

Safety of Infrastructure Operation in New Climate Conditions

Šárka KROČOVÁ¹⁾

¹⁾ VSB-Technical University of Ostrava, Faculty of Safety Engineering, 700 13 Ostrava-Výškovice, Lumírova Str. 13, Czech Republic; email: sarka.krocova@vsb.cz

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Abstract

The reliability of infrastructure buildings is a basic prerequisite for utility values of built-up in towns and municipalities areas. It creates the prerequisites for the long-term sustainability of the housing stocks of humans and, at the same time, is a condition for the region industrial base development. This reality is perceived by the public as an obvious standard which is a part of human life. However in the reality this is a very complex mechanism that can be severely disturbed in various conditions and situations. To prevent these situations from happening in practice it is imperative that state, government and different infrastructure types know the security risks that have a potential to change natural and operational environment and are ready to eliminate them. The following article deals with these issues, how to recognize the threat of an imminent emergency or critical situations and which resources are needed to increase the infrastructure reliability.

Keywords: reliability, security, infrastructure, risk, emergency, risk elimination, system immunity

Introduction

The current European human population knows no longer its environment other than benefits that national infrastructure provides to its citizens. In most non-European countries, however the real living conditions are completely different.

Infrastructure environment is not a natural stable phenomenon but a human variant of life which is not only necessary to maintain but also to develop further. Infrastructure maintenance and development must not be natural but have to respect the full range of rules that respect the natural environment and human needs. Immediate human needs and interests must not be preferred to balanced states. Humanity in today's technologically advanced countries since the 19th century has not respected the number of natural laws or underestimated their significance. Consequences are now beginning to show up in secondary phenomena in their own natural environment, aquatic ecosystems and also in infrastructure, its reliability and the safety of operating systems.

Now the time occurs when part of mistakes will need to be remedied and change the overall approach to the use of the natural environment. As mentioned in this article some mistakes are only a regional character and a negative scope. Others are beginning to manifest themselves on a global scale which can be reduced by a global approach to solving the problem. With their concurrent action, without solutions, they may not only affect the current living conditions of the people in the coming years but also have a serious to critical negative impact on flora and fauna worldwide and consequently may appear in the social society sphere [1]. In addition to aspects above it will also affect the reliability and safety of different operation types of public and private infrastructure.

Infrastructure and its impact on the function of the economically and industrially used area

The infrastructure of technologically advanced states in the world consists of a number of object and technical line structures in particular the energy supply, drinking water and wastewater drainage to the recipients. Their incorporation in territorial units has a fundamental geostrategic significance not only in a standard environment but also in extraordinary events or crisis situations. They have a potential to increase or mitigate consequences of these extraordinary events possibly with the appropriate composition to prevent these negative phenomena.

Without the operational reliability and basic infrastructure function it is not possible to develop the economic activity of the built-up areas in the regions and to improve the newly created environment.

The basic infrastructure consists of the following technical and operating systems:

- residential public and private buildings,
- technical infrastructure of territorial unit (natural gas, electricity, drinking water, sewage),
- transport infrastructure (roads, railway communications),
- medical facilities (hospitals, medical institutions),
- industrial objects (production and storage facilities),
- industrial zones,
- business zones.

The facilities and building are changing over time. It has been changing not only their basic parameters but also their reliability and usability for their primary purpose. In the case of general constructions in particular the changes are slow and so called domestic, the construction of the technical infrastructure during its lifetime often loses its initial performance parameters. These parameters can seriously endanger general city stability, municipalities, industrial base and broader concepts and also citizen security.



