PRESS RELEASE

Zagreb, May 28th 2014

Façades can significantly affect the spread of fire

Although many believe that façades have no or little impact on the spread of fire in buildings, a large scale test carried out today by the University of Zagreb Faculty of Civil Engineering, Fire Safe Europe and the Croatian Association for Fire Protection (HUZOP), has revealed that façade fires can in fact spread very rapidly depending on the type of materials used.

The large scale test carried out as a part of an international seminar on façade fire safety, under the patronage of the Croatian president prof. Ivo Josipović and European Commissioner for Consumer Protection Neven Mimica, was attended by 200 international experts including regulators, media, and industry from 26 countries.

In the opening video address Commissioner Mimica said "*we should not take safety for granted*". He expressed the openness of the European Commission to the opinion of experts so as to further enhance the fire protection of Europeans, especially in public buildings where many people congregate such as schools, shopping centers and hotels.

President Josipović pointed out that a fire can spread quickly and destroy in few minutes what we created for years. "*Therefore we the need to invest in systems which can reduce the risk of fire to a minimum, and in case fire does occur, it can be extinguished as fast as possible*", president concluded.

University Prof. Dubravka Bjegović, PhD from the Faculty of Civil Engineering followed outlining that the aim of the seminar is to demonstrate the importance of raising awareness among building professionals, decision makers and the general public about the impact of façades on the risk of the ignition and spread of fire in buildings, especially during the period of building energy renovation. "*Today's modern buildings, apartments and offices contain more combustible materials than ever*", she said, explaining that these materials can cause fire to spread from the inside of a building to the external façade through a window within few minutes. Depending on the type of façade, she added, fire can spread to the neighboring floors of the building. She emphasized the importance of better understanding the effect of various façade systems when assessing the fire protection of buildings and highlighted the need to improve existing methods of fire tests construction products and elements given that many of these tests are outdated.

To demonstrate this point in practice a test of three façade systems, all using different thermal insulation materials, took place in the Laboratory for Thermal Measurements (LTM) in Stubička Slatina near Zagreb following the morning's introductory session. As well as LTM, two additional prominent scientific partners performed the measurements – the SP Technical Research Institute of Sweden and the ZAG Slovenian National Building and Civil Engineering Institute. At first glance, all three facades looked identical, but as the fire spread it became apparent that there were significant differences in the way they reacted to fire.

The large scale fire test: completely identical samples at first sight

All three samples were identical apart from only one important component: the type of thermal insulation material. All of them were covered with classified façade systems; one with combustible insulation (EPS), B s2 d0, another one with combustible insulation (EPS), B s2 d0 + stone wool horizontal fire barrier, while the third one with non-combustible insulation (stone wool), A2 s1 d0. All were lit at the same time.

During the test, the sample with EPS insulation completely burned and the fire spread across the façade throughout the wall only 15 minutes after the outbreak. Also, the guests could see large amounts of black smoke resulting from the combustion of flammable materials. The fire on the 3^{rd} sample did not spread across the façade due to non-combustible insulation (stone wool) and the wall structure remained undamaged. Miodrag Drakulić, President of HUZOP commented: *"Fire barrier made of non-combustible materials between floors should function as horizontal fire protective barriers. We saw today that relatively small barrier can slowdown the fire spread on the facade but it cannot effectively stop the spread of fire. As seen on the 2nd sample, it did delay the spread of fire for about 10 minutes compared with the system made entirely of EPS, but for longer prolongation of fire spread alongside combustible façades, fire protective barriers have to be designed according to proven technical rules. But, in spite of these prevention measures for fire spread, risk of gases emitted from combustible façades is still very high. And we should remember that statistics show that 8 out of the 10 people killed in the fire actually die from suffocation by smoke and gases, not because of fire".*

Miroslav Merćep from the Public Fire Department of the City of Zagreb was invited to comment the test specifically at the 15^{th} minute, as it is within this time that firefighters are required to arrive at the fire scene after receiving their call. He stressed: '*If we find such a situation, when the fire had spread across the façade due to combustible material, and there are large amounts of smoke, we first have to evacuate people from the building in order to prevent them from suffocating, and only then try to extinguish the fire and rescue the property. When it comes to combustible materials, so called 'flaming droplets', melted combustible material droplets of extremely high temperatures threaten lives of people coming out of the building, but also those of us who are trying to rescue them. It happened that such facade began to fall off the wall during the intervention and collapsed, threatening firefighters and residents during the evacuation. Even after the fire stops to be visible, we need to check it with thermal camera and cut off the facade until we reach intact part because it can reignite even hours after firefighters had left the fire scene*.'

