

Article citation info: Betus, M., Sofranko, M., Feher, J., Cambal, J., Feher, D., Ondov, M., Bases for vocational training and education of IRS units - rescue work in road tunnels. Transport & Logistics: the International Journal, 2022; Volume 22, Issue 52, February 2022, ISSN 2406-1069

BASES FOR VOCATIONAL TRAINING AND EDUCATION OF IRS UNITS - RESCUE WORK IN ROAD TUNNELS

Miroslav Betuš¹, Marian Šofranko², Ján Fehér², Jozef Čambál², Dávid Fehér², Marek Ondov³

¹ Independent expert inspector, Regional Directorate of Fire and Rescue Corps,
Požiarnícka 4, Košice, Slovakia, e-mail: m.betus@centrum.sk

² Institute of Earth Resources, Department of Montaneous Sciences, F BERG, TU Košice,
Park Komenského 19, Košice, Slovakia, e-mail: marian.sofranko@tuke.sk, jan.feher@tuke.sk,
jozef.cambal@tuke.sk, david.feher@tuke.sk,

³ Institute of Logistics and Transport, F BERG, TU Košice, Park Komenského 14, Košice,
Slovakia, e-mail: marek.ondov@tuke.sk

Abstract:

During the preparation of the Command and Staff Exercise in two months, on crisis staff of Prešov District Office, trade unions civil protection and crisis management Prešov District Office and Poprad, were considered complexity of carrying out rescue work in road tunnel Branisko. Exercise of rescue units of the integrated rescue system (IRS) in the district of Prešov and Poprad in the road tunnel Branisko, in addition to positive experiences, it also revealed a number of problems. Avoiding mistakes and shortcomings in similar exercises is also the role of the National Program of Education of the Components of the Integrated Rescue System in the Conditions of its Implementation in individual regions of the SR.

Key words:

Road tunnel, rescue units, integrated rescue system, fires, accidents

1 INTRODUCTION

Fires, accidents and other emergency events in road and railway tunnels, in large car parks and in park houses where a lot of people, even large amounts of flammable substances endanger and affect a large area and a number of people. When deploying forces and means of integrated rescue system, in particular fire and rescue services, ambulances and civil protection forces, the management of the rescue system in terms of the complexity of rescue tactics and techniques work, firefighting, first aid, emergency supply and emergency

accommodation is important. These are the most demanding activities. In the case of buildings in which there are simple spaces and conditions for the evacuation of persons, animals and things, the loss of life is minimal, the risk to health is manageable, the cost of rescue work, the deployment of forces and resources is relatively low. The risk of endangering persons is directly proportional layout of the building, especially in terms of escape routes, quantity and characteristics of flammable substances, as well as in terms of number of people and their ability movement. Road tunnels are among the most dangerous operations in terms of the above criteria. We have been able to talk about this fact in the last 10 - 15 years in within the European Union. With a growing phenomenon terrorism even in our conditions is the issue of effective and high-quality construction and fire safety of road tunnels is more than an important part of safety measures (Directive, 2004).

During the preparation of the Command and Staff Exercise (CSE) in the months of May - June, on crisis staff of District Office in Prešov, trade unions civil protection and crisis management Prešov District Office and Poprad, were considered complexity of carrying out rescue work in tunnel Branisko (Fig.1).



Fig.1 Road Tunnel Branisko, Slovakia
Source: Authors

Possible threat and occurrence of extraordinary events in road tunnels and in their proximity, especially traffic accidents associated with fires and the threat of escaping transported hazardous substances, was the intention and consideration. Crisis management bodies carry out training of interveners units. The problem was mastery management activities, coordination and definition of competencies in the performance of tasks.

2 METHODS AND METHODOLOGY

The steering group of the CSE, on the basis of the draft of the plan, will draw up organizational and methodological instructions in order to avoid individual provision. Activities of individual training components without coordination. Following the consultations, a plan for training, exercises and exercises will be drawn up. Similarly, it is desirable to rethink and provide training and exercise after material, technical, financial and

medical aspects. It can't happen like in our case, the extras at high temperatures during the CSE did not have a secure drinking regime. The care must also be taken in safety precautions during training or exercises with riot patrols equipped with coupling technology so there was no injury to the trainees.

