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Abstract

The thesis is aimed at improvement of procedures for the risk assessment of structures exposed to accidental actions. For the risk analyses of structure in accidental design situatitons, the probabillities of occurrence of hazard events, the potential consequences of structural failures, measures undertaken for prevention or mitigation of adverse events and levels of acceptable risks are taken into account.

Selected terms and their definitions are introduced in the first part of the thesis because the correct application of terminology facilitates the mutual understanding of all involved parties in the process of risk assessment. The basic methods for the risk assessment of structures and technical systems are infroduces and the main advantages and disadvantages of the methods are evaluated.

Applied methods for the reliability assessment of structures take into consideration the structural resistence and action effects only. I tis shown that the structural reliability in accidental design situations caused by extreme actions and environmental influences may be effectively investigated using methods for risk engineering. The methods for risk analysis and risk assessment of structures in accidental stituations are illustrated by practical applications.

The basic tools of risk assessment consist of event tree method and Bayesian networks. The concequences are presented in the form of F/N curve which enables to express expected consequences with respect to the probabilitie of human injuries and excluding influence of the value place on preventing fatalities, based on the theory of socio-economics.

The presentation of results in F/N curve seems to be more efficient that expression of risks as the product of probabilities and consequences which may lead to the same results when considering a rare event. With extensive conseguences or frequent event with small consequences.

Two elected types of structures are considered in detail:

- Bridge pier in the vicinity of railway endangered by the train impact
- Road safety barriers on roads and their levels of retention

The recommended procedures of UIC 777