

# **“INCREASE IN THE NUMBER OF FIREFIGHTING INTERVENTIONS AND THE PREVALENCE OF POST-EARTHQUAKE INTERVENTIONS IN ZAGREB AND BANOVINA IN 2020”**

*Research paper*

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## **“Abstract”**

*The research paper will describe firefighting as a multidisciplinary activity that includes the development of technical services within firefighting. Furthermore, the paper will describe and elaborate the continuous increase in the number of technical interventions in firefighting. In the Republic of Croatia, the need for technical interventions by firefighters is becoming more frequent. The entire technology, teaching and training of firefighters was based on knowledge from other countries. After the earthquakes in Zagreb and Banovina, firefighters in Croatia intend to receive additional training in order to be able to work in catastrophic situations. Firefighting personnel are being trained due to natural disasters in the Republic of Croatia. After the 2020 earthquake in Croatia, an increased number of interventions was recorded on a daily basis. Any type of training, procurement of equipment as well as education of the local population increases security in certain areas.*

*Keywords: Firefighting, Natural disasters, Technical interventions, Earthquakes in Croatia.*

## **1 Introduction**

Firefighting is a multidisciplinary activity. With the organization of the fire service and the division of firefighters by duty, firefighting is gaining more and more dimension and importance in society.

Since 1272, various provisions have been found in Croatia that precisely determine fire protection. In Croatia, according to available documents, the oldest professional unit was founded in Rijeka in 1863 under the name "Fire Brigade in Rijeka". The first Croatian fire brigade, i.e. the image of today's fire brigade, was founded on June 17, 1864 in Varaždin. Since the founding of the Fire Brigade, we have recorded the development of voluntary firefighting (Popović et al, 2006).

The history of overall firefighting is based on fires, fire protection, firefighting methods and fire extinguishing vehicles (syringes). Fire is one of the most extensive branches of firefighting, and the majority of interventions are based on fires, but we should certainly mention other interventions performed by firefighters.

As we have mentioned, firefighting is a multidisciplinary activity that participates in the implementation of fire and explosion protection measures, extinguishes fires and explosions, rescues people and property endangered by fire or explosion, provides technical assistance in accidents and dangerous situations and performs other tasks in accidents and environmental and other accidents. This Article 1. from the Law on Firefighting, we justify the growing role of firefighters in performing various technical interventions that are not related to possible fires or explosions (National Newspaper, 2019).

With the arrival of the war period in Croatia, in 1991 the Government of the Republic of Croatia adopted the so-called "Instructions for the operation of the fire organization of the Republic of Croatia in extraordinary circumstances, war conflicts and terrorist activities, which can cause fires, explosions, accidents and more" (Popović et al, 2006). By making such a decision, firefighting activities are extended from fires and explosions to various other accidents.

With the modernization of technology and the World globalization, the need for firefighters is growing. As the new technology came, so did the fire danger, the number of technical interventions in traffic increased with the increase in traffic, with the construction of industries, the number of interventions related to environmental catastrophe is growing, and so on.

## 2 Continuous Increase in The Number of Fire Interventions

Analyzing the interventions over a period of 8 years (2008 – 2012), we obtain information that firefighters perform, on average, 47 percent of fire interventions per year, up to 53 percent of interventions are technical or other fire interventions (Data generated based on minutes 133-137 of the Croatian Parliament firefighting communities, 2009 – 2013). Throughout the year, we recorded a continuous increase in the number of technical and other interventions in relation to fires, which can be seen, over a period of 8 years, on table 2.1. (Croatian Fire Brigade 2005 – 2019).