We have noticed that mistakes have been made at the CSE in the delineation of the premises, so in the future we are proposing appropriate solutions that can be used in education and vocational training preparation before exercises.

2.1 Lesson for future interventions and their preparation on the basis of the obtained knowledge

Training objectives:

- Rescue components - acquisition of theoretical knowledge, practical skills and abilities for demanding species intervention activities in road tunnels using material means, personal protective equipment, machinery service, gas service and a liaison service.
- State administration and self-government - solutions for prevention and preparation for emergencies events, crisis phenomena, mitigation (elimination) of their effects, crisis planning and management. Preparation for elimination of consequences, restoration of the system in the territory affected by the consequences of exceptional events. Practical exercises model situations aimed at developing and updating tasks and measures for the protection of the population of the territory and the protection of workers, and persons were taken into care. Promotion of experience gained in the field of civil protection.
- Management units, crisis management bodies - clarification of the topic and objectives of the training of the exercise in terms of management competencies and coordination of activities, which in our case was not all components understood.

To verify the degree readiness of trainers with the design of the used technique, devices and intervention amenities requires a study of necessary regulations, directives, aids and literature (Technical regulation, 2011), (Decree no. 121/2002 Coll, 2002).

2.2 Workplaces and premises

There are areas in front of the tunnel and areas for intervening forces and means and devices to enable preparation training units, extras, techniques for rescue work, firefighting, which include (Government Regulation, 2006):

- a) Access communications,
- b) Boarding areas,
- c) Area for air rescue service,
- d) Intervention routes,
- e) Emergency supply premises; and emergency accommodation.

Access communications

There must be access roads allowing the arrival of a mobile firefighting equipment to both portals of tunnel, ambulance units techniques and special liberation units on the road leading to the tunnel. Access to road tunnels can be (Technical regulation, 2011):

- After the communication used for ordinary traffic with the possibility of exclusion traffic, on a separate road lane use Brand for normal traffic in the length from the nearest intersection with a connection to the tunnel to the boarding area in front of the portal,
- After a separate access communication to the exclusion of normal traffic leading to boarding area, if allowed locally conditions and if it ensures a significant reduction in arrival time of fire brigades. Access communication must be made according to the Decree of the Ministry of Interior of the Slovak Republic no. 94/2004 Z. z., Which lays down technical requirements for fire protection safety during construction and use of buildings.

Boarding areas for training interventional forces and means

The boarding area must meet the following requirements (Government Regulation, 2006):

- To be at both exit portals of tunnel,
- To be connected to access communications,
- To be at least 6 m wide, at least 12 m long in tunnels up to 300 m, 25 m for tunnels up to 3,000 m and 50 m for tunnels with a length of 3,000 m or more; the width of the boarding area can also include the curb of the road,
- To be permanently free, marked with the road sign PROHIBITION OF STANDING (STN 01 8020 Traffic signs on roads). Recommended boarding distance area from the portal is a maximum of 20 m.

Area for air rescue service

The establishment of an area for air ambulance service is recommended for tunnels with a length of more than 500 m, considering the overall location of the tunnel in the field and its air accessibility. For tunnels longer than 3,000 m, must establish an area for air ambulance service at both portals. As an area for air rescue service can the road itself or another area near the portals of the tunnel may also serve, if it meets the conditions for landing of the air rescue service and, if necessary, its release is secured (Government Regulation, 2006).

Intervention routes and information for trainers about their use

In the project documentation of the tunnel for the purposes of construction proceedings are intended emergency routes and the type of mobile equipment intended for use in the intervention in the tunnel tube. As a way of intervention serves the transport space of the tunnel and escape routes. If the use of an escape route is also envisaged for intervention with a small mobile intervention technology, both widths of such an escape route must be at least 2.5 m, the width of the door on such an escape route is at least 1.2 m.

