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# Fire, Rescue, Disaster Management. Experiences from Different Countries[1]

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*On international level we can find various methods in the field of fire and disaster management interventions. Individual nations are trying to manage the activities related to firefighting, technical rescue, and, in some cases, healthcare on the basis of international trends but individually and at the highest quality possible.*
*In this article, the author intends to present some syntheses of information that have already been published about the differences and some good practices of rescue organisations applying common, basically similar tools by taking an international outlook and studying various countries—including Hungary. The target countries are in Europe: Poland, Germany, the United Kingdom and Italy.*
**Keywords:** *fire, rescue, disaster management, experience, international*

## Introduction

In order to be able to make an accurate evaluation of national organisations, disaster management and firefighting forces carrying out primary response as well as their effectiveness and development potential from the viewpoint of fire protection operations responsible for the protection of the lives and properties of the population, it is necessary to take a look at similar activities of other nations. [1]

To start with, it is important to point out the fact that the protection and rescue of a citizen or a person passing through the country, the need to intervene in a fire or a road accident are based on almost the same grounds all over the world. The differences can be spotted in the national development potentials, the adaptation of international best practices, in minor variations, mind sets and traditions. In order to discover all these development potentials and best practices and to examine their adaptability, the author has launched a research at the National University of Public Service, Budapest, Hungary under the Zrínyi Miklós Habilitation Program. With the help of the findings gained through research, this paper describes and compares fire protection activities—providing the basis of the research—at national and international level. Some of the results of my research in this field have already been published before in Hungarian. The already finished synthesis will be published in this paper on an international level.

International outlooks require a correct analysis of the data, not just a dry review of the figures but also considering the differences in fire-, technical rescue- and disaster management-related risks. [2] Firstly, the current environment in Hungary is described along with organisational, technical and procedural characteristics responsible

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for protection, which is followed by a description of circumstances and activities in other countries—relevant to the research. These countries are the United Kingdom, Germany and Italy. The description of individual countries may include smaller details of professional interest, though of seemingly less scientific importance. The purpose of this paper is also to disseminate knowledge among those interested.

In this paper, the international outlook will also pay due attention to the difference that in several countries around the world fire service and disaster management provides, ambulance service, as well. Best practices and solutions which can be considered for adaptation are presented in the conclusion, at the end of the paper.

## Hungary and its Fire Protection Operations

Hungary's territory is 93,030 square kilometres; its population is 9,877,365 (based on 2014 data) and it has the 58$^{th}$ largest economy in the world (based on 2015 GDP[3] figures). In Hungary, fire protection operations are primarily a public task. [3] The professional disaster management organisation, or in a short and a more comprehensive interpretation of the activities, disaster management is responsible for the related activities such as primary response, firefighting, technical rescue and disaster response.

The professional disaster management organization is divided into national (National Directorate General for Disaster Management—NDGDM), regional (county disaster management directorates, the Disaster Management Training Centre and NDGDM Economic Supply Centre) and local organisational levels (disaster management branch offices, professional fire brigade headquarters and their posts). The total number of the professional staff is 11,451 (1 July 2016), out of which this paper can take into account approximately 8,000–8,500 professional firefighters directly involved in fire operations. [4]

The interventions at the operational level are primarily performed by professional fire brigade headquarters (conventional and special fire engines with staff on duty) and some organizational elements of county disaster management directorates (county operations control, mobile laboratory and operations management service).

The intervention activities of the professional disaster management organisation are assisted by additional fire brigades of different legal statuses. They include municipal, industrial and volunteer fire brigades with similar equipment. [5]

[3] Gross Domestic Product, an economic indicator.


Picture 1. *Joint training of the disaster management, fire, ambulance and prison guard services in Hungary, 2015.* [Author's own photo.]

It should be noted that the country has two urban search and rescue (USAR) organizations. They are the heavy-category, professional HUNOR and the medium-category HUSZÁR consisting of typically volunteer members.

The total number of deployments of professional firefighters, municipal and industrial fire brigades as well as volunteer firefighters' associations between 2011 and 2015. (Table 1.)

Table 1. *The total number of deployments of professional firefighters.* [4]

| Period (year) | Number of deployments (pcs) |
|---|---|
| 2011 | 69,828 |
| 2012 | 69,392 |
| 2013 | 55,444 |
| 2014 | 57,264 |
| 2015 | 59,860 |

Given that the international outlook in this paper is basically intended to highlight differences from Hungary, it assumes a minimal knowledge of this system, therefore the Hungarian aspect will not be explained in more details.