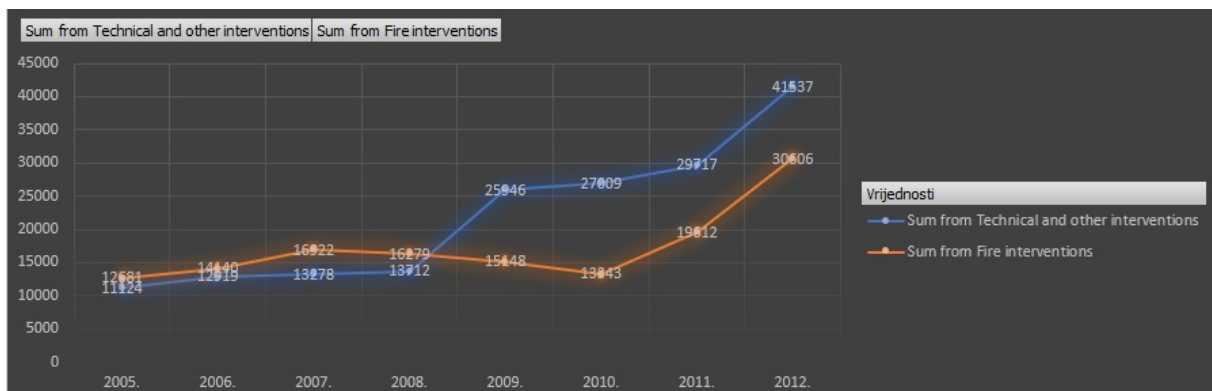


Figure 1. Continuous increase in the number of interventions (Source: Croatian Fire Brigade, 2005 – 2019).

Such an analysis proves to us the multidisciplinary nature of this activity and the need for an increasing number of education and training of firefighters in terms of technical service, as well as a great need for by acquiring appropriate equipment.

### 2.1 Training of firefighters in the Republic of Croatia

Training of firefighters for technical interventions is continuously carried out in the Republic of Croatia (Figure 2), and such training partly covers interventions in the form of earthquakes or rescue from rubble (Croatian Fire Brigade 2005 – 2019).

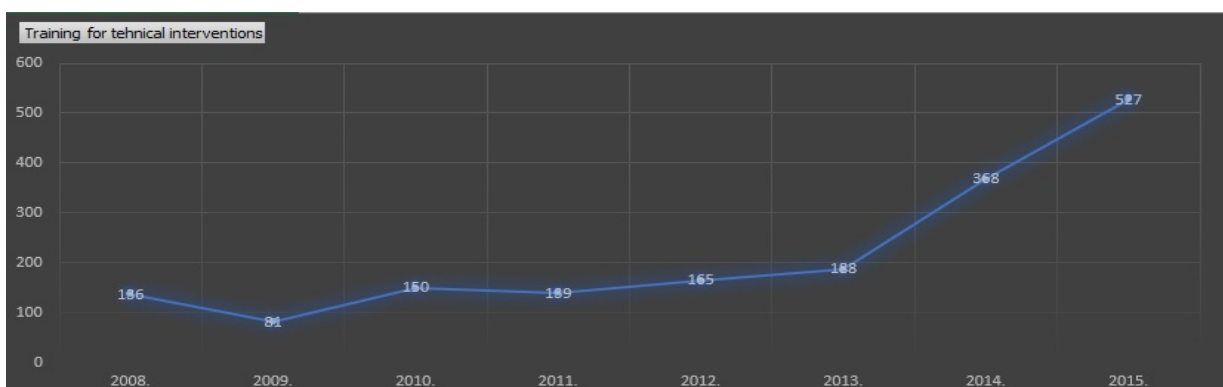


Figure 2. Continuous increase in firefighter training (Source: Croatian Fire Brigade, 2005 – 2019).

It is not only technology that is the main culprit for the increase in the number of interventions, climate change, but also the composition of the soil is responsible for the occurrence of natural disasters (Ambrenac, 2020).

The role of firefighters in natural disasters has been proven from the recent past to the present. In the event of an earthquake, classified rescuers are hired who are usually members of the fire department and have the appropriate equipment for responding to such interventions.

When it comes to interventions that do not require additional skills, civilians are often involved. During floods, civilians can use their physical strength to help build embankments, during earthquakes, civilians can help take care of easily injured people.

In the case of natural disasters of a larger scale, the lives of the victims are endangered, and then there is a need for the intervention of specialized rescuers who are trained for such interventions and have developed the necessary knowledge. Every natural disaster requires a special qualification of firefighting personnel. Firefighters are trained to put out fires in open areas, just as firefighters are qualified to work on water in case of floods. Qualified rubble rescuers are familiar with a range of secondary consequences of an accident, rescue equipment and rescue techniques.

With the launch of a firefighting training project between the Republic of France and the Republic of Croatia in 2007, the knowledge and possibilities of using rescue equipment in ruins during possible earthquakes were expanded. Since then, equipment has been acquired, various trainings have been organized and a training program for rescuing people and animals from the ruins has been launched. Interventions for rescuing people from the ruins become a separate unit and are separated from the technical service in the fire department. The importance of intervention in ruins has grown rapidly under public pressure, and the approach and method of intervention have changed (Gorički, 2014).