The doors on the emergency road are designed to allow small passages mobile intervention technology and smooth exit from the emergency route to the tunnel ovens. A small mobile intervention technique is a motorcycle, tricycle, quad ap. Tunnel tubes of a double tube tunnel with a length of more than 1,500 m must be connected by an intervention route (transit transverse connection) for the mobile firefighting equipment. Distance from each other intervention routes connecting tunnels the pipe of a double-pipe tunnel may not exceed 1,200 m (Government Regulation, 2006), (Change no. 4, 2019).

These conditions for the elaboration of the intention, theme and implementation plan are main prerequisite for preparation practitioners. In training, except another, we emphasize that extraordinary road events also caused by natural disasters, floods, winter calamity, are conditioned by the following factors (Technical regulation, 2011):

- High intensity of road traffic and transporting trucks with a large amount of own fuel and at the same time transporting dangerous substances,
- High rate of leakage of hazardous substances, development of fire and intensity of smoke in tunnel objects, high temperature and danger more people that can be affected during its onset and course an emergency accident in a tunnel,
- Complexity of the deployment of forces and resources of the integrated and territorial (local) rescue system, Fire and Rescue corps, ambulance, civil protection units for territorial use, units for monitoring and determining the nature of the leakage NL. Also, a solution to regulation and diversion of traffic from the place the occurrence of an emergency. Negative knowledge and experience of transport motorway accidents confirm that this last task is still being solved not enough,
- Providing high-quality modern special means of individual protection of rescue services integrated rescue system,
- Limiting the volume of forces and resources in terms of their technical and instrumentation, e.g., fire protection system equipment associated with a possible deployment in tunnels such as Branisko (Fig.1), Bôrik ap.,
- Limits of forces and resources, e.g., fire-fighting sources, the necessary amount of water and fire-fighting materials, value characteristics electrical networks and distribution, system alternative resources and infrastructure,
- Limits the possibilities of planning and carrying out the evacuation and rescue of persons, providing first aid from an underground object, by complexity escape of persons from an emergency place events. Emergency planning management in the tunnel is presented in Fig.2.