The importance of choosing the right material

Prof. Bjegović PhD pointed out: 'Using the right material on a façade is very important as we witnessed today. The test showed how the façade covered with EPS, a type of cheaper combustible thermal insulation nowadays extensively used can behave devastatingly in a fire. However the façade using only noncombustible, stone wool insulation had minimal fire damage only to the finish layer, and even more importantly the fire did not spread onto the neighboring floors. This is a particularly important factor in buildings where, in case of fire, the safe and quick evacuation of large number of people is paramount. This need to be taken into account both in new constructions and energy renovation projects, especially for public buildings such as shopping malls, schools, hospitals or care homes.'

Need for updating existing fire test standards

Milan Hajduković from ZAG explained that there are significant differences in the testing methods for the standardization for products across the world and this is also an issue. The 8 meter high mock ups in this test were built according to British Standards BS 8414, and simulate the development of a fire in the two-story building, which starts in a room and spreads out of the window onto facade. Lars Boström from the Swedish Institute SP said however that, besides a set of measurements according to this standard, they have conducted many additional ones because 'existing standardized fire tests do not cover all essential parameters for the development of a fire. These additional measurements will give valuable information to supplement and update existing fire tests standards.'

Tomislav Skušić from LTM hopes that this test will contribute to further improvements in the regulations relating fire protection products and will provoke our citizens and legislators to think about the importance of fire safety.

The problem: same fires, different regulations

Bill Duncan from Fire Safe Europe (FSEU), explained that this test has highlighted another problem: whilst fires are the same all over the world, fire protection regulations differ substantially. "*Our goal is to work with policy makers and regulators to ensure that fire safety rules are drastically improved across the entire EU. This includes ensuring that harmonized EU-wide rules are put in place to make sure that construction products and practices consistently meet appropriate, higher and more rigorously enforced fire safety standards. We are on good track as more than 70 candidates to the European Parliament pledged to work with us to put "fire safety first" during the next parliamentary term from 2014 till 2018,*" said Duncan.

Energy renovation - a great chance to increase fire protection in buildings

Thermal renovation programs are underway throughout Croatia and Europe. These programs will deliver huge reductions in energy use and create millions of new jobs. They also offer an unprecedented opportunity to improve the fire safety of the built environment.

'In economically challenging times, priority is usually given to less expensive façade systems rather than those providing both energy efficiency and fire protection. This seminar aims to show that energy efficiency and fire safety can, and should, go hand in hand', was the conclusion of organizers.

The façade systems from left to right:

Sample 1 classified system with combustible isolation (EPS), B s2 d0, **sample 2** classified system with combustible isolation (EPS), B s2 d0 + 20 cm horizontal fire barrier made of stone wool and **sample 3** classified system with non-combustible insulation (stone wool), A2 s1 d0. All other components are identical in all three samples.
The photo shows the very beginning of the test (00:30) when the furnaces that simulate an apartment fire are lit, all at the same time. A few minutes later fire is coming out of the

15 minutes after the start of a fire:

Sample 1 is completely caught by fire while it emits large quantities of smoke and gases. Flaming droplets of the burning insulation are increasing the area affected by fire.

At this point there is no greater difference between the reactions of the **sample 2** and **sample 3**

19 minutes after the start of a fire:

Sample 1 is still emitting large quantities of smoke and gases.

On **sample 2** the fire jumped over the fire barrier placed above the window frame and caught the combustible insulation (EPS). The evidence is black smoke at the top of the wall.
On **sample 3** the fire has not caught the insulation.

28 minutes after the start of a fire:

Sample 1 the system has burned out, there is only fire in furnace. The steel frame with sensors prevents parts of final decorative plaster from falling.

On **sample 2** the fire spread entirely on the combustible insulation which now emits large quantities of smoke. The situation on the **sample 3** is unchanged.

40 minutes after the start of a fire:

Sample 2 is still burning and emitting smoke, even though the fire is not visible. The horizontal stone wool fire barrier above the window frame has delayed escalation of fire for about 10 minutes, but also extended the time of burning of the insulation and emission of gases. The fire in the furnace of **sample 3** extinguished on its own. Unlike **samples 1** and **2**, the façade on the third sample is not structurally damaged.

These photos were taken during the preliminary test on March 28th, 2014 on identical samples as the ones used for public test on May 28th 2014.