All firefighting interventions, including technical ones, take place more and more quickly, there are sudden changes in the situation and the response time to interventions is greatly reduced compared to the past.

The dangers of rescue interventions in the ruins are very great, they need to be removed, and if this is not possible, reduced to an acceptable measure for the rescuers and victims trapped in the ruins.

By studying new techniques, improving the technique and individual resourcefulness of individual firefighters-rescuers, the quality and efficiency of such interventions increases, and the speed of execution decreases, which greatly increases the chances of a rescue success (Gorički, 2014).

### **3 Natural Disasters**

Natural disasters are complicated events within which people are exposed to a multitude of risks and dangers. Each disaster scenario is unique in its own way and presents new and unusual challenges to victims and rescue services (March 2002).

Disasters, immediately afterwards, have a high negative impact on society because their occurrence damages normal lifestyles, disrupts cultural, political and economic living conditions and slows down the work and development of the community. Emergency measures taken by emergency services during natural disasters are inevitable (Nikolić et al, 2020).

Natural disasters can have large and unusual proportions, such as the 2011 tsunami and earthquake in Japan's Tohoku region, which caused enormous human damage and suffering. Over 100,000 people have been evacuated from their homes, and about 19,000 people lost their lives (World Nuclear Association, 2012). There is no complete protection against natural disasters, but it can be influenced by investing in protective infrastructure and the possibility of providing more effective medical and other assistance immediately after the disaster.

Natural disasters are a good indicator of how vulnerable society is, i.e. how resilient it is, on the other hand, and ready to react promptly in an appropriate way to combat the consequences. The consequences of natural disasters are large-scale, both for society and the environment. Managing this natural risk is

key to reducing risk, limiting consequences and increasing society's resilience to disasters (Nikolić et al, 2020).

With the advent of the modern age, the sudden onset of natural disasters has been greatly reduced because various highly effective technologies can be used to predict some of the risks. By forecasting, we can prepare quite well for the risks caused by meteorological events, while a large part of natural risks is still unpredictable. By anticipating meteorological events, we prepare people, techniques, and tactics of action, but we cannot stop such events, we can only predict them. Precisely because of the unpredictability of natural disasters, we consider this risk to be one of the most dangerous and significant for human and animal lives.

We cannot say that every natural disaster is a catastrophe. A catastrophe is only when the disaster results in a negative effect on people, animals and property. Every threat, earthquake, fire, flood, which is an activating event with great damage and vulnerability, leads to disaster, and it then ultimately causes great losses in human and animal life and property (Nikolić, 2020). For example, a flood in an uninhabited area, without agricultural goods, cannot be considered a catastrophe regardless of the intensity because, as such, it does not directly endanger people, animals and property and the damage is very small or non-existent.

The dangers offered by nature become catastrophic if people, who are sensitive to their danger, are exposed to their influence. Natural disasters can be divided into geophysical, meteorological, hydrological, biological and extraterrestrial, and we can classify them according to the place and source and speed of action (Edward, 2005; Tobin and Montz, 2007; Mladjan and Cvetkovic, 2013; Nikolic et al, 2020).

Ultimately, the consequences of natural disasters are very detrimental to humans, animals, natural resources and infrastructure (Shaluf, 2007), which poses a great need for a serious approach to research and study of natural disaster risks. By studying and researching, we find ways and opportunities for more effective protection, security and resilience of people and property in possible situations (Nikolić and Anđelković, 2018).

Risk management can be divided into three key phases (Nikolić and Anđelković, 2018; Nikolić and Živković, 2010) which include preventive and operational action. The first phase is the phase before the natural disaster, preventive action. At this stage, activities are undertaken aimed at reducing potential material and human losses in the event of a natural disaster. Plans are being made within the framework of dealing with the occurrence of risks, an early warning campaign is being implemented for the society, so that concrete actions in this phase are called mitigation and preparedness measures. Unlike the first phase, the second phase is carried out during the natural disaster. We can freely say that the second phase is the operational action or intervention of all emergency services during the disaster. All actions for the purpose of protection and rescue of people, animals and property are understood. Activities at this stage are called immediate and prompt disaster response measures. Furthermore, the third phase follows, which is also the operational operation of the services, which is the phase that is carried out immediately after the natural disaster or natural disaster. The third phase rehabilitates the damage caused by the catastrophe, the consequences of a natural disaster are remedied and eliminated. Activities in the third phase of risk management are called measures of rapid response and recovery from natural disasters.