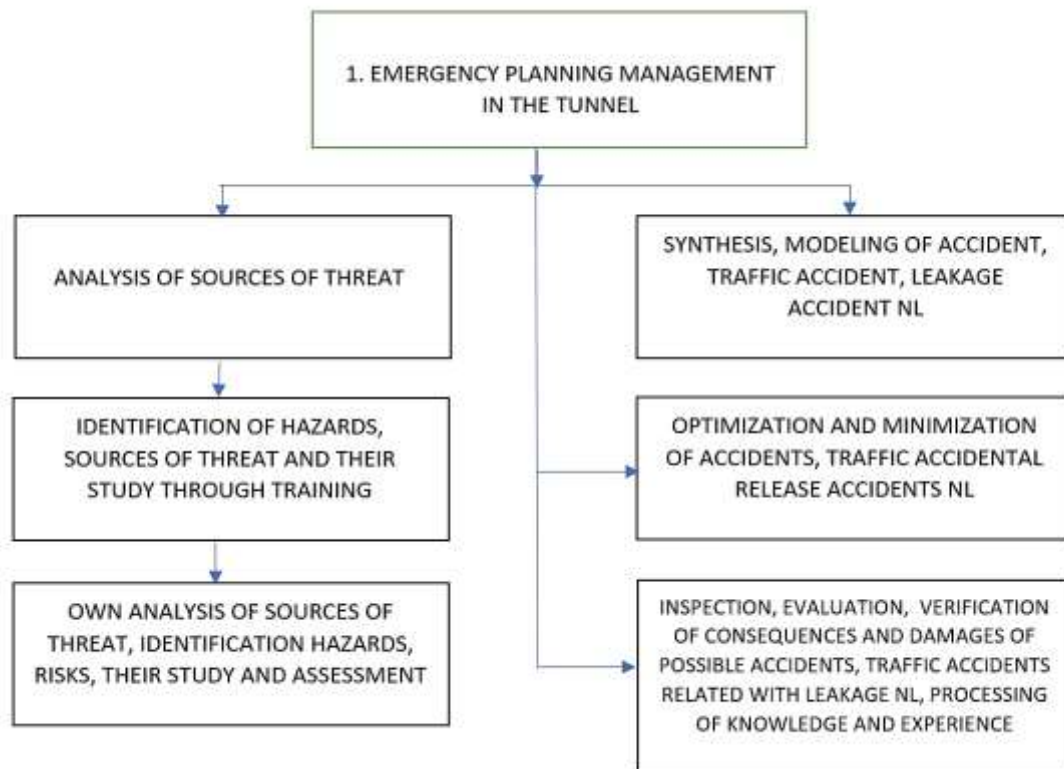


Fig.2 Emergency planning management in the tunnel,
Source: Authors

2.3 Tunnel equipment

Legislation applies to the construction, technological equipment and maintenance of tunnels regulations (standards and directives) that determine the design, construction and tunnel maintenance (STN 73 7507, 2008), (STN 73 6101, 2008).

Tunnel design according to the standard STN 73 7507, 2008:

- The following applies to the design of a road in a tunnel: STN 73 6101 and STN 73 6110, STN 73 7507
- Seismic or dynamic effects - according to separate regulations,
- Tunnel life - for 100 years (equipment life - special regulations) according to length, the tunnels are:
 - Long - over 3,000 m,
 - Medium - 300 m to 3,000 m,
 - Short - up to 300 m.

During the training of IRS units in the months of May - June was for the management of CSE necessary for the components to know the rights, obligations and competencies of the National Motorway Company, which was not, according to in our opinion, properly involved in management activities. If the management of the property of the National Motorway Company (NMC) is a summary of the rights and obligations of the administrator property, which has property entrusted in accordance with the Road Act, is this administrator entitled and compulsory property to use on performance of tasks within or in connection with the

subject of the activity, to maintain it in good condition, enjoy all legal means to protect it and to ensure that in particular, it has not been damaged, lost, misused or reduced. Owners and road managers are obliged to keep the roads in a condition corresponding to the purpose for which they are intended. They had these questions, as they stated colleagues from District Office in Poprad, more pronounced understand in the preparatory stage especially the members of the management staff of the exercise.

In the future, we will add the entire Road Communication Information System to such exercises. He is equipped with a road and such facilities that provide various information and services to both road managers and road users. It is a system for our needs enabling the acquisition of information from technical and technological equipment roads for the purpose of their use in the operator workplaces that are part of it, especially for driving transport and informing users about road phenomena and the situation. It also contains information about the operation of the tunnel, which is a summary of knowledge the current state of the tunnel and is affected by the operational capability of the tunnel (technological and construction part), as also by transport in it.

The involvement of employees of the Highway Administration and Maintenance Center will also be important (HAMC) or the Administration and Maintenance Center Expressways (AMCE), which is an organizational unit of the NMC providing part of the delegated report (in relation to the environment and waste economy) and maintenance of the entrusted section of the motorway resp. expressways. Those persons are professionally fit for use in crisis communication during rescue operations works. Also, the involvement of the Local Operator's Office (hereinafter LOO), which collects, evaluates and distributes information from the entrusted section of the highway with the aim of using it in the activities of the AMCE and for the needs of motorway users, roads for motor vehicles within one SSÚD or AMCE and Highway Information System (hereinafter referred to as HIS).

A specific example of our exercise was the area of evacuation of persons from the tunnel after the occurrence of an emergency and the subsequent emergency accommodation and emergency eating. Escape routes have been tried and how to help people with disabilities.

Escape routes are equipped with fire doors and ventilation devices for proper airflow in case of fire through an evacuation escape way of immediate evacuation and escape persons from the affected tunnel tube. The middle escape route in the tunnel is passable with motor - operated doors by which a special tunnel fire truck can pass from one tunnel to another ovens. In addition to this medium-largest escape route between the tunnel tubes, there are two other evacuation escape routes in the tunnel (Directive, 2004), (Government Regulation, 2006).

The crisis staff at the management and decision-making process was based on these characteristics process after the occurrence of an emergency and during a declared emergency in the Branisko road tunnel.

