Utilization of Risk Analysis Methods in Decision-Making Process on Fitness of Rehabilitation

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Abstract. The paper reflects the possibility of utilization of methods and proceedings used in risk assessment for area different from nowadays usage. Risk determination is customary for large and significant constructions within the feasibility study. Used procedures and methods can be applied very well in some cases of expert's and authorized proceedings, such as setting the sequence of buildings acceptable for reconstruction of objects in defined group, or setting the coefficient for specification of claim amount arisen in the construction in the case of time-independent price.

Introduction

Risk assessment is usually the experts [3]. Forensic expert must express the damage in funding. It is in the money. The valuation of buildings or insurance works with so-called time value, that is the price for "amortization". It takes into account the wear and tear of structures, its condition at the time of assessment. Unlike the award-winning building has this value (the amount of damage - quantification of compensation for damage) nothing to do with the "time value", the price relative to time (the length of) the existence of structures, building or structure. Time works price of the lifetime of the object (building or structure) and the duration of its existence, ie with age. In the case of determination of damage to the building or building construction this procedure by using prices depend on time is inappropriate.
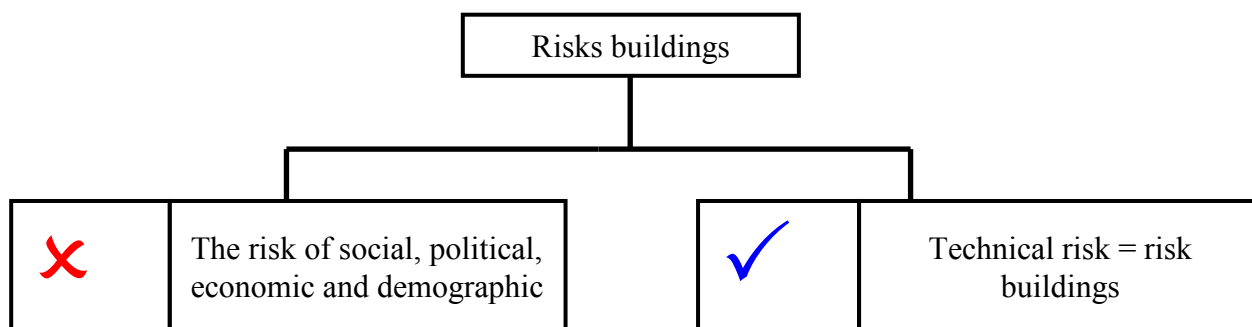

Fig. 1: The basic risk allocation

Every human activity is burdened with a certain degree of risk. The activities collectively known as the "construction" we are facing a lot of risks. These risks arise from such social conditions of the region, the demographic composition of the population in the region, etc. For example, faulty market research related to the purchasing power of the population, thus erroneously developed economic studies may lead to the construction of shopping centers in places where there is sufficient purchasing power of the population (Fig. 1). Then this investment can be thwarted.

The risk analysis is solely engaged in technical risk.

Universal Matrix of Risks Analysis

The Method UMRA (Universal Matrix of Risks Analysis) was used for the first time around the year 1986 (by Prof. Milík Tichý) 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 [3], [4]. 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 [7] – dissertation, FAST VŠB-TUO, Ostrava 2012).

These activities [2] 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 [5], [6] 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 analyzed 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 [3], [4]:

- 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.

Evaluation of the data

Evaluation can be done in two methods. We use evaluation
- Analytical
- Histograms

Analytical evaluation of the data is based on the use of simple mathematical formulas for evaluation. The calculation result is obtained, which is the benchmark variable.

$$Pc_t = \frac{\overline{\sum_{ijk}} Sv_{ijk}^E}{Sv_{max} \cdot N_{act}^E} \tag{1}$$

Evaluation using histograms is to build histograms of frequency matching variables [8]. Histograms compound each other (1), (2), (3) and comparative magnitude as the 90% quantile-rs.

$$H_{ST} = f\left(H_{ZD1}; H_{ZD2}; H_{ZD3} \cdots H_{ZDN}\right) \tag{2}$$

$$H_{ST} = \prod_{ZD=1}^{N} H_{ZDN} \tag{3}$$

$$H_{ST7} = \prod_{ZD=1}^{N} H_{ZDN} = \prod_{ZD=1}^{10} H_{ZD1\ldots10} = H_{ZD1} \cdot H_{ZD2} \cdot H_{ZD3} \cdots H_{ZD10} \tag{4}$$
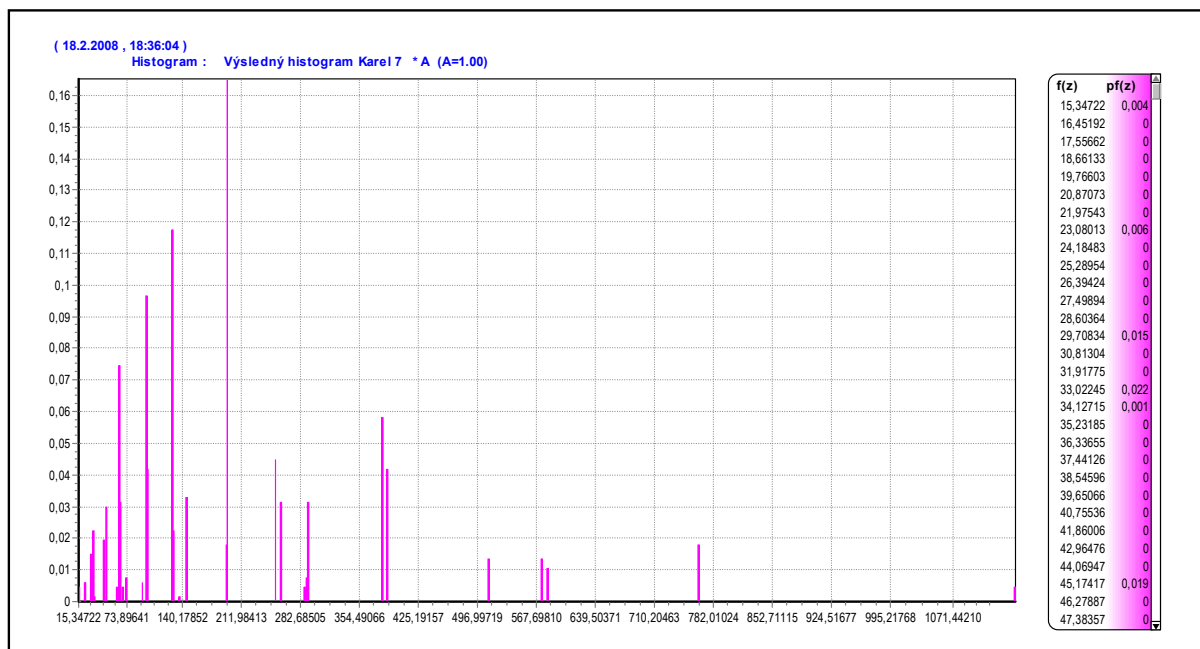

Fig. 2: Histogram

Summary

By comparing the two methods is possible to conclude that:
- Both methods (both classical and probabilistic approach) are useful in this area expert and expert assessment of objects and structures.
- The probabilistic approach takes into account the distribution of assessments and therefore better reflects the expert assessment provided by the respect in the resulting quantity and therefore it translates into a sequence of objects.

- For that reason, it may be inferred assumption that the importance of the probabilistic approach will be enhanced by higher data samples, namely, the amount of resources danger, a sufficient number of experts. It will therefore be preferable to use a probabilistic approach in a larger complex of buildings (structures).

Acknowledgements

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