## Poland: Training Possibilities for Fire Protection Operations

In Poland the fire protection higher education centre is in Warsaw. It is called the Main School of Fire Service[4] which is also the central fire protection university in Poland. The author has already visited a lot of fire departments, training centres all over Europe and outside the European Union, as well. In Poland there are some good practices in the area of training firefighters and future fire officers.

Two ways can be interesting to mention, the first is the practical way. The Main School of Fire Service has a central education building complex in the heart of Warsaw. For special practical trainings, they have a training ground in Zamczysko with real fire circumstances.

Picture 2. (left) and 3. (right) *Containers of fire equipment in Zamczysko ready for drills and a fire chamber belonging to the network of containers for real fire trainings, 2015.* [Author's own photo.]

This training ground is in a forest, far from the capital and other cities. During the first period of the education, the students of the university live here for months in order to socialize them for the fire service and support them with a wide range of fire skills.

Picture 4. (left) and 5. (right) *Roof training scene to get movement and cutting skills and targets to get fire hose control skills 2015.* [Author's own photo.]

[4] In Polish: Szkoła Główna Służby Pożarniczej.

The second way can also serve as a good practice in the issue of training fire officers which was initiated in 2017 by decision makers in Warsaw, at the Main School of Fire Service.

The best way to make freely modified circumstances realistic is using computer technology. Situations can be displayed on a big screen like in a computer game. The fire officers (incident commanders) during the training are doing their normal tasks by radio and the impact of their decisions can be immediately seen on the screen by the operator.

Picture 6. (left) and 7. (right) *The decision maker training room with the operator and his workplace, in the background there is the place of the trained incident commander, 2015.* [Author's own photo.]

The operator due to the drill tasks can change the place of the incident (e.g. city, motorway, forest), the weather (summer, winter, snow, fog) and also the time (be it day or night). The displayed moving of the firefighters and engines are like in real life, with real speed.

The using costs of the incident commander simulation room is very low and there can be built any kind of accidents or disasters. Several kinds of intervention team leaders can be trained here not only fire service officers; it can also be used by the police and ambulance.

## The United Kingdom and its Fire Protection Operations

The United Kingdom has a total area of 244,820 square kilometres, with a population of 65,102,385 (based on 2016 data) and it has the world's 5$^{th}$ largest economy (2015 GDP figures). [6] The total number of deployments of firefighters between 2011 and 2015. (Table 2.)

Table 2. *The total number of deployments of professional firefighters.* [7]

| Period (year) | Number of deployments (pcs) |
|---|---|
| 2011 | 288,000 |
| 2012 | 272,800 |
| 2013 | 192,700 |
| 2014 | 212,500 |
| 2015 | 191,647 |

Organisations in charge of fire protection operations (Fire and Rescue Service) operate under different regulations and foundations in Scotland, Wales, Northern Ireland, and England. The concept of a volunteer fire service is different from the one used by us, it rather refers to part-time firemen, who are paid in proportion to the time spent on job, as it is also shown in their name. There are more than fifty professional fire brigade organizations in the country, and the equipment and activities of fire engines are similar to those in Hungary.

In order to find various operational issues and good practices available, personal consultations were carried out with a variety of firefighters. From the professional conversations, the following—occasionally uncategorised—knowledge can help you get to know the UK firefighter intervention area.

For a variety of reasons, the number of people in the fire brigade responsible for Liverpool and its vicinity has decreased. The fact that the number of the staff fell to less than its half over the past twenty years is likely to aim for a more effective organisation and a higher-quality fire protection, although we cannot ignore possible demands from the supervisor to reduce expenses. The high workload, the tight responsibilities (in addition to the intervention activities) could be clearly observed during the research. Schedules typically consist of four shifts of twelve hours, but in some cases, we can find different examples. In London, day shifts last nine hours, while night shifts last fifteen hours, with changes at 9 a.m. and 6 p.m.

As regards the technical conditions of the interventions, the masks of the respirators are cleaned and maintained by the firefighters using them. During the change of shift, common, complete tests are carried out on all devices kept on standby on the fire engines along with the telemetry.[5]

The training and further training of firefighters is clearly separated into five key areas, which need to be repeated every two years. These are road interventions, alpine techniques, working at height, use of breathing apparatus and smoke chamber, water interventions as well as dangerous substances. The alpine techniques training is provided to all firefighters even at basic training, with standard equipment available on all fire engines. It is important to note that the harness straps are also available on fire engines.