For the crisis staff of the District Office in Prešov and in in turn, model situations are prepared so that they are close to the real reality. Therefore, practical exercises components of the integrated rescue system and the whole activity of the crisis staff at exercises and practical training has its place in the training plan of the districts of Prešov and Poprad region (Change no. 4, 2019).

We will give a specific example: in the event of an emergency with large loss of life, transport equipment, loss of life of rescuers components in the Branisko tunnel and the Bôrik tunnel an emergency situation will be declared in the district of Poprad and in the Prešov Region. What will be the activity of each component integrated rescue system and what will be the procedure of the crisis staff of the district and the region? The following are taken into consideration:

- Tunnel pipes,
- Tunnel objects,

- Objects outside the tunnel tube with workplaces for emergency accommodation and supply,
- Risk areas.

2.4 The tunnel risk analysis Model

The tunnel risk analysis model examines personal risk of tunnel users (all parameters used relate exclusively to accidents with personal injury). The statistical value of the risk for the risk of the tunnel user group (statistically expected value of the number of victims per year). The risk relates to tunnelling construction (in the case of a tunnel with two pipes both pipes are included).

Partial risks that result mechanical damage, fire and dangerous goods are displayed on the simulation panels separately. However, the effects of dangerous goods are so far examined only with an extremely simplified model, therefore the model is not suitable for deeper risk investigation (Decree no. 121/2002 Coll, 2002).

In the preparation of the VŠC associated with the evacuation, the division of the tunnel into fire sections is considered. In terms of fire safety, the tunnels on the road communications are divided into smaller units - fire compartments. The fire section is complete a tunnel, or a part thereof which is separated from its other parts or from another structure by a fire dividing structure, or distance. A separate fire compartment in the tunnel must consist of (Technical regulation, 2011), (STN 73 7507, 2008), (STN 73 6101, 2008):

- Tunnel tube, including air duct and ventilation shaft (if any) are designed in the tunnel),
- Protected escape route,
- Transverse connection connecting tunnel pipes,
- Electricity substation with a floor area of more than 50 m² in the basement and with a floor area of more than 100 m² in the above ground floor,
- A transformer station with a floor area of more than 50 m² in the basement and with a floor area of more than 100 m² in the basement, oil and dry transformers must not be in the common fire compartment,
- A space with an alternative source of electricity with a floor area of more than 25 m² in the basement and with a floor area of more than 50 m² in the basement,
- Cable spaces, ducts and shafts according to STN 38 2156 Cable ducts,
- Shafts, bridges and spaces (hereinafter referred to as STN 38 2156) and collectors according to STN 73 7505 Collectors and technical corridors for combined underground lines (hereinafter referred to as STN 73 7505),
- Supervisory or control centres (operator workplaces) with a floor plan,
- An area of more than 50 m² in the basement and with a floor area of more than 100 m² in the basement,
- If the individual floor plans of the premises in the basement according to letter d), e), f) and i) do not exceed 50 m², they may be in a common fire compartment; the common floor area of these spaces in one fire compartment must not exceed 100 m², if the individual floor plans of the premises on the upper floor according to letter d), e), f) and i) do not exceed 100 m², may be in the common fire compartment; common floor plan the area of these spaces in one fire section must not exceed 150 m², the fire sections thus created must be protected by a stable fire extinguishing device,
- Part of the fire section according to letter d), e), f) and i) may be communication and hygiene areas (areas without fire risk); the floor area is set floor area restrictions according to letter j) does not count.

3 RESULTS AND DISCUSSION

Problems that have not been solved at the exercise and require that they be incorporated into the topics, intentions and plan of the exercise:

- Count on the biggest accident in the history of tunnels in the Slovak Republic on roads.
- In the analyses, take into account the intense causes of fire with a domino effect.
- Have all material and technical means necessary to save human lives in order and verified.
- Ensure that forces and resources are concentrated on both sides of the tunnel as soon as the accident with subsequent fire is reported.
- Count on the worst options that conditions during an accident and fire do not allow the active use of forces and resources due to:
 - Zero visibility,
 - Very high temperature,
 - Malfunctions of vehicle engines from due to lack of oxygen,
 - Only partial use, escape roads, in connection with the unopened second tunnel tube in the conditions of the Branisko tunnel.

