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Disaster management from the viewpoint of fire protection in Hungary. From the effectiveness of fire prevention to the safety of firefighters: Complexity of the firefighters' work in crisis situations

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Abstract. There are different aspects of disaster management however in a limited scale accidents are usually responded immediately by firefighters even if the event can escalate to disaster in time. Firefighters can barely influence the initial conditions of the interventions. The differences in the environment and complexity result in volatility, uncertainty and ambiguity of information available. Thus, the effectiveness and safety of the intervention is a vital task, which can be achieved by improving the components such as the fire prevention, the quality of the operational work, the level of firefighter's safety and the quickness of making decision. The present paper concluding that fire prevention means strategic level achievement, quickness of making decision, and tactical level of managing crisis situation. Authors give an overview of the complexity of the situations of the firefighters work in emergency from the level of strategy to tactics.
Key Words: fire, firefighting, fire prevention, safety intervention, decision making in emergency.

Introduction. In order to avoid large scale fire disaster a lot of factors must be taken into account in regards of general safety, for example the building's fire protection, whose main element is defining the criteria of the firefighters' intervention. The risks and danger sources must be assessed properly in order to moderate or completely eliminate them while the costs cannot be ignored either. The risks and their physical parameters are essential data of the planning, and their incorrect definition can trigger disastrous consequences. The correct assessment results are based on assumptions, occurrence probabilities and the danger levels which frequently lack any empiric elements. These assumptions must be in accordance with the number of people in the building and the size of the problem resulting from the external spread of the event. As we plan for the less likely events with bigger impact, so will the building's planning and construction costs increase. It is a delicate balance and it is very hard to draw the line where the safety can be determined adequate. Yet the costs are still acceptable.

Ensuring fire safety in (multi-level, high) 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 possible extent. 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 neighboring 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 pose 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 (Miskey 2013). For this purpose they need to be aware of the possible uses of modern fire safety systems, trust then, 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.

Hazard reduction of fire interventions. Labor safety, namely protecting the life and health of those who do their jobs is an elemental task in all parts of life (Bleszity & Zelenak 1989). We should be especially careful with the scope of activities where workers have to do hard and dangerous labor work. Danger and risk is raised if they have to work in unexpected circumstances, unknown contingencies, especially when this task is mandatory. 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 perform 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 are: 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 can be deployed in rescue missions can be mentioned in this regard. The different telemetric systems are

used especially to reduce risks since the surveillance, supervision and advising, 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. Authors conducted the present 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. Authors have proven that the results can be further improved with regular, scheduled practice, as this way was used years ago also by other similar areas (Bleszity & Grosz 2012). Authors propose the consideration for standardization and implementation of the firefighter equipment for example exterior firefighting tools, remote controlled robots, telemetric systems, heat cameras, etc.

Special method of decision making used by fire managers in case of 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 pressing 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. The differences in the environment and complexity result in volatility, uncertainty and ambiguity of information available. 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 the occurring uncertainties.

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 practical but also theoretical trainings (Grosz 2009).

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 (Klein 1999). Even if not in all cases but many times fire managers make this special decision method to avoid large scale disaster.

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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What was the name of the 1973 report of the National Commission on Fire Prevention and Control? America Burning. What federal agency operated the Building and Fire Research Laboratory?Â Residences are normally exempt from routine inspection, not exempt from the code. What action is generally required by the fire official before attempting to secure an inspection warrant? Why the occupancy was selected for inspection to start with.Â In the 1978 study published under the title Fire Code Inspections and Fire Prevention: What Methods Lead to Success?, what percentage was caused by carelessness, foolish actions or electrical or mechanical failures? 40-60%. the closer the flames are to the structure, the greater the chance of ignition. A second way a structure may start on fire is through conduction. Conduction is caused by direct contact between the flame and the structure. Firebrands, which are small pieces of burning material often carried by wind, can start new fires, and are a common form of conduction.Â Convection is caused by the superheated air that rises from the fires and preheats the fuels above it. Convection is most often associated with steep slopes and the Â«Chimney EffectÂ». The best way to minimize loss due to convective heating include: â€" build all structures back away from steep slopes.Â The purpose of the video is to show lifesaving effectiveness of fire sprinklers. The National Fire Protection Association NFPA (U.S. organization charged with creating and maintaining minimum standards and requirements for fire prevention and suppression activities, training, and equipment, as well as other life-safety codes and standards) standards and local building fire codes set the standards for application and design of fire protection. The types of measures can be broken down as follows: Life safety. Passive fire protection.