Basic health care training is also part of the various training courses. However, some reluctance can be observed among firefighters (in several countries) to provide (occasionally obligatory) health care assistance, which is basically emergency service, given the differences in the attitudes of the two fields and that their basic activities themselves (firefighting, technical rescue) are physically very demanding and less sterile (smoke, soot, oil, dirt).

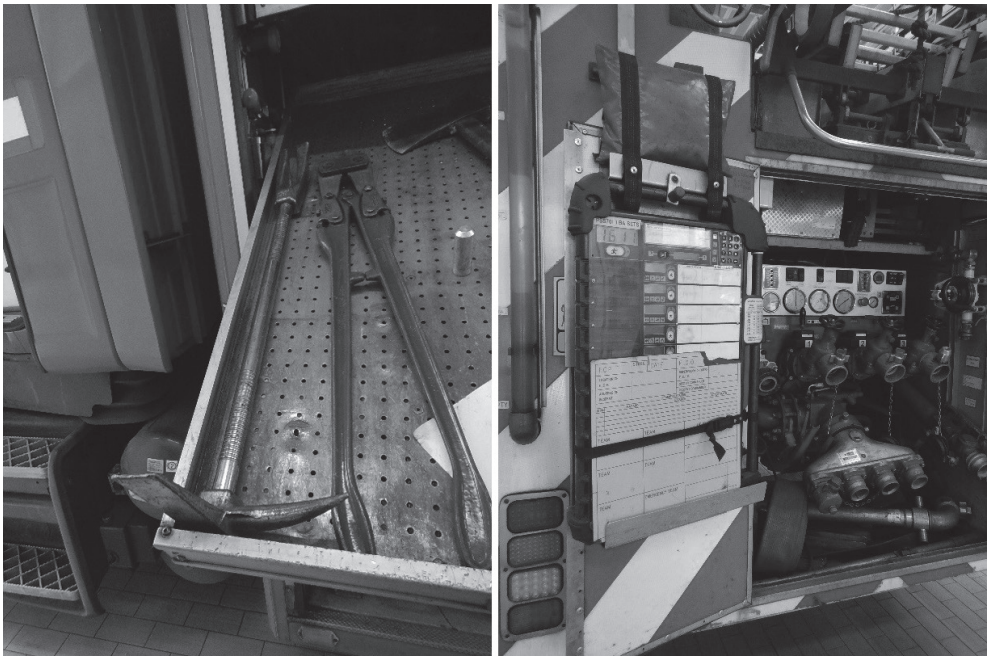
As regards handheld devices used in interventions, it can be said that modern technology can often help the work in certain fields, but in some cases simple and effective solutions turn out to be the best ones. Special forcible entry tools (hooligan tools) are standardised equipment on certain fire engines. It is similar to the force bale standardised in Hungary, perhaps with fewer functions, but with higher efficiency in its main activities (e.g. opening doors and windows). To make interventions quick and easy British firefighters are also assisted by manual window cutting saws. Still about simple, quick and low-cost equipment, one

[5] A radio communication-based remote monitoring system, whose purpose is to monitor the safety of the firefighters, more precisely, their air consumption, volume, expected operation time and other safety factors.

standardised on all fire engines and listed in all intervention regulations is the highly durable, colour-coded protection film (manufactured by Packexe). Attached to the windscreens of vehicles or any other glass surfaces and then cut around, the glass surface can be safely removed and the sharp edges of cut metal surfaces can be made safe. Quick technical rescue and entrance is also supported by electric, battery-operated angle grinders, hand saws and mobile lighting systems, all standardly available on fire engines. Hoses are coupled together in a way other than the Storz standard widely used in Europe, but no significant difference in efficiency can be detected.

Picture 8. (left) and 9. (right) *Electronic spreader-cutters and highly durable, colour-coded protection Packexe film in a fire engine in Liverpool, United Kingdom, 2017.* [Author's own photos.]

