Application of FSE in one-family dwellings : feasible?

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Fires within buildings are complex events and are recognized as one of the major threats to life and property in many countries. The primary goal of fire protection is to limit, to acceptable levels, the probability of death, injury, and property loss in an unwanted fire. Therefore, it is paramount to provide adequate fire safety and protection in buildings, in Belgium for all buildings except for private dwellings, prescriptive rules are available as a Royal Decree. The fact that no rules are available for private dwellings, the owner of the house is responsible to choose for fire safe building materials and to construct a safe house for all its inhabitants, another fact is that there is no control due to the privacy law, this will not change the amount of fire accidents.

The purpose of this work is to point out some solutions to the government which can influence, or better limit the amount of incidents. In some cases, solutions are available in the regulations of other countries, some solutions are worked out with the help of aspects of Fire Safety Engineering.

To introduce solutions and analyzing data, I felt it necessary to understand the fundamental principles on fire safety, divided in two areas: fire dynamics and fire safety engineering or shorter FSE . The implementation of FSE and proposed or already implied solutions in the Belgian, Dutch and other European member state regulations are reproduced.

An analysis is made of existing statistics and new data, for a period of 1998 till 2009, representing data on fire hazards, materials which first start to burn and origin of fire, some frequent fire origins / hazards, can be avoided by issuing new rules, which is the main goal of this work.

In almost all fire cases, smoke evacuation was performed by the fire departments, A solution for early smoke evacuation before the fire department is on location, is one of the analyzed solutions. Therefore CFD simulations are performed to predict the smoke evacuation. The NIST software, FDS version 5.5 is used on a simplified model to evaluate the impact of the solutions on the smoke development in terms of temperature, visibility and FED values.

Simulations on the ‘detailed model’, were calculated with FDS version 5.3., some restrictions in the latter version were noticed by using and thus comparing both versions of the software.

The use of smoke detectors in dwellings has a positive impact on the reaction time of the inhabitants, still smoke intoxication is the most frequent cause of death. Some investigation is

done on smoke evacuation by opening the front door and a roof window as soon as smoke is detected by a smoke detector. The impact of sleeping with open and closed doors is taken into account.

Out of the fire statistics and after some literature survey, I noticed that most fires originate in terraced houses. Simulations were therefore made in a pre-designed model ('detailed model') developed by the Flemish Government, used for simulating calculations on energy performance of dwellings, in order to fulfill the exigencies of the European Energy Performance Regulations.

Smoke evacuation, use of smoke detectors in every bedroom and residential sprinkler systems are the main solutions, focused on in this work, to reduce the amount of fatalities in dwellings.

Conclusions:

- Early smoke evacuation by opening front door and roof window, helps reducing the temperature .
- FDS version 5.3 has a rudimentary possibility to give results on FED values, with version 5.5 further improvements have been implemented.
- The newly published version of the Belgian intervention file, will not give any results in fire statistics on fire hazards, materials which have first burned, fire origin.
- Residential sprinklers are proven to be effective in suppressing the fire hazard, thus reducing temperature and even FED values.

Detailed information on FDS simulations is available in annex.