

COMPLEXITY OF THE FIREFIGHTERS' WORK IN CRISIS SITUATIONS, FROM THE EFFECTIVENESS OF FIRE PREVENTION TO THE SAFETY OF FIREFIGHTERS

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ABSTRACT

An important element of the activities of firefighters is that they cannot or only to a very limited extent can modify the terms of the task. Despite the differences of environment, indications of the *complexity* of the situation, the possibility of the *radical change or volatility* in the given situation, *uncertainty* and *ambiguity* of the information available can be recognized and well identified. Therefore to reduce the risk of the environment and help firefighters' work during intervention is very important and complex task. It has more components such as the effectiveness of the fire prevention, the quality of the operational work, the level of firefighter's safety and the quickness of making decision. Authors give an overview of the complexity of the situation firefighters work in emergency, stated it on three components: fire prevention, safety intervention and special decision making.

Key words:

fire, firefighting, fire prevention, safety intervention, decision making in emergency.

ABSTRAKT

Dôležitou úlohou súvisiacou s činnosťou hasičských zborov je znižovanie rizika na danom území a tak predchádzať výjazdom hasičov. Znižovanie rizika sa skladá z viacerých činností, ako napríklad efektívnosť požiarnej prevencie, kvalita operačnej práce, úroveň bezpečnosti hasičov a rýchlosť rozhodovania. Autori poskytujú náhľad do zložitosti situácie, v ktorej pracujú hasiči v núdzových podmienkach, poukazujú na tri zložky: prevencia požiarov, bezpečnostné zásahy a špecifické spôsoby rozhodovania.

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Kľúčové slová:

Požiar, hasičstvo, prevencia požiarov, bezpečnostný zásah, rozhodovanie v krízových situáciách

1 ENSURING FIRE SAFETY IN BUILDINGS

When designing buildings, one of the main factors to consider is guaranteeing safety. One of its main elements is the proper level of fire safety. A basic requirement in case of fire is that the stability of the structure ensures escape, the possibility of fire fighter intervention for a required but limited period. In addition, it endangers other buildings, properties to the least extent possible. This fire safety conformity can be achieved by complying with more related requirement systems, which can be defined in the following way:

Requirements on building placement

When considering building placement, it is not the only requirement that potential fire spread does not endanger neighbouring buildings. We must also take into account that the intervention crews must be provided with quick and unhindered access to the building and engines need to be able to work effectively. Moreover, there should be enough places outside for the occupants in the surroundings.

Requirements on the structure and building materials

Building structures have to maintain their load-carrying capacity, features disabling fire spread for the specified or planned time span. Structures, materials serving fire safety need to react to fire properly and to fulfill their function for the required time period. When all the requirement systems are met, we expect that the spread of fire and its accompanying phenomena can be controlled or stopped inside the building and outside on the facade. This allows time for the occupants to escape and for the fire fighters to rescue occupants and to start the intervention.

Evacuation and rescue

When designing buildings, we need to consider the requirements on informing and alarming the occupants in case of fire and – primarily – the provision of escape routes. The escape and rescue of disabled people and people with impaired mobility need to be provided in accessible buildings, too, which poses a challenge for the architects. These requirements can be met by an adequate internal structure, suitable routes, stairways and the installation of fire service elevators if needed. Proper technical standard demands efficient smoke and heat venting systems, emergency lighting and fire detector and sprinkler systems if necessary.

Creating the conditions of fire service interventions

It involves requirements which grant that the fire service can start rescue and firefighting without delay and they can safely complete rescue. The necessity of effective firefighting – saving property – is questionable, but for the time being, it can be considered a demand. When creating the conditions of fire service interventions, we need to pay attention to fire alarm and its quick, adequate report. Entry to the building, the proper supply of extinguisher and its fast and effective use must be ensured besides

shutting down the power to save the lives of firefighters. Quick and safe movement is also essential for those involved in rescue, so emergency lighting is indispensable to the intervention crew without knowledge of the building. Last but not least, factors affecting radio systems must be looked at. Of course, we decide on the necessity of fire safety systems and their parameters on the basis of these basic requirements.