In addition to the conventional hydraulic spreader-cutters, new electronic innovations have been introduced in recent years by manufacturers. At the 2011 Interschutz International Exhibition for Rescue, Fire Fighting, Fire Prevention, Disaster Relief and Security, only one out of ten rescue sets were electronic, but by now the rate has reversed and there are much fewer ones with traditional, combustion engines. Despite some of its disadvantages (for example, limited battery life, slightly larger weight), there are significant advantages when it comes to their practically unlimited mobility and their freedom from hoses. British firefighters have accumulated many years of experience in the daily use of electronic rescue sets, which are considered to be rather useful. According to the information gathered during consultations, the devices worked properly practically in every situation and they offer about twenty minutes of battery operation time (continuous operation). With the additional batteries stored on the fire engines and the built-in chargers, a near-continuous operation can be guaranteed.



Picture 10. (left) and 11. (right) *Halligan bar and Draeger Merlin telemetry system in a fire engine in Liverpool, United Kingdom, 2017.* [Author's own photos.]

The telemetry remote monitoring system mentioned earlier—intended to monitor the use of the breathing apparatus and the safety of the interveners—includes the entry control board keeping track of the wearers having entered the closed, smoke-filled space (at Merseyside Fire and Rescue Service, products of the safety technology company Draeger are used, such as the Merlin board). Each fire engine carries one and they are checked at shift changes. It is handled by the person appointed by the on-site incident commander, who is most often the driver of the fire engine.

Each fire engine in Liverpool is manned by four people (one driver, one commander, two intervening firefighters), which may seem few, but good firefighting coverage and short travel times can ensure timely help from supplemental firefighter units. The so-called *start* systems ensure a higher level of preparedness to the engines themselves at fire stations, similarly to other countries. They continuously charge the batteries and keep the cooling water warm, but the air tanks of the brakes are not filled (contrary to several examples in Hungary). Fire engines and their compartment doors can be opened and locked centrally with a hidden switch.

Taking a step back from the local operative level, we can find further background support facilitating the safety and efficiency of the interventions. Declared procedures followed by the staff as intrinsic motivation, cooperation among those involved in emergency rescue (fire service, ambulance service, police) aim at a common goal. Cooperation will always be on the same level, similarly to the procedures in other countries. [8] [9]

After some of the higher priority incidents, consultations are carried out between the interveners and local officers to draw the consequences and to avoid possible mistakes in the future. One of the core activities of the commanders, officers is the continuous development of the staff they are in charge of. Negative retaliation is typically not used towards firefighters for mistakes, the goal of trainings and further trainings is to become more and more efficient in performing their tasks. Subsequent analyses of cases are aided by on-board camera systems installed on each fire engine, which preserve recordings from cameras on all four sides of the engine for several hours. Safety is of utmost importance (a frequently expressed slogan is *safety first*). Recent cases posing threats (such as a damaged part of a fire helmet, what was in use on the engine) are addressed and published in special information circulars.

Picture 12. (left) and 13. (right) *Mobile Data Terminal and its thermal printer integrated in a fire engine, Liverpool, United Kingdom, 2017.* [Author's own photos.]

At present there is no fire bike service in Liverpool, but earlier these vehicles used to allow fast arrival, reconnaissance and early steps to be taken. In any case, they are worth considering based on these examples and experiences.

A rather good practice is the analysis and data collection department with a fairly sizeable staff of civilian employees (about twenty employees in Liverpool). They also support fire service, civil protection and authority tasks, as well. Data from local governments are continuously collected and entered into a database. Operations control relies on this data (emergency calls to 999 are directed here, answered by fire officers) and it is available on on-board computers on every fire engine. They have information about the residents in each building, about different social problems in certain neighbourhoods and about people with disabilities. A separate department with similar operation and number of staff is responsible for technical data collection, gathering information about roads and their temporary closures, the condition of buildings, utilities and services. Upon request, the police may also receive information, in addition to the incident commander on the spot or even during travel to the incident. At the time of the alarm, all basic information available are accessible to the incident commander through the on-board computer, but he may also receive SMS messages with further information he requires. They now have ten years of experience in collecting and forwarding background information. Long-term

use has proved this kind of background support rather effective. Connecting a printer to the on-board terminals allows printing and handing out hard copies of data, maps and site plans, which has proved to be a good practice.

During the recruitment process to the fire service—similarly to other countries—there are several rounds. The first is a simple test, followed by exams in English, Mathematics (e.g. calculating decrease in water volume) and other general knowledge questions as well as health and psychological tests. After twenty-three weeks of basic training, a mentor firefighter is assigned to the new-joiner for a period of one year and after its successful completion, it is his turn to fulfil mentor duties to new-joiners. In Liverpool, a driving licence for large vehicles (category C) is among the requirements and as soon as during the first year of service they have to drive fire engines more and more frequently.

