

Exploratory Tests on Structures Resistance during Forest Fires

Authors : Luis M. Ribeiro, Jorge Raposo, Ricardo Oliveira, David Caballero, Domingos X. Viegas

Abstract : Under the scope of European project WUIWATCH a set of experimental tests on house vulnerability was performed in order to assess the resistance of selected house components during the passage of a forest fire. Among the individual elements most affected by the passage of a wildfire the windows are the ones with greater exposure. In this sense, a set of exploratory experimental tests was designed to assess some particular aspects related to the vulnerability of windows and blinds. At the same time, the importance of leaving them closed (as well as the doors inside a house) during a wild fire was explored in order to give some scientific background to guidelines for homeowners. Three sets of tests were performed: 1. Windows and blinds resistance to heat. Three types of protective blinds were tested (aluminium, PVC and wood) on 2 types of windows (single and double pane). The objective was to assess the structures resistance. 2. The influence of air flow on the transport of burning embers inside a house. A room was built to scale, and placed inside a wind tunnel, with one window and one door on opposite sides. The objective was to assess the importance of leaving an inside door opened on the probability of burning embers entering the room. 3. The influence of the dimension of openings on a window or door related to the probability of ignition inside a house. The objective was to assess the influence of different window openings in relation to the amount of burning particles that can enter a house. The main results were: 1. The purely radiative heat source provides 1.5 KW/m² of heat impact in the structure, while the real fire generates 10 Kw/m². When protected by the blind, the single pane window reaches 30°C on both sides, and the double pane window has a differential of 10° from the side facing the heat (30°C) and the opposite side (40°C). Unprotected window constantly increases temperature until the end of the test. Window blinds reach considerably higher temperatures. PVC loses its consistency above 150°C and melts. 2. Leaving the inside door closed results in a positive pressure differential of +1Pa from the outside to the inside, inhibiting the air flow. Opening the door in half or full reverts the pressure differential to -6 and -8 times respectively, favouring the air flow from the outside to the inside. The number of particles entering the house follows the same tendency. 3. As the bottom opening in a window increases from 0,5 cm to 4 cm the number of particles that enter the house per second also increases greatly. From 5 cm until 80cm there is no substantial increase in the number of entering particles. This set of exploratory tests proved to be an added value in supporting guidelines for home owners, regarding self-protection in WUI areas.

Keywords : forest fire, wildland urban interface, house vulnerability, house protective elements

Conference Title : ICFSSST 2016 : International Conference on Fire Safety Science and Technology

Conference Location : London, United Kingdom

Conference Dates : September 29-30, 2016