There are firefighters began rescuing a severely injured driver and passenger from a truck with a rescue tool and a doctor from a helicopter of the Air Rescue Service in Poprad classifies the wounded persons and provides first aid in Figure 3.



Fig.3 Training rescue equipment using a rescue helicopter

Source: Authors

They come to the scene at the same time fire brigades from HS Prešov, HS Levoča, HS Sabinov, HS Behárovce, HS Spišská Nová Ves and ZB HaZZ in Humenné (these HS are shown in the figure). There are also crews of emergency medical care from the towns of Levoča and Krompachy. The wounded are provided with first pre-medical assistance. The schemes of solving a traffic accident are shown in Fig. 4-6.

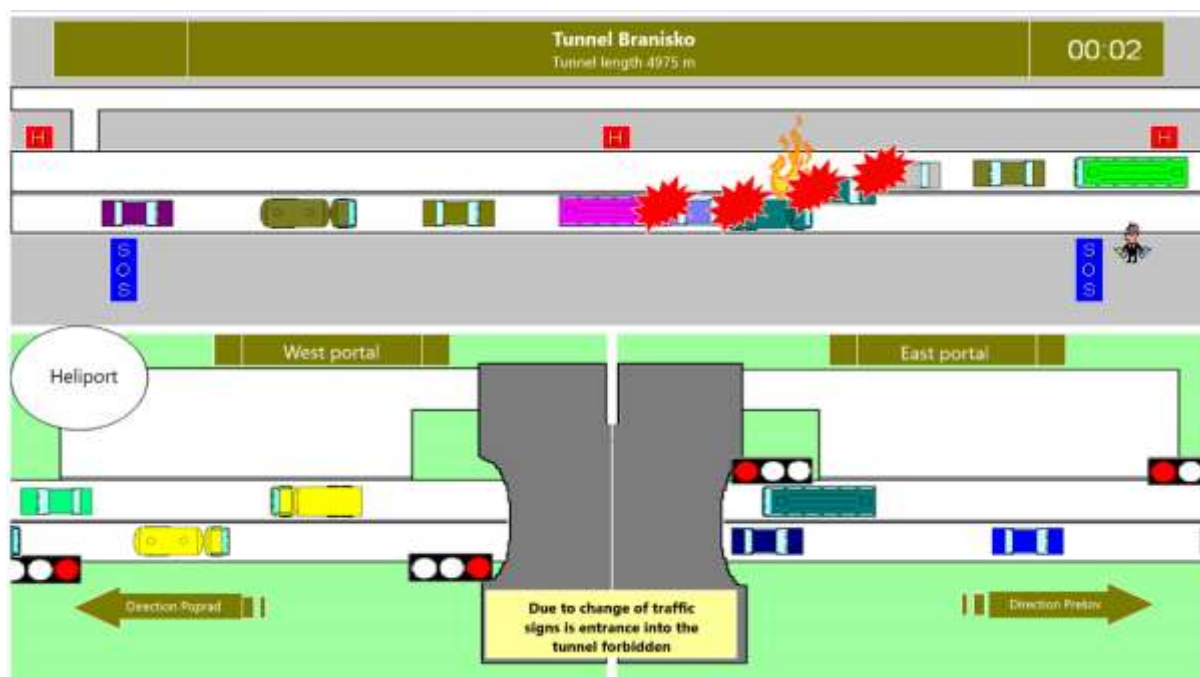


Fig.4 Scheme of solving a traffic accident - the origin of MU and an accident associated with a fire

Source: (Change no. 4., 2019)