Fig. 1. Flooded area due to flood in 1997 [2]

Rys. 1. Zalany teren w związku z powodzią w 1997 r. [2]

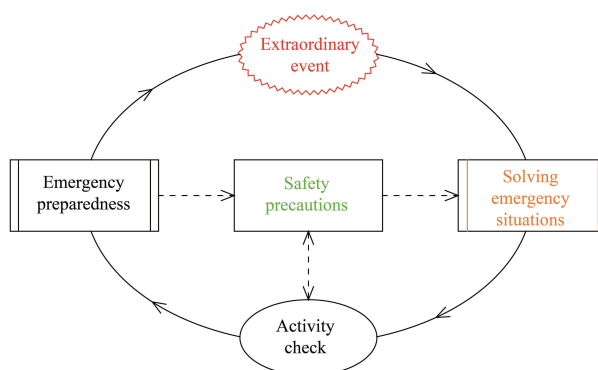


Fig. 2. Emergency management concept in the Czech republic [3]

Rys. 2. Koncepcja zarządzania kryzysowego w Republice Czeskiej [3]

Security threats to infrastructure in new climatic conditions

As clear from the previous chapter in this article, the general urban functionality and operability are conditioned by reliability of technical infrastructure. Despite technical progress however technical infrastructure can not achieve 100% system reliability and security of energy supply or drinking water. These systems can affect two fundamental factors which have a potential to shut down for a different time:

- natural influences,
- anthropogenic events.

These events occurrence is dependent on the geological and natural conditions in which the infrastructure is located in and at the same time on the technical adaptation of infrastructure facility concerned to handle difficult natural changes or anthropogenic events. With the upcoming climate change it is not only possible to increase the natural incidents number but also to increase intensity of the secondary anthropogenic emergencies impact in the affected area.

Natural influences

In the whole range of occurrence possibilities an extraordinary event with a natural character with an extremely negative impact on the useful environment of built-up areas and its infrastructure are floods, see in Fig. 1.

Floods, climatic and hydrological droughts will be almost certainly major threats in 21st century global climate threat. They will fundamentally influence the whole range of human activities and infrastructure facilities. Without a sufficient pre-

ventive preparation for their preparation, the consequences will increase in many cases and accumulate at the same time.

Anthropogenic events

Anthropogenic events themselves have often far-reaching negative impacts on human health and people's lives. However in many industrial activities they have also a potential to endanger the environment. This is particularly the case for aquatic ecosystems in which during the emergencies events with chemical leakage into receptacles or flooded soil layers, serious natural and safety damage can occur. These are in particular the following threats:

- groundwater or surface contamination
- temporary decommissioning of drinking water sources,
- serious damage to the environment, fauna and flora in the river basin,
- amplification of abovementioned extraordinary events with the simultaneous hydrological drought.

If a person has limited possibilities to influence the occurrence of extraordinary events or crisis situations caused by natural influences, then creating sufficient preventive conditions to minimize the consequences of threats to anthropogenic events is in the human power.

Elimination of natural and anthropogenic risks

The theoretical elimination issue of natural and anthropogenic threats is currently relatively sophisticated. However

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Bezpieczeństwo eksploatacji infrastruktury w nowych warunkach klimatycznych

Niezawodność budynków infrastruktury jest podstawowym warunkiem wartości użytkowej zabudowy w miastach i gminach. Niezawodność tworzy warunki wstępne dla długoterminowej stabilności zasobów mieszkaniowych ludności, a jednocześnie jest warunkiem rozwoju bazy przemysłowej regionu. Ta rzeczywistość jest postrzegana przez opinię publiczną jako oczywisty standard, który jest częścią ludzkiego życia. Jednak w rzeczywistości jest to bardzo złożony mechanizm, który może być poważnie zakłócony w różnych warunkach i sytuacjach. Aby zapobiec takim sytuacjom w praktyce, konieczne jest, aby państwo, rząd i różni operatorzy infrastruktury znali zagrożenia dla bezpieczeństwa, które mogą podlegać zmianom przez zmiany w środowisku naturalnym i być gotowymi na ich wyeliminowanie.

Artykuł dotyczy tych zagadnień, dotyczących rozpoznawania zagrożeń wynikających z sytuacji awaryjnych lub sytuacji krytycznych oraz określenia jakie zasoby są potrzebne do zwiększenia niezawodności infrastruktury.

Słowa kluczowe: niezawodność, bezpieczeństwo, infrastruktura, ryzyko, awarie, eliminacja ryzyka, odporność systemu