Summarizing all three phases, the modes of action can be divided into preventive and operational. We act preventively by anticipating, preparing, creating various barriers, learning, knowledge, studying and teaching the population about the dangers that follow them. When a natural disaster occurs, and after the end of the disaster, it acts operationally.

The forces trained to work in natural disasters are operational, namely the emergency services of the Republic of Croatia. One of the leading emergency services in the Republic of Croatia, in the operation of natural disasters, are firefighters. Firefighters, due to the structure and mode of operation (24/7/365), they are the only emergency service in the Republic of Croatia that has such a fast-operational ability to go out on the field within a few minutes, together with the necessary equipment and manpower and respond to the situation in the form of rescue operations, animals and property. Fire brigades, both professional and largely voluntary, have largely given an operational injection to all citizens of the Republic of Croatia affected by natural disasters in the recent and distant past. We are aware of the fact that the Republic of Croatia is continuously affected on an annual basis by major natural disasters in the form of floods and open fires, and in 2020, the Republic of Croatia was affected by devastating earthquakes in Zagreb and Banovina. All three disasters are an integral part of natural disasters because they directly endanger people (Šimić 2019).

#### **4 Prevalence of Fire Interventions After the Earthquakes in Zagreb And Banovina in 2020**

On March 22, 2020, at 06:24, the people of Zagreb were hit by a strong earthquake with a magnitude of 5.5 on the Richter scale. After the main impact, about half an hour later, at 07:01, another earthquake measuring 5.0 on the Richter scale followed. In just over 24 hours since the first earthquake in the city of Zagreb, according to the Seismological Service and the Euro-Mediterranean Seismological Center, 57 earthquakes were recorded, among which the strongest was 5.5 magnitude on the Richter scale and the weakest 2.0 on the same scale (Humski et al, 2021).

Thanks to the organization of the fire service and the firefighters themselves, the firefighters were on the field within the legal deadline of 60 seconds. The quake also caused a series of fires in the city, which were reported to the fire service, and a prompt reaction prevented their spread. In disasters of this magnitude, not a small number of reports from citizens arrive at the operational centers. All calls and alerts should be better considered and filtered and priority sites for intervention identified. When determining priority interventions, interventions in which human lives are endangered, interventions that threaten human lives and the like are considered (Popović et al, 2006).

Firefighting, as a multidisciplinary activity, is obliged to respond to all interventions caused by this disaster. Due to the volume of work, the number of endangered people and the number of reports, fire commanders, in coordination with the Chief Fire Chief, are seeking the help of personnel and equipment from wider parts of Croatia. Such aids to firefighters are called dislocations. After the earthquake in Zagreb, the assistance of the fire brigade of public fire brigades possessing rescue vehicles from a height (hydraulic pull-out ladders and hydraulic articulated platforms) was requested in order to approach the intervention faster and more efficiently.

Immediately after the emergency rescue of people and property affected by the earthquake, firefighters continue to work in the rehabilitation of the area affected by the earthquake. Remediation includes various actions such as removing facades that are threatening to fall, cracked chimneys, the remains of buildings, clearing buried parts of the streets and so on.

According to available data, around the City of Zagreb in the period from March 23, 2020. until 11.05.2020, firefighters performed a total of 3607 technical interventions. After 11.05.2020. followed by the intervention of firefighters in the area affected by the earthquake, but with less intensity and fewer interventions carried out daily (data generated based on the Fire Operations Center report, 2020).

Based on the total number of interventions, on an annual basis, and considering the average of 9 years (2010-2018), in the City of Zagreb firefighters annually perform a total of about 3580 interventions of

all kinds, including fire interventions (data generated from the minutes 129 - 149th session of the Assembly of the Croatian Fire Brigade, 2005 - 2019).

Analyzing the annual average of interventions, we concluded that in the period of 50 days more technical interventions were performed than the annual average of total interventions in the City of Zagreb, so that during this natural disaster, the number of interventions increased by 636 percent. Interventions to rehabilitate the earthquake-affected area have not yet been concluded and continue to extend into 2021.

On 29.12.2020. at 12:19, a magnitude 6.2 earthquake with an epicenter 5 km southwest of Petrinja. This quake was preceded by two quakes, the day before, of magnitude 5.2 and 5.0 on the Richter scale. Given the strength and location of the earthquake, the earthquake was felt in most parts of Croatia, parts of Germany, Austria, the Czech Republic, Romania, Slovenia, Hungary and a number of countries closer to us (Ros Kozarić, 2021).

