

Risk analysis - an alternative method in forensic sciences

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Abstract. The paper introduces an alternative method for damage pricing on buildings in consequence of defects, failures and collapses. This alternative method operates with time-independent price of the structure and follows damage on the construction. By using the risk analysis method the price of construction can be reduced depending on the technical conditions of the structure and the construction assessment can be made with compare of structures health.

Introduction

There are many scientific methods used in the civil engineering and subsequently in the forensic sciences [1, 2] and the applying of them depends mainly on the investigation area of course. Logically, to choose the correct one the theoretical research must be carried out at first [3].

Some methods are generally valid and therefore are useful to apply in all fields of study (e.g. comparison, general analysis), the others are specific [4] for the given field (see Fig. 1) or for given specialization (see Fig. 2) (e.g. thermal analysis, spectral analysis).

In the forensic engineering in construction field (see Fig. 2) especially in the construction process the lot of methods can be applied [5, 6]. We can use all available scientific methods [7] but the aim is mainly to use the simplest methods for their clarity and low cost demand. The construction process is complicated unit which is divided to a number of phases and the forensic experts can work in all of them (see Fig. 2).

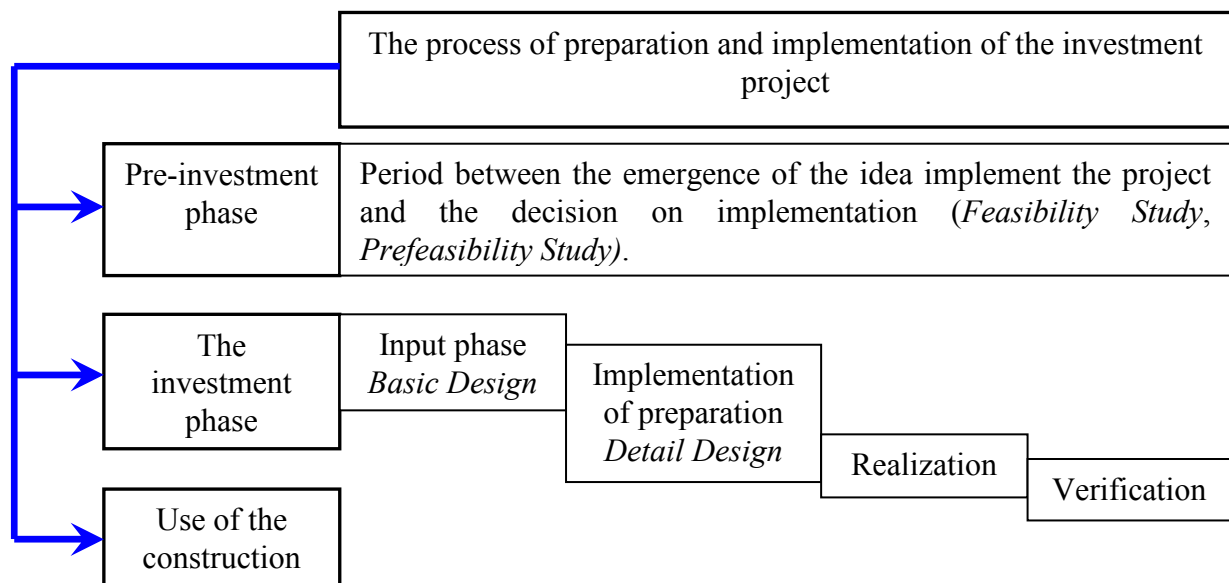


Fig. 1: Preparation and implementation of the project

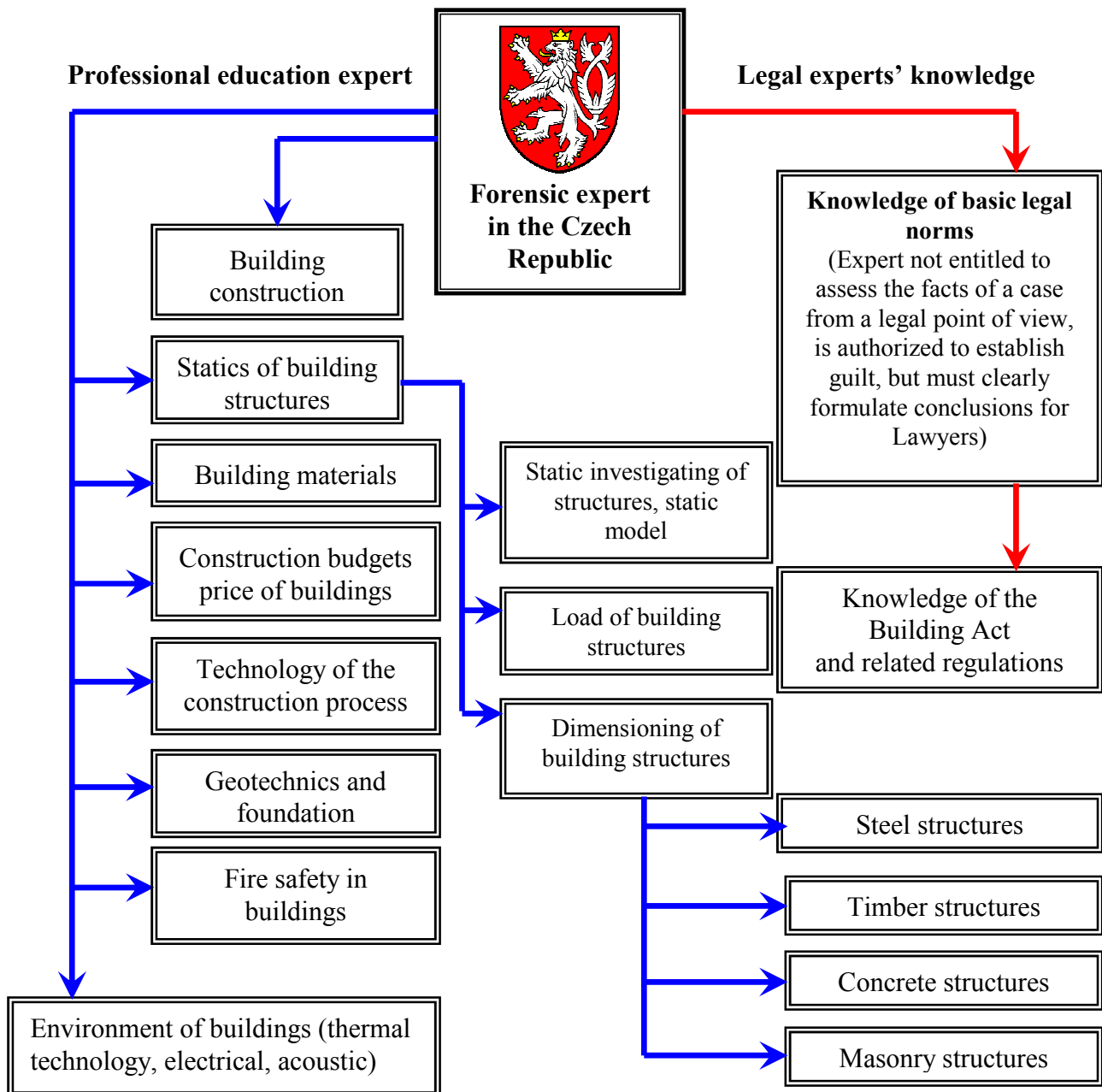


Fig. 2: Requirements for professional knowledge expert and legal knowledge

Alternative methods of forensic experts

Next to common methods used by forensic experts [5, 6] in the civil engineering [1] in case of all project phases (see Fig. 1) and of all specialization fields [7] (see Fig. 2) there is the scope for general risk analysis methods to use in. These methods are applicable and therefore they are also applied in all areas of the human activity. The dominant applications of these methods we can find in the management area (e.g. SWOT analysis) and in the banking area in the insurance and in the other areas. In civil engineering there is the place of risk analysis in the point of technical and economical studies and of course not only there [8, 9].