If we paid attention to these principles and took the necessary steps, then we can state that our building meets the current requirements. Fulfilling these requirements entails high costs – fire safety does not come cheap – so it is of utmost importance that the intervention crew takes advantage of the fire safety features of the building for the sake of effective intervention. For this purpose they need to be aware of the possible uses of modern fire safety systems, trust them, but must not forget about their limitations either.

For the safety of the intervention crew, we need to know that buildings do not withstand fire forever, so we only have limited time to complete rescue and extinguish fire. When dealing with prolonged fire with great thermal load, the limitations of the building must be considered so that the intervention team can be withdrawn in time. We apply heat and smoke venting systems in vain in the escape routes, if the amount of smoke flowing into the corridor from the fire origin surpasses the limitations of the venting systems. It does not mean that the system is not adequate or that they are outdated, but rather that all systems have their limitations. These limitations must be chosen with great care so that they make the intervention crew feel safe, yet the costs are reasonable.

Using built-in fire safety systems are necessary for both rescue and intervention. Without due knowledge and information about the building, it is not possible. New alarm systems supporting interventions can give much help in it by providing information about fire safety parameters of the building after the alarm. The locations of interventions, the internal structure of the building, escape routes; built-in fire safety systems and further important issues can be recorded. Graphic applications may make it more visual. However, the above mentioned limitations must also be recorded in the information system to make it easier to plan the intervention and reduce the level of risk.

2 HAZARD REDUCTION OF FIRE INTERVENTIONS

Labour safety, namely protecting the life and health of those who do their jobs is an elemental task in all parts of life. [1] We should be specially careful with the scope of activities where workers have to do hard and dangerous labour work. Danger and risk is raised if they have to work in unexpected circumstances, unknown contingencies, specially when this task is obligatory. Firemen who are on standby service work in these circumstances irrespectively of doing service in an establishment, as a voluntary or as a professional. The risks of fire and damage do not select among the positions. The protection of life and health of interloper fire brigade should be supplied as high as possible by the fire brigade organizations or supporter.

The Hungarian rescue fire protection is ensured by career and volunteer (public body) fire departments which are appropriately situated (dislocated). Approximately

2000 people carry out primary intervention tasks on different employment contracts as career, members of a public body or on-site firefighters. Career firefighters must leave barracks within 120 seconds following an alert and head to the indicated site of fire event or disaster. The volunteer and on-site firemen tackle equally dangerous fire and harmful events, although they follow a different alert routine and are on dissimilar work contracts. All firemen are equally at risk from emerging hazards while on firefighting duty in closed areas. The basic protective equipment is the same; the career personnel are in a better situation with regards to training and practice. The followings are the obligatory equipment for protection for firemen:

- coveralls,
- helmet for protection (with mask and neck cover),
- cowl against heat,
- boots for protection,
- gauntlets,
- belt for climbing,
- mask for breathing.

Firemen extinguishing fires and doing technical rescue work face dangers from many directions compared to an open area and the works of these firemen are made more difficult by many circumstances. For example, these dangers present are great heat load, decreased visibility, unknown materials and structures, limited possibilities for transportation, escape, and ventilation and respirator deployment. Wearing personal firefighter safety equipment generates such further loads for those wearing them like significant weight burden, heat load, limited visibility and perception, communication difficulties, risk of getting pinched or tripped. This is coupled by the stress resulting from the awareness of hazards and the dangerous nature of tasks.

The fire extinguishing and technical rescue operation tendencies have turned around years ago, therefore, today rather the technical rescue missions are predominant, a large percentage of which involve intervention at road accident sites. The most dangerous events are fires and there are over ten thousand fire event interventions on an annual basis.

Out of the five most serious, fatal casualties, four were due to smoke poisoning and one other was choking following panic and disorientation. Most common causes of firefighter injuries listed by order of frequency: falling over, bumping, falling down, stabbing/cutting, material slips and slides, structural collapses as well as getting burned and hit by explosions.

The most common injuries suffered in buildings, closed areas these circumstances are: diving down, getting burned, smoke poisoning, lacerations/stabs, structural collapses, electroshock, movement injuries (sprains, fractures) and different unexpected incidents such as getting attacked by people.

