Testing Method for External Cladding Systems - Incerc Romania

A Simion¹ and H Dragne²,³

¹ Laboratory of testing and research for building fire safety from National Institute INCERC Bucharest, National Research and Development Institute URBAN-INCERC, Bucharest, Romania
² Laboratory of testing and research for building fire safety from National Institute INCERC Bucharest, National Research and Development Institute URBAN-INCERC, Bucharest, Romania
³ PhD, Technical University of Civil Engineering, Bucharest, Romania

E-mail: simion_i_adrian@yahoo.com

Abstract. This research presents a new testing method in a natural scale for external cladding systems tested on buildings with minimum than 3 floors [1]. The testing method is unique in Romania and it is similar about many fire testing current methods from European Union states. Also, presents the fire propagation and the effect of fire smoke on the building façade composed of thermal insulation. Laboratory of testing and research for building fire safety from National Institute INCERC Bucharest, provides a test method for determining the fire performance characteristics of non-loadbearing external cladding systems and external wall insulation systems when applied to the face of a building and exposed to an external fire under controlled conditions [2]. The fire exposure is representative of an external fire source or a fully-developed (post-flashover) fire in a room, venting through an opening such as a window aperture that exposes the cladding to the effects of external flames, or an external fire source. On the future, fire tests will be experimented for answer demande a number of high-profile fires where the external facade of tall buildings provided a route for vertical fire spread.

1. Introduction

The test method simulates a fully developed fire in a room abutting the face of a building and venting through an aperture. In this test, the external cladding system is applied to a vertical external masonry surface simulating the face of a building in the form of a main face together with a perpendicular side wing, with the cladding system attached in the manner specified by the test sponsor. At the base of the main vertical masonry wall an opening is provided through which the fire can vent. Extend of damage caused to the external cladding system is evaluated, particulary the ability of the external cladding system to resist the propagation of the fire upwards or penetration through the system. Any falling debris and fire penetration was recorded. The test is concerned not only with the reaction to fire properties of the materials, as to now in Romania, but also with system performance in terms of overall integrity and stability. The large-scale test method covered by this test, determine the comparative burning characteristics of exterior wall assemblies by evaluating fire spread over the external surface, fire spread internally within the system under test and mechanical response, that is, the degree of distortion and local or global collapse [3].
2. Experimental procedures
The test facility is illustrated schematically in figure 1.

The parameters recorded until the test was: temperature 18 °C, humidity 81.6 % and wind speed 0.4 m/s. The thermal insulation of the facade was made of fireproof polystyrene with a thickness of 10 cm over which an exterior and protection decor layer has been applied (figure 2).

![Figure 1. Large-scale cladding test facility (dimensions in mm) [4].](image1)

![Figure 2. Building façade composed of thermal insulation.](image2)

Inside the chamber was a stack of wood with a thermal load of 450 Mj (figure 3).

![Figure 3. Stack of wood.](image3)

Thermocouples was placed at two levels to measure both internal and external fire spread (figure 4, 5).
After ignition of the stack of wood (figure 6), start time for measuring fire spread occurs when the temperature recorded by any external thermocouple at level 1 reaches 200 °C above the ambient temperature value and remains above that level for a period of at least 30 seconds (figure 7).

Failure due to external fire spread will have occurred if the temperature rise of any of the external thermocouples at level 2 exceeds 600 °C for a period of at least 30 seconds within 15 minutes of the start of the recording period.

Failure due to internal fire spread will have occurred if the temperature rise of any of the internal thermocouples at level 2 exceeds 600 °C for a period of at least 30 seconds within 15 minutes of the start of the recording period. Details of any system collapse, spalling or delamination was reported (figure 8, 9, 10).
3. Results and discussions
The fire resistance test of the thermal insulation system lasted 1 hour. After finish the resistance fire test, the records values of temperatures have been processed and interpreted. Damage is recorded in the following areas: flame spread on surface, flame spread in cavities or insulation area of façade damaged or detached. In the first 15 minutes since ignition the fire, no thermocouple on the second floor recorded temperatures at least 600 °C. The maximum temperature in the combustion chamber was about 1000 °C and the maximum face temperature above 800 °C. The complete firing time of the polystyrene insulation thermal rehabilitations systems, was 40 minutes from the ignition of the fire. During the fire test, they fell burned droplets and a large amount of black-grey smoke was released in atmosphere.
4. Conclusions
This test method was developed to address systems installed to masonry structures. Many European states have similar tests for façade systems recognising the need to understand the system interactions [5]. The INCERC test method, provides a means of assessing performance against a realistic scenario in terms of fire load and provides information on the performance of the system and not just the exposed surface. This research presents the fire propagation and the effect of fire smoke on the façade building. The results obtained from the test provide the data, needed to evaluate the fire protection performance of the external cladding systems. Is most important as the fire performance of external walls, covers fire resistance to restrict fire spread across a site boundary, the combustibility of the outer surface to minimise the possibility of ignition from an external source and subsequent fire spread up the external façade. Following this test it results that it is necessary for external walls which form elements of structure then the provisions for fire resistance will apply. However, the external envelope of a building should not provide a medium for fire spread. The use of combustible materials in the cladding system in tandem with unstopped cavities is a potential route for rapid fire spread. In this moment, in Romania is not obligate the testing of the fire resistance for external cladding systems on buildings. As an alternative means of compliance it is now possible to meet the fire performance criteria of the external cladding system of the masonry face of a building given which could hope contribute to elaborate the new provisions of fire legislation in Romania [6].

References
[1] Lalu O, Anghel I, Codescu S and Branisteau B 2016 Experimental research on fire behavior analysis for polystyrene insulation thermal rehabilitations systems Romanian Journal of Civil Engineering 7 208
[2] Lalu O 2016 Research on developing sustainable solution for thermal rehabilitation of the building envelope. Behaviour in case of fire, fire safety solutions Technical University of Construction 4-10
[3] Lannon T 2011 Structural fire engineering ICE Publishing 32-35
[4] BS 8414-1 2002 Fire performance of external cladding systems applied to the face of the building BSI 4-6
[5] Coldwell S and Baker T 2003 BR-135 - Fire performance of external thermal insulation for walls of multi-storey buildings BRE Bookshop 10-14
[6] Lalu O and Bubulete L 2017 Termosistem pentru placari exteroare utilizat pentru anveloparea constructiilor. Raspuns la actiunea focului Construction Magazine 133 8