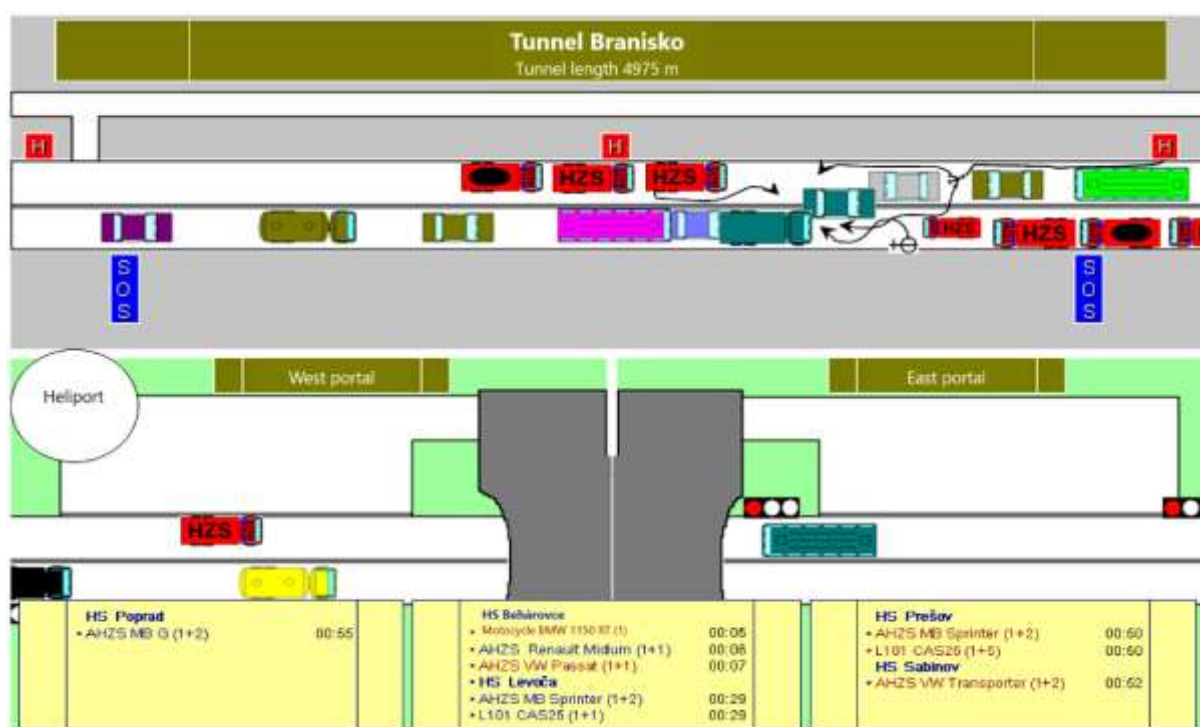


Fig.5 Scheme of solving a traffic accident - deployment of forces and resources

Source: (Change no. 4., 2019)