There are three areas where the safety of firefighters could be improved. First, we should find the more modern versions of personal protective gears, equipment and standardize them once they have been tested by firefighter squads. Improvement of passive and active visibility, more sophisticated and multifunctional respirators, general purpose heat cameras or respirators enabling long mission time which are

reservable for rescue missions can be mentioned in this regard. The different telemetric systems are used especially to reduce risks since the surveillance, supervision and advising of entering firefighters. There are some very promising developments in this field and soon it will be possible to follow movements of persons within buildings. Second, we should train firefighters in trainings as realistic as possible. Third, hazard reduction can be achieved by adopting such new equipment as have not yet been standardized by Hungarian disaster management, however, either the given circumstances can be made safer or direct personnel involvement can be reduced through their use. Author recommend here attacking the fire trough the outer wall, using overpressure ventilation and deploying remote-controlled fire extinguishing or rescue devices. The more wide spread national standardization of different types of special support poles, glass-securing foils or recording or video footage of certain operations are worth mentioning here.

In author's research it was developed a training and in-service training method following the research series for firefighters by which their performance can be equally measured and their development can be compared so that more conclusions could be drawn. Author conducted research in order to prove that the by providing continuous training on interior operation there is improvement in the oxygen use, task completion, pulse rate change for the entire emergency standby troop. Author has proven that the results can be further improved with regular, scheduled practice, as this way was used years ago also by other similar areas [2]. Author proposes the consideration for standardization and implementation of the firefighter equipment for example exterior firefighting tools, remote controlled robots, telemetric systems, heat cameras, etc.

3. SPECIAL METHOD OF DECISION MAKING USED BY FIRE MANAGERS AT TACTICAL LEVEL

Firefighters can face to special or emergency situation without any pre-sign and even if it has forecast they can meet the requirements of improvisation making their decision. Improvisation can be taken at any level of the management (strategic, operational and tactical) but at tactical level the time press is certainly the biggest problem.

An important element of the activities of fire managers is that they cannot or only to a very limited extent can modify the terms of the task, improve them as desired. Despite the differences of environment, indications of the *complexity* of the situation, the possibility of the *radical change* in the given situation, *uncertainty* and *ambiguity* of the information available can be recognized and well identified. Most of these factors are present; occasionally all of them may be present at a certain level of emergency decisions: including the strategic, operational and tactical levels, but certainly with a different focus or at different times. On strategic and operational level, in general, not only more time is available, but also human and technical resources are at hand more broadly, and decision support instruments as well to reduce uncertainties occurring.

As an example, the extinction of fire in a smaller dwelling house requires the implementation of a completely different, simpler scope of tasks than to control fire in a mid-high building. In other case, during technical rescue of a traffic accident fire commander can have time just below a second to decide of using special tools but the high ranked chief can have much more time to organize resources at a big forest fire.

The different scopes of tasks exist in different environments and structures, so the solution of similar basic problem also exists in other dimensions. The most limiting factor from the above is *time*. This provides a framework impossible to burst and a forced drift, a *pressurized channel* for the fire managers, entangled in which one can no longer break free. It is important and necessary to involve not just to practical but also theoretical trainings [3].

The above proves that, in certain situations, the multi-criteria, analyzing, evaluating decision-making simply cannot be used or in a limited manner. However, it can be seen that managers, directors or commanders are many times in situations that they simply *cannot elude from their decisions*; they should make them in a short time. The functional background of decisions made in a short time, their mechanism different from the conventional was studied in latest time, and gave the name *recognition-primed decision* to this special decision procedure [4].

4. CONCLUSIONS

Summarizing the above that is fact, managing fire is very difficult and complex task. Even if all people want to stop fire immediately after its start, the quick and safety responses begins not with starting the intervention but following the rules of fire prevention. It ensures the appropriate circumstances of the quick and effective responses even if the necessity of reducing risk is always in priority. Experiments say the environment can be very difficult during the action, and because of the time press traditional decision making can't be effective method in many cases. Therefore, fire managers use different decision making method, called recognition primed decision.

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Článok recenzovali dvaja nezávislí recenzenti.