally. The vertical load limit is 12.0 kN, so that only two stretching cantilevers are needed per panel (Fig. 2). In a simpler solution suggested by HILTI straight anchors are functioning as cantilevers.

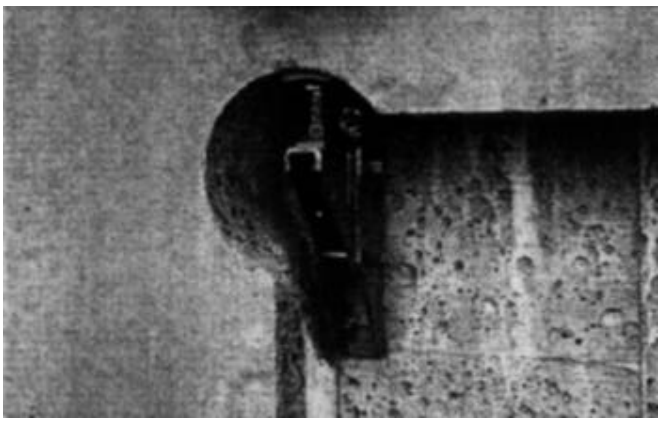

Fig. 2 FISCHER stretching cantilevers

3. VALUE-INCREASING FACADE COVERINGS

There are 2 main groups of follow up facade covering methods:

- aired rift coverings (e.g. ceramics)
- DRYVIT system coverings.

Both fulfil the requirements mentioned in the introduction though on different aesthetic and financial levels.

Energy-centred planning and the development of building materials however give preference to the second approach, namely the transparent heat-insulated and transparent layered facade-forming system integrated into DRYVIT.

This transparent insulation works in the following way: the rays of the sun reaching the facade goes through an external insulating layer up to a black absorbing plate in which it is turned into heat. Because of the heat insulation the warmed-up absorbing level does not radiate his warmth outside but towards the rear walls, increasing their temperature. Transparent insulation can change the direction of the heat current emerging in the wall structure even in wintertime, effectively reducing heating costs.

Still overwarming in summer can be a great problem, which can only be solved by shading. Transparent insulation is extremely vulnerable so its external crust should be of normal glass or some other see-trough plate. Transparent insulations are being developed now so that they have been built in only in a few cases.

4. TRANSPARENT HEAT INSULATION SYSTEM

A special variant of transparent insulations is the Transparent Heat Insulation System (THIS), a common development of STO AG and Fraunhofer Institute Stuttgart. It is based on the traditional DRYVIT insulation covering where pre-fabricated THIS elements are fixed into certain parts of the surface. The transparent parts on the surface are scattered in patches, their outer surface being something like mortar but its material differs from the insulating DRYVIT surface (Fig.3). The thickness of the prefabricated elements is in accordance with the thickness of DRYVIT coverings applied. The layered THIS elements are glued to the back walls, this glue functions as an absorbent as well.

The body of the heat insulation element consists of a see-through and mechanically resistant policarbonate capillary plate which is given a glass mortar from the outside. This glass mortar contains 2-3mm glass pearls and joins the capillary plate by a common glass veil.

Because of the special mortar the functioning of the transparent part can be characterised as follows: in the case of deeper sunbeam the proportion of reflected light is bigger. Because the average angle is ≈15° in winter and ≈65° in summer, it can be stated that the amount of heat let in from outside is 3-4 times greater in winter than in summer (Fig.4). Consequently there is no overheating in summer but considerable extra heat in winter. The effectivity of THIS is naturally the greatest on southern facades (120kWh/m^2) but can be used quite effectively on eastern and western facades, too. In general we can say that what you have gained by the system can be felt on the inner wall surface after about 8 hours.