Firefighters undertake further trainings on a monthly basis (training packs), focusing on a different area each month in view of recent incidents. When compiling the annual plan, fire commanders and staff are welcome to submit their own recommendations about their preferred development areas. Trainings which cannot be held at the fire station are carried out in regional training centres. In the case of the Merseyside Fire Department, the training centre is located in the Croxteth suburb of Liverpool.

In order to achieve a higher level of fire protection, it is important to mention a British campaign in which the fire service can give away and install smoke detectors free of charge on request to the public. This campaign significantly increases the number and quality of smoke detectors in homes.

## Germany and its Fire Protection Activities

Germany has a total area of 357,340 square kilometres, with a population of 81,292,400 (based on 2015 data) and it has the world's 4$^{th}$ largest economy (2015 GDP figures). [10] The total number of deployments of firefighters between 2011 and 2015. (Table 3.)

Table 3. *The total number of deployments of professional firefighters.* [7]

| Period (year) | Number of deployments (pcs) |
|---|---|
| 2011 | 205,386 |
| 2012 | N/A |
| 2013 | N/A |
| 2014 | N/A |
| 2015 | N/A |

As we can see, unfortunately the CTIF[6] world statistics does not have data about some part, for example about last year's in Germany.

Similarly to Hungary, within the fire service (in German: *Feuerwehr*) we can differentiate between professional (also referred to as *paid* firefighters), volunteer and industrial

[6] *Comité Technique International de prévention et d'extinction de Feu* (Fr). Founded in 1900 in Paris, develops comprehensive world fire statistics.

organisation forms. Volunteer fire service is rather popular and widespread, well-equipped and continuously trained. Under the German law, cities with a population of more than 80–100,000 people (depending on the province) are required to maintain a professional fire service.

Volunteer fire brigades provide in a large number strong support to professional firefighters in their duties. In Germany, approximately 1.3 million trained firefighters work at different levels and in different ways. Out of the 1.3 million firefighters, 1 million serve as volunteers.

Emergency medical services are often carried out by firefighters, and in Hamburg there are only a small number of ambulance vehicles not belonging to the fire service.

Picture 14. (left) and 15. (right) *Ambulance and Fire cars and trucks, combined fire training ground at the Fire Academy of Hamburg, Germany, 2017.* [Author's own photos.]

Still about Hamburg, taken as an example, let us have a look at its fire protection operations together with the emergency medical service. In addition to the seventeen professional firefighter units, there are also 187 volunteer units. As regards the figures on interventions and emergency calls, besides the approximately 230,000 medical emergency interventions annually, the fire service is deployed to fires or technical rescues about 120,000 times a year.

Professional firefighters in Hamburg have two mobile command posts, which are typically set up in large buses designed for this purpose. The drivers and the commander of the vehicles are professionals, while the operators (of various communication systems, the vehicle, recording and forwarding reports) are provided by volunteer firefighters. A fire engine is located at the Hamburg Fire Academy (in German: *Feuerwehrakademie Hamburg*), while the newest purchase is on standby at one of the professional fire brigades.

In the course of further training, every firefighter is obliged to carry out fire container trainings every year (actual fire suppression in a controlled environment), including the staff of the 86 volunteer fire stations in the close vicinity of the city.

Professional firefighters work 24-hour shifts, during which each of them is a paramedic at the same time. Emergency service on the ambulance is performed in turns on a daily basis by members of the entire staff. They perform all general types of emergency medical service (administering injections, using a defibrillator, intubation etc.).

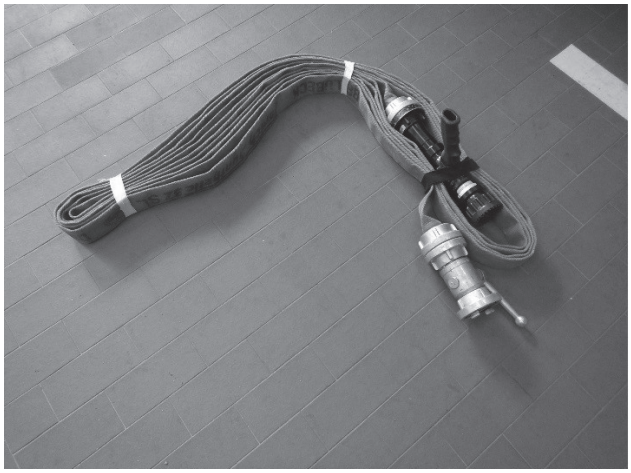
In Germany, those completing basic firefighting training (voluntary) are in fact only eligible to be present at the site as well as to perform minor auxiliary tasks. Further trainings,