New damages have occurred in the already destroyed area of the City of Zagreb, and thus a new series of fire interventions. The area of Sisak-Moslavina County has been hit on a large scale. The first, as in Zagreb, on December 28, 2021, firefighters from the area of Cities and Municipalities come to the field and colleagues from the whole county come to the rescue. Due to the new, more devastating earthquake on December 29, 2021, based on the order of the Chief Fire Commander, additional firefighting forces from the Republic of Croatia were raised, and humanitarian aid in the form of firefighting vehicles, equipment and techniques was sent by neighboring countries.

In the area of Sisak-Moslavina County in the period from 28.12.2020. to 28.01.2021. a total of 11,727 interventions were carried out, in which 10,378 firefighters and 2,748 firefighting vehicles participated cumulatively. The number of interventions over a period of 32 days largely proves the devastation of the earthquakes that occurred in the area. As time went on, the intensity of the intervention, daily, decreased, so that the firefighters carried out another 1101 interventions in the next 38 days (Croatian Fire Brigade, 2020 – 2021).

In conclusion, in a period of 69 days (28. 12.2020. to 06.03.2021.) firefighters, in the Sisak-Moslavina County, performed a total of 12828 interventions in which cumulatively participated 12033 firefighters with 3384 vehicles. In the future, the dislocations of firefighters are continuously reduced, and the number of interventions is summarized on a daily basis and primary and emergency interventions are performed (data generated based on the report of the fire operations center, 2020,2021). According to the average of 9 years (2010 - 2018), firefighters in Sisak-Moslavina County annually perform a total of about 1500 all types of interventions, including fire, technical and other interventions (data generated based on minutes 135 - 143rd Assembly of the Croatian Fire Brigade, 2011 - 2019).

With the onset of the devastating earthquake, we record a huge and historical increase in the number of interventions by about 4435 percent of the total number of interventions. Extreme increase in interventions has greatly affected the psychophysical condition of firefighters, fire brigades, but also the correctness of firefighting techniques. An increase in the number of interventions of this scale has not been recorded in the history of Croatia, and with the occurrence of major disasters there is a possibility of more frequent occurrences, which both firefighters and fire brigades and civil society must be prepared for (Croatian Fire Brigade, 2020 – 2021).

## **5 Conclusion**

Firefighting as a multidisciplinary activity provides great operational support to all residents, both in the world and in the Republic of Croatia.

In the event of natural disasters, firefighters are the only emergency service that can respond promptly and be on the ground in just a few minutes, at the service of unfortunate citizens. With the modernization



of society, the movement of the world forward, firefighting is counting more and more technical interventions.

For quality and efficient performance of technical interventions, continuous training of firefighters is required, as well as the purchase of additional equipment that greatly helps firefighters in performing their tasks.

Training of firefighters is being carried out in the Republic of Croatia, but for now, the number of trained firefighters to respond to a disaster of this magnitude is very small. It is necessary to organize more training, and training members of fire brigades to make the immediate response to such disasters even higher and more acceptable. By continuous education and training of members, the risk of injuries is reduced to a minimum, firefighters are informed about possible dangers and the skills of performing such types of interventions are developed. All firefighters-rescuers need psychological help, both before the intervention and after the intervention in order to avoid stress, which is ubiquitous and dangerous for the long-term health of the firefighter. An earthquake as a great natural disaster has a very great power to destroy the affected area (Gorički, 2014).

Earthquakes in Zagreb, and later in the Banovina, are classified as the most devastating earthquakes in the Republic of Croatia in the last 100 years. Many people were left without their homes, their property, and human lives were lost. With the earthquake, there was a huge overall increase in the number of firefighting interventions in Zagreb by 636 percent, while Sisak-Moslavina County recorded an increase of 4435 percent of the total number of interventions annually. The scale of this natural disaster in the Republic of Croatia is historical, and as Croatia is in a seismically active area, a recurrence of such a catastrophe is certainly possible. The earthquakes in Zagreb and Banovina were a great physical and mental burden for firefighters, as evidenced by the number of interventions (Croatian Fire Brigade, 2020 – 2021).

Despite the burden, lack of equipment, low level of education, fire brigades never gave up in their work, and showed great readiness and organization in the deployment of firefighters from all over the Republic of Croatia.

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