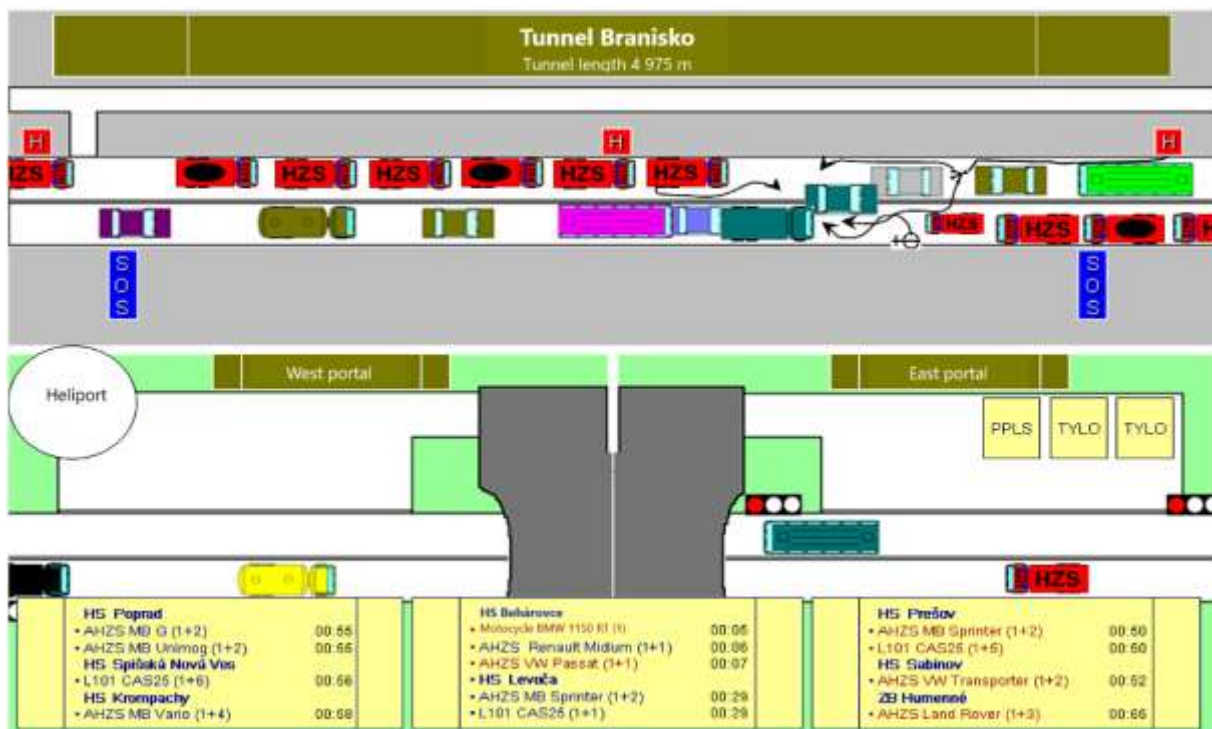


Fig.6 Scheme of solving a traffic accident - deployment of forces and resources
Source: (Change no. 4., 2019)

3.1 Organization of crisis communication an emergency and rescue connections works

In intervention management, the intervention commander and subordinate intervention commanders sections organize the connection. The intervention commander must decide what options connection for that event case. In most cases, it went during CSE for radio communication, where it is necessary to follow the rules of radio operation, but it is possible to use the full range starting clutch and ending using a mobile phone. If the technical means allow, the commander of the fire brigade shall notify the unit that arrived at the site the first operation of the HaZZ District Directorate (and the Emergency Call Coordination Centre), which sent her to the scene intervention and confirm or specify the location intervention. With the content of the information sent to the district 's operations centre the directorate of the corps that sent the fire brigade, the commander agrees intervention (Technical regulation, 2011).

The content of the information is:

- Situation at the scene of the intervention,
- The need for forces and resources, and for other assistance and data on their concentration,
- Possible change in the occupation of the function intervention commander,
- Activities of fire brigades, other intervening IRS units, authorities at the place of intervention,
- A fundamental change in the situation at the scene of the intervention, including injured or killed persons, firefighters or other persons,
- Time of locating and extinguishing the fire,
- Departure of fire brigades and IRS units from the place of intervention.

4 CONCLUSIONS

The crisis staff in Prešov and Poprad has established and functional communication management and communication system during extraordinary events and emergencies. The importance of the new concept of structure and organization of personnel communication system, security structures communication system has proven itself in the activities of the Tatras Territorial Rescue Service.

Maintaining the safe operation of each tunnel is always a priority. For this reason, too, regular inspection and maintenance of all technical, technological and fire-fighting equipment. In addition to the above controls and measures, review and tactical exercises are carried out at regular intervals basic components of the IRS to verify the ability to take action when performing rescue work in the event of an emergency in the Branisko tunnel. From the results and knowledge resulting from the solution of individual types of extraordinary events, it is currently possible to classify the Branisko tunnel as a safe tunnel. Based on all available information and future forecasts, it is necessary to start addressing the issue of construction of a second tunnel tube, to increase safety in terms of ever-shrinking transport capacity.

Acknowledgement

This work is supported by the Scientific Grant Agency of the Ministry of Education, Science, Research, and Sport of the Slovak Republic and the Slovak Academy Sciences as part of the research project VEGA 1/0588/21: "The research and development of new methods based on the principles of modeling, logistics and simulation in managing the interaction of mining and backfilling processes with regard to economic efficiency and the safety of raw materials extraction", and is supported by the project of the Cultural and Educational Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Sciences project No. KEGA 006TUKE-4/2019, and is supported by the project of the EIT RM (European Institute of Innovation and Technology RawMaterials) project MineTALC – Backfill Mining Optimisation for Low- and Medium- Strength Deposits.

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