courses are necessary to participate in more complex intervention activities. Such courses and trainings cover the use of breathing apparatus, driving an engine, operating a pump, interventions in the presence of dangerous materials as well as different managing and leadership skills. In the following part some of the incident commander positions are described. The squad leader is typically in charge in direct pair interventions, while the team leader is prepared to manage a bigger unit, generally a unit of eight in addition to the team leader. The battalion chief is entitled to lead at least three fire engines and their crews, up to 21 + 1 persons (including the chief himself). Priority interventions may require a leader or commander of a higher level than the battalion chief (in German: *Verbandsführer*), who can be in charge of up to three battalions during the actual intervention.

Unlike in Hungary where the alert time is regulated, in Germany the regulation specifies the arrival time. Following the alert, the ambulance has to arrive within five minutes, the fire service within twelve minutes. The recommended arrival time for ambulances of general purpose is seven minutes, while in cases requiring medical attendance, it is twelve minutes.

The training of professional firefighters (the terms paid or career firefighters are also used) starts with an eighteen-month basic training. The training of volunteer firefighters lasts twelve weeks, which is divided into segments, given the fact that volunteers typically have a full-time job. Volunteering is so deeply rooted in the fire service that certain special engines were meant for volunteer fire stations. For instance, the volunteer fire station in the centre of Lübeck (in German: *Freiwillige Feuerwehr Innenstadt*) houses a dangerous material detection apparatus (similar to the disaster management mobile laboratories in Hungary), purchased from the central government budget and manned by volunteer firefighters specialising in this field. An all-terrain truck for disaster management purposes purchased from similar resources can also be found at this station. It is also worth noting the adequate supplies and periodic replacement of personal protective equipment the fire station has. The entire staff is provided with protective clothing made of polybenzimidazoles (Polybenzimidazole—PBI) material ensuring the highest level of safety.

The training centre (in German: *Feuerwehrakademie Hamburg*) operated by the professional fire department in Hamburg organises basic and further trainings for firefighters of every status in the city. All conditions are favourable in the rather extensive facility for the simulation of various incidents and for practice-oriented trainings. Such incidents can be gas leakage, liquid fires, incidents in agricultural and industrial high-rise buildings, rail interventions, water and underwater interventions, accidents occurring during the transport of dangerous materials. Alpine technique training of several levels can even be continued indoor in case of bad weather. Besides the permanently installed container, a mobile fire simulation container is also available, which can be installed at various fire stations, thus avoiding transporting the entire staff to the Academy instead. Another good practice is the use of smaller practice tracks, such as for the training for movement on roofs, where it is also possible to remove tiles.




Picture 16. (left) and 17. (right) *Prepared fast fire hose and new PBI turnout gears in a volunteer fire station, Lübeck, Germany, 2017.* [Author's own photos.]

Not only the traditional firefighting, but also the emergency service training takes place here in various situations, for example, rescuing a person suffering exhaust fume poisoning in a family house garage. [11]

## Italy and its Fire Protection Activities

Italy has a total area of 301,318 square kilometres, with a population of 60,599,936 (based on 2016 data) and it has the world's 8th largest economy (2015 GDP figures). [12] The total number of deployments of firefighters between 2011 and 2015. (Table 4.)

Table 4. *The total number of deployments of professional firefighters.* [7]

| Period (year) | Number of deployments (pcs) |
|---|---|
| 2011 | 230,244 |
| 2012 | 241,232 |
| 2013 | 196,196 |
| 2014 | 189,375 |
| 2015 | 234,675 |

The Italian fire service (in Italian: *Vigili del Fuoco*) has been a unified national fire and rescue organisation since 1941. It boasts having the oldest firefighting traditions of the world originating in as early as the Roman times. Although scientifically not an important data, it is important to note that outlets of Roman wells famous for their fresh water can be found at certain fire stations. 24–72 as well as 12–24, 12–48 shift schedules are also in use.