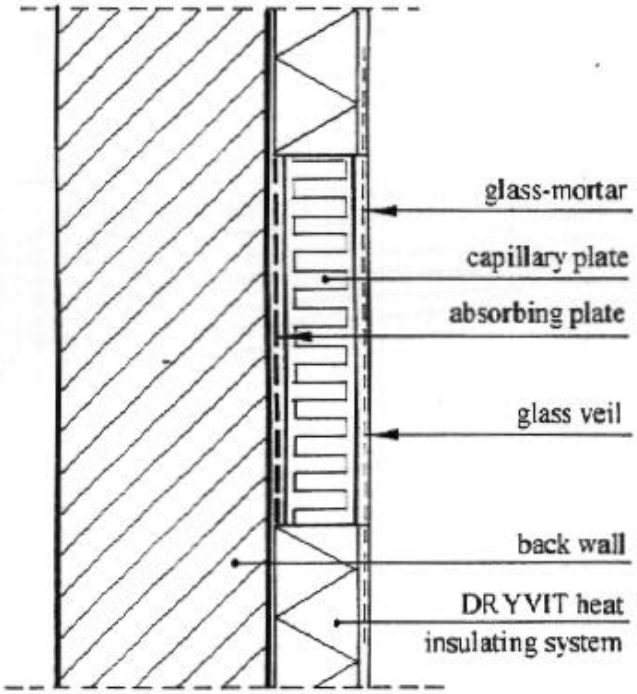

Fig. 3 Transparent Heat Insulation System

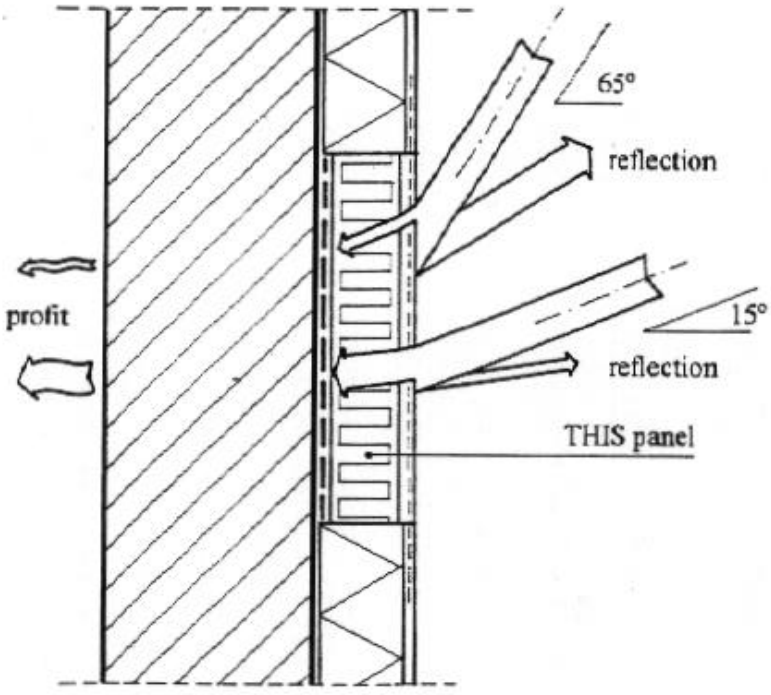

Fig. 4 Appliance of Transparent Heat Insulation System

The conditions of applying THIS are the following:

- a totally insulated facade,
- heavy back walls able to store heat well,
- a surface suitable for the special glue.

These conditions can also be created when renovating panel houses.

5. THE APPLICATION OF TRANSPARENT HEAT INSULATION SYSTEM ON THE FACADES OF PANEL BUILDINGS

Because the inner insulation of panels considerably reduces the effectivity of transparent insulation, it is worthwhile to be used only around facade heat bridges.
Fastening panel crusts afterwards and creating heat bridges in this way can also give way to the application of transparent heat insulation. Thus warming of the load bearing panel is limited, but is concentrated to the critical points, considerably increasing the temperature of facade heat bridges, and the heat fluctuating of joints is reduced. Their corrosion and inner vapour condensation is eliminated.

6. CONCLUSIONS

When rehabilitating panel buildings the task is to renovate huge facade surfaces. To achieve this aim an effective way could be the application of Transparent Heat Insulation System. The features of the system are more favourable than those of traditional insulation systems. In case of mass applications the cost of THIS could be considerably lower than than price of aired rift coverings. As the transparent heat insulation (at the moment) is really expensive, a cost pay-off study should be made.

7. REFERENCES

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