



10th International Conference Interdisciplinarity in Engineering, INTER-ENG 2016

Alternative Solution for Thermal Rehabilitation of Buildings with Polystyrene Panels

Adrian-Cosmin Bojan^{a,*}, Anca-Gabriela Popa^a, Attila Puskas^a

^aTechnical University of Cluj-Napoca, 28 Memorandumului Street, Cluj-Napoca, 400114, Romania

Abstract

The construction industry in the European Union is turning increasingly in the direction of sustainable building. A particular important component of sustainable construction strategy is represented by the reduction of operational energy in buildings. One popular solution for the reduction of heat losses through the exterior envelope is the thermal insulation with polystyrene panels, frequently used in composite systems (ETICS – External Thermal Insulation Composite Systems). These solutions are efficient for operational energy savings, contributing in the same time to the reduction of environmental pollution and degradation due to the current energy production systems. Still, they present some reliability problems, being vulnerable to wind actions. The paper proposes an alternative solution for fixing the polystyrene panels by replacing the adhesive mortar with anchors and regular mortar to compensate the flatness. The paper presents experimental results for adhesive bonding strength of adhesive and regular mortar to various substrates. The results were embedded into numerical models for determining the response to wind actions both for the classical and proposed solution. The paper presents a comparative analysis of the mechanical and economic performance for the two fixing solutions. Finally are discussed the advantages and disadvantages of the mechanical fixing solution proposed and are identified the main areas of application.

© 2017 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of INTER-ENG 2016

Keywords: Thermal insulation; polystyrene; composite system; adhesive; mortar.

1. Introduction

One of the primary requirements of sustainable buildings is energy efficiency. The reduction of operational energy can be achieved by thermal insulation. A widely used material for thermal insulation of the external envelope

* Corresponding author. Tel.: +40-721-196320.

E-mail address: Adrian.BOJAN@cem.utcluj.ro

is polystyrene, frequently used in composite systems (ETICS – External Thermal Insulation Composite Systems). These systems involve contact with the substrate by bonding with adhesive mortar.

ETICS are effective both for new and old buildings but show some problems regarding the operational reliability, being vulnerable to wind action. Pulling off ETICS from the building facades is most of the time caused by the failure of the adhesive bond between the mortar and the wall, this failure pattern being systematically present in cases of old buildings that were thermal rehabilitated.

Case studies analyzed by the authors revealed also that, in most situations, dowels remained fixed on the facade, the loss of stability of the insulation being produced by the local crushing of polystyrene panels. This suggest that mechanical fixing is safer than bonding for wind action. Last but not least it should mention that the climate change recorded in the last period, characterized by an increased incidence of extreme weather phenomena, brought in attention the issue of operational safety of the external thermal insulation of buildings.

Based on these considerations, the paper proposes an alternative fixing system for polystyrene panels, replacing the CT adhesive mortar with anchors and a regular mortar CS II to compensate the flatness of the substrate layer.

2. Mechanical and constructive characteristics of ETICS

This paper is a comparative analysis of the response to the wind action of two composite systems having as insulation material expanded polystyrene EPS 80:

- (a) ETICS bonded with CT adhesive mortar and additional fixing with 8 plastic anchors per square meter (classical solution, Fig. 1).

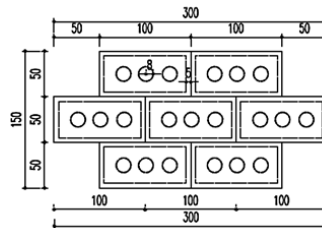


Fig. 1. Boundary conditions on the panel soffit for the classical solution.

- (b) Mechanically fixed ETICS with 8 plastic anchors with increased diameter of the disk, of 140 mm, and CS II flatness compensation mortar (proposed solution, Fig. 2).

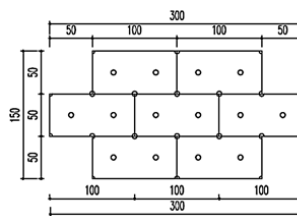


Fig. 2. Supporting conditions on the front face for fixing with 8 anchors per square meter (proposed solution).

In the case of the classical solution (a), wind loads are transferred to the substrate by the CT adhesive mortar for bonding expanded polystyrene boards. Anchors act as a temporary connection until the adhesive mortar reaches the entire adhesive strength [10,11].

For the proposed solution (b), wind loads are totally undertaken by the anchors and transmitted to the structural elements of the external envelope. The regular mortar CS II ensures the flatness of the polystyrene plates during the execution of the insulation.

Download English Version:

<https://daneshyari.com/en/article/5028901>

Download Persian Version:

<https://daneshyari.com/article/5028901>

[Daneshyari.com](https://daneshyari.com)