The building of a professional fire brigade in Rome inaugurated in 1929 also functions as a museum, built in the style of the Roman Empire. This brigade can rather be characterised

as a special station without a commander of its own, its crew only performs standby duties. As regards its apparatus, an auto pump, a tanker, an aerial and an apparatus equipped with a jump cushion are all on continuous standby among the antique walls. A dangerous material apparatus and a special apparatus for both roads and water are also available without a permanent crew, thus with possible delays in alert. For interventions in the presence of dangerous materials, engines of various sizes and designs are on standby at the Italian fire service. There are examples of larger engines with swap bodies and containers, ones of middle-category with fix bodies, but also lighter engines with swap bodies, as well.


Picture 18. (left) and 19. (right) *One of the oldest fire stations in Rome and a very special fire truck staying there, Italy, 2017.* [Author's own photos.]

The fire protection in Rome, Capital City is ensured by thirty-two professional fire brigades. The population to be protected—including the unregistered inhabitants—is around 3.5 million people. The lack of Italian language skills is noticeable among certain parts of the immigrant population (similarly to the situation of the London Fire Brigade). In stations where the social conditions are met women can also join the crew and work as intervening firefighters, although their number is around six in the capital.

In the Mediterranean country, the daily work is complicated by the fact that—except in a few special places—there is only one kind of uniform footwear, that is the protective boots. However, further personal protective equipment such as the protective helmet and coat are generally placed on fire engines and put on at the site. [13]

Fire engine crews typically consist of the driver, the leader and three operators. At the site, the colours of the helmets signal the position of the wearer. Operators wear black helmets, the leader of the engine red, while senior officers wear grey ones. Only one white helmet is standardised in Italy and it belongs to the national commander. Rank insignias and badges showing time of service are not common on uniforms. Typically, only jackets display such signals, former arm insignias have been replaced with uniforms and embroidered firefighter patches over the last few years. Members of the urban search and rescue team (USAR; similarly to the Hungarian professional rescue organisation HUNOR) wear a separate patch. As regards the ranks, in short, it can be said that time-in-grade requirement is basically five years and positions have maximum rank ceilings. For instance, the category of a subordinate firefighter is signalled by a red mark at the time of the appointment, changing it every five years by adding a new V-shaped mark up to three times. In principle, it is similar to the sergeant ranks

in Hungary. Shift commanders (in Italian: *capo turno*) has a gold line on a red background at the time of the appointment and by receiving the second line, they reach the rank ceiling.

Taking a flagship fire station in the city centre as an example, it is remarkable that the high-pressure wound hose (Storz system) attached to the water cannon of the aerial ladder platform is also fitted with a spring fastener. However, threaded fasteners are not uncommon on fire engines either. Fire engines are also marked by type as well (for example, AS1 ladder, 1A auto pump). An urban search and rescue vehicle is also available in the capital if equipment and tools are needed to stabilise and shore ruined buildings.

As regards emergency numbers, there are several solutions in use across the country, generally it is 115 for the fire service. In Rome, uniquely, it is 112, where emergency calls are handled in a call centre by civilian employees in accordance with the subject of the call.

There are altogether three alarm levels to rank the severity of the fire and damage. Operations control uses a colour code system to indicate the status of the vehicles. Engines marked red are out at the scene, green ones are on standby at the fire station, whereas yellow ones are travelling back or being refilled with water etc.


Picture 20. (left) and 21. (right) *A light mobile hazardous material unit with changeable container and the city communication centre of fire service, Rome, Italy, 2017.* [Author's own photos.]

The country's central training centre is also located in Rome. The institute boasts a rather long history, dating back to the 1940s and it can be considered well-equipped. Basic training lasts six months, which is continuous, and courses on firefighting are also held for other uniformed organisations, as well. Commanders and incident commanders take part in a one-year course (which might be shorter temporarily in the future for organisational reasons), while officer retraining lasts two and a half years (also when it specialises in fire prevention). One can only become an officer if there is a vacancy, if he holds a civilian degree and is supported by the commander. In light of the above, waiting time is rather long and there is no specific university course in this field in Italy. Instructors coming from all over the country take part in the training and share their professional expertise.

In the firefighting training centre, a lot of emphasis is placed on providing sports facilities, which is supported by various governmental organisations, for example the Ministry of Sport. Since swimming classes are also included in the basic training, an indoor swimming pool is also available, which has a separate deeper section for practicing underwater exercises and

diving techniques. Water rescue skills must be mastered by urban search and rescue team members.