We can assume that the risk assessment of construction projects (see Fig. 1) will be placed increasing emphasis in the future as the result information is non-negligible decision making factor due to its relation to the economic aspect of the construction work. Likewise, in the field of forensic engineering the risk analysis methods have found their place. This is a field where the decision on the basis of a large amount of variables is required [10] and currently the acceptable decision-

making is based on the platform of logical and numerical methods. The practical examples have shown us that this way is real and that these methods are thereby complying with the basic requirements which are:

- Simplicity
- Clarity
- Low-cost demand
- Acceptable accuracy of the results
- Explanatory power

New method – Universal Matrix of Risk Analysis

The Method UMRA (Universal Matrix of Risks Analysis) was used for the first time around the year 1986 (by Prof. Milík Tichý) [11] for the construction of a tunnel as a whole (from a sketch), which means for the period from the initial idea, through a life cycle to its death. From 2005 to 2013 this method was applied separately for the individual phases of the construction. The method was consequently used also in forensic research and was proved and thus was verified in practice. On the basis of this verification a “certified methodology” was utilized for various dual usage with subsequent integration into instruction.

The possibility of usage (and also an official confirmation of an applicability of this certified methodology) has provided in this case an alternative method of forensic research and for giving proof.

At the same time a way has been opened for the application of other methods of risk analysis in the fields, which these methods were not primarily intended for. It is worth mentioning the use of SWOT analysis for assessing whether an area is suitable for construction (Pavel Vlček – dissertation, FAST VŠB-TUO, Ostrava 2012).

These activities have awakened other student’s interest in the unconventional usage of risk analysis methods such as the usage of the UMRA method in the process of creating a construction project (Silvie Dobiášová, [1] – dissertation, FAST VŠB-TUO, Ostrava 2013.)

The UMRA method was originally established for risk analysis, but as it turned out the sphere of application is broader. (Miluše Valjentová– dissertation, Faculty of Civil Engineering, ČVUT Praha, 2010). It is a verbally-logical/numerical method. It serves as an identification of danger, alternatively a script of danger, then as an estimation of the seriousness of danger, the estimate of damage or as a source for the creation of risk maps.

The method is based on matrix [3], [4], which assesses the confluence of sources of danger and endangered segments. Matrix-forming is the verbal part of the analysis, filling in the matrix is the logical-numerical part. The method enables the identification of potential danger or the qualification of the relative seriousness of danger. It is important to form a team of experts (the recommendation is from 5 up to 20 people) led by a risk analyst whose role is not only to moderate the execution of the analysis but also to process the expert’s statements.

The UMRA method lays emphasis on the formation of a team of experts, as during the application of this method the following factors are decisive: the qualification and experience of the experts, their perception and ability to estimate the character of concurrences, etc.

The results of the analysis using the method UMRA state the order of the importance of sources, the segments and concurrence from the point of view of an examined process, project or object. They can be used as input data for further analysis using the FTA method in order to create a tree of malfunctions, or they can be further analysed by the FMEA method.

The above mentioned principles were newly applied into two sectors that were mostly dealt with as the issues of a forensic expert in an expert’s report on structures in the case of a lawsuit or building and construction accidents:

- Determination of the order of construction units from the point of view of the assessed structural-technical state.

- Determination of the damage assessment amount and its share in the assessment of a building.

All the general rules and principles of work with this method have remained the same and students have the opportunity to think over how to adjust and alter this method.

Summary

Using of risk analysis methods is useful as an alternative method for forensic engineering field. Practice has proved that the methods which are designed for management or designed for the others non-technical field can be used also in forensic field very effectively. The risk analysis methods provide additional decision-making forensic tool in the area where doesn't exist any other relevant instrument.

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