Thermograms reveal what naked eye cannot see

Thermograms taken during the public test on May 28, 2014 which was part of the seminar „Facades in Fire“

<table>
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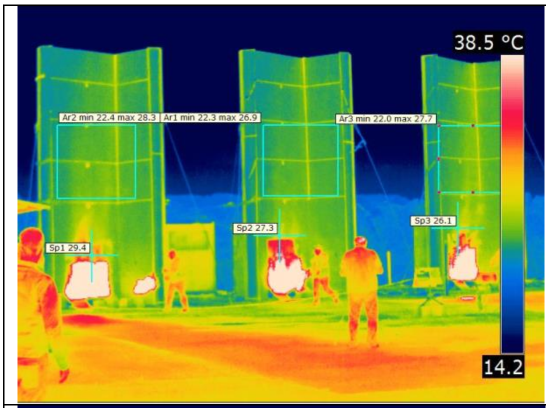
<td>
</td>
<td>Façade systems looking from left to right:
Sample 1 was classified system B s2 d0 made with combustible insulation (EPS)
Sample 2 was classified system B s2 d0 made with combustible insulation (EPS) + 20 cm horizontal fire barriers of stone wool
Sample 3 classified system A2 s1 d0 made of non-combustible insulation (stone wool).

All other components are identical in all three samples.

The photo shows the very beginning of the test (0:30) when the furnaces that simulate a fire in an apartment were simultaneously set on fire. Few minutes after the fire came out of the window. The temperature scale on the right side shows the set temperature range shown on the thermogram.</td>
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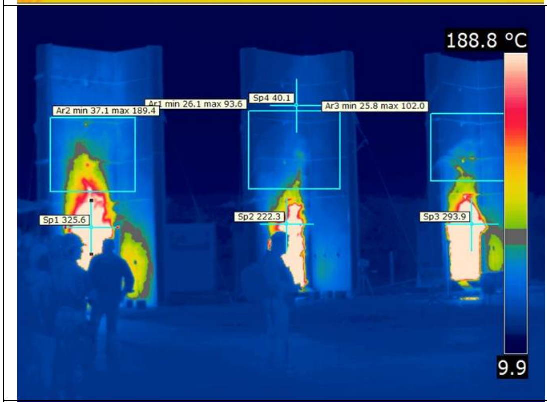
<tr>
<td>
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<td><u>3:30 minutes after the fire:</u>

Sample 1 the temperature has reached the value of 189°C at the height of about 3 meters. Since the melting point of the combustible insulation (EPS) is 75°C the melting process has already begun.
Sample 2 Fire barrier slows down the fire spread through the facade but cannot effectively stop it. Despite the barrier temperature at a height of about 3 m is 93°C and the isolation is melting.
Sample 3 temperature in the furnace is similar to that of the neighboring furnace, but as the melting point of stone wool is above 1000°C, stone wool resists fire.</td>
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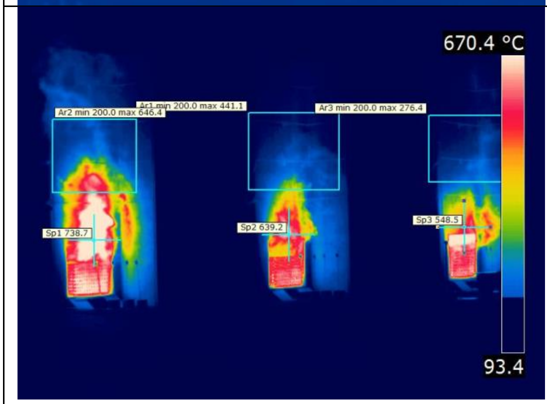
<td>
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<td><u>9 minutes after the fire:</u>

The temperature just above the furnace has drastically increased and ranges between 738°C in **sample 1** to 639°C in **sample 2** while in **sample 3** it is 548°C.
The temperature at a height of 6 meters (equivalent to the height of windows two floors above) exceeds 200°C on all three samples. At this point glass in these windows would break due to high temperatures.
Combustible insulation at this height starts to melt due to high temperature.
Despite increasing temperature stone wool insulation is not melted in **sample 3**.</td>
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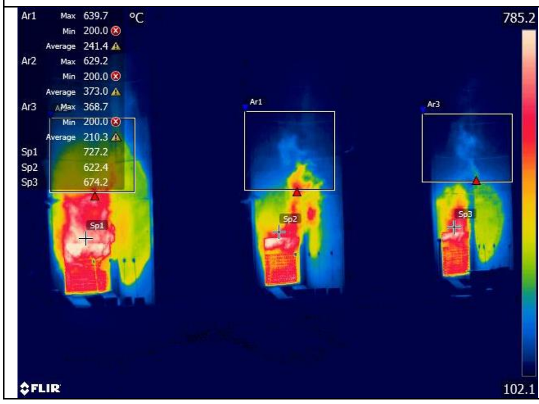
<td>
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<td><u>13 minutes after the fire:</u>

The melting of combustible insulation impact the significant rise in temperature on **samples 1 and 2** at height of 3.5 meters, 639°C and 629°C respectively. At the same height the temperature on the **sample 3** is significantly lower and reaches 368°C.

The photo shows that the combustible insulation on **sample 1** has begun to melt throughout its height.</td>
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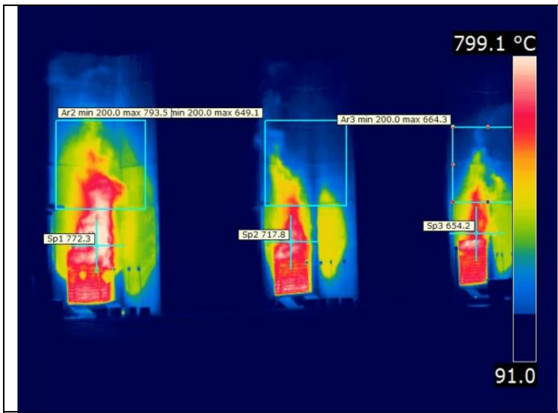
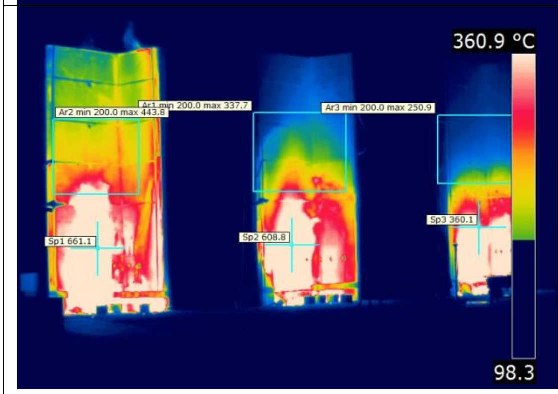


<u>15 minutes after the start of fire:</u>

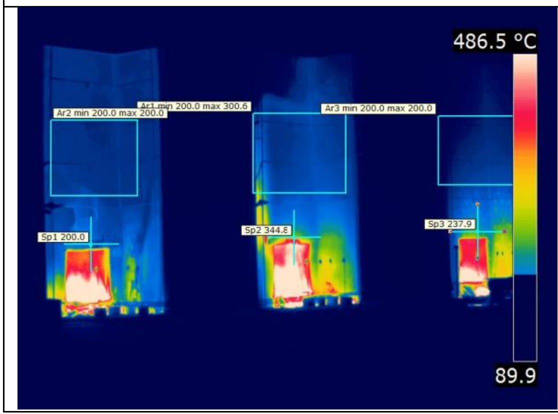
Sample 1 insulation contributes to the spread of fire and is melted up to 8 meters. Burning particles formed due to melted insulation are dripping to the bottom of the sample.

On **sample 2** chimney effect is created due to melting insulation. The temperature rises and now reaches its maximum during this measurement. Insulation is melted almost throughout the sample.

Sample 3 temperature reaches its maximum, which is 60°C lower than the neighboring sample. Despite this fact, the insulation does not melt.



<u>33 minutes after the start of fire:</u>
Sample 1 the temperature is about 400°C almost all the way to the top of the sample. Chimney effect is visible on the right wing of the sample. The insulation has burned out throughout the sample. The particles of melted insulation are still burning at the bottom of the sample.
Sample 2 the temperature is still very high due to the burning particles, especially on the wing right of the furnace. The melted particles of insulation are burning at the bottom of the sample, as well as on the top of the fire barrier onto which they have dripped. Only the top left corner was not affected by the fire.
In the furnace of **sample 3** the temperature dropped to 360°C while in the furnaces of other samples is above 600°C. The temperature throughout the sample is continuously dropping, there are no open flames and the thermal insulation remained intact.



<u>48 minutes after the start of fire:</u>

The façade on **sample 1** has burned and the fire had extinguished on its own. The temperature decreased on all three samples. Burning particles on top of the fire barrier of **sample 2** are still burning, and the temperature is still high (344° C). Melted insulation is burning at the bottom of the sample.

The fire on **sample 3** extinguished on its own, the fire has not spread through the façade and it retained its integrity.