Each of the intervention areas and venues has been equipped with separate practice fields, such as a ruined city area, a place where dangerous substances are present, various roof structures, unstable window openings in different designs which need shoring. It is important to mention in the alpine techniques training that instead of the climbing belts used in Hungary, harnesses are standardised at the fire brigades offering a higher level of safety. [14]

Italian manufacturers of fire fighting vehicles (for example, Brescia Antincendi International Srl—BAI) ensure that domestic expectations are met. An interesting solution is the safety barrier on a Volvo fire truck, which automatically opens on the top of the vehicle, operated by a pneumatic system, when the back-ladder to the top is opened. The *start* system, which helps to keep the vehicles on standby, can also be found, in some cases on the rear side of the vehicles. There is also an example of a mobile lighting trailer that can be towed by a fire engine and several boats are also on standby. The winter period typically brings heavy rainfalls resulting in flood risks for the Italian fire service.


Picture 22. (l) and 23. (r) *Building stabilizing trainings in the Italian fire education centre and a mobile sleeping car for long term interventions, Rome, Italy, 2017.*
[Author's own photos.]

Based on the experience gained in a suburban fire brigade (in the city district EUR), it can be seen that the fire brigade building can become completely empty—outside office hours—when an alarm comes in and the fire engines are dispatched. At various fire brigades, as it could be previously seen, special fire engines are kept dislocated, depending on free garage places, such as a mobile sleeping car, in which up to eight people can take a rest during prolonged interventions, and it is also suitable for technical rescue to a basic extent due to some technical equipment it possesses (for example, a floating pump, a pneumatic lifting pad etc.).

Unlike in the United Kingdom, there are no mobile terminals and on-board computers on fire engines in Italy. Maps are prepared specifically for the conditions of the intervention sites (reinforced and waterproof).

As regards breathing apparatuses and masks, after the interventions, the masks are sent to a central workshop for maintenance and cleaning, replaced by already inspected masks from the local stocks for the firefighters concerned. For this solution we can see examples from several countries.

## Conclusions

When examining international fire protection operations, and at the same time a bit of traditional ambulance services, the used technical equipment and procedures, slight differences and variations can be observed. [15] In this paper fire protection operations in five countries were examined, Hungary, Poland, the United Kingdom, Germany and Italy. Good practices and solutions can be found in each country, whose adaptation seems reasonable to other countries, as they are likely to have a favourable impact.

I make recommendations on considering the following elements, listed by countries.

From *Poland:* there are a lot of good practices in the area of training fire officers, decision makers by the Main School of Fire Service in Warsaw. It is also interesting to mention the freely modifiable training scenes with real fires and smokes near Zamczysko and the absolutely freely buildable and usable computer simulation room in the centre of the university.

From the *United Kingdom:* Fire engines performing firefighting and primary intervention activities are equipped with mobile terminals and simple, easy-to-use printers, thus facilitating flexibility, orientation on the site and management of the response. Developments have already begun in Hungary in this field (developments of the National Directorate General for Disaster Management for on-board PCs). Instant access to data that can be easily updated, with firm background support and the possibility for quick, simple and cheap printing on the spot can all be of significant help for the firefighters and the commanders in certain cases. It may be worth considering the achievements of British firefighters with outstanding international experience. At the same time, auxiliary hand tools, equipment mentioned in the paper also increase safety and effectiveness of the intervention. These are for example the so-called hooligan tools, self-adhesive protection films and battery-powered equipment allowing greater mobility and flexibility. Telemetry commonly used in respiratory protection in the UK is also a good example, although expenses are much higher than those of simple designs.

From *Germany:* A very strong voluntary presence in the fire service is clearly one of the major strengths of the German fire protection system. Their deep involvement in fire protection operations and disaster management result in an increased effectiveness and at the same time, lower costs. Their training and further training system is very varied and thorough, there are good opportunities for trainings in individual areas, close-to-reality situations, and sometimes even in mobilised versions.

From *Italy:* Hybrid fire trucks that can be used in a complex way, both on water and on land can be of good help in firefighting, technical rescue and disaster responses. Preliminary assessment prior to the procurement may be justified, it is worth paying attention to issues of purchasing, maintenance and applicability. The general use of alpine technology equipment and training and the use of straps for self-rescue (similarly to the United Kingdom) increases effectiveness and safety of the firefighters. Integrating swimming training into the basic training and further practice to maintain these skills can also be a good example for fire stations where water interventions are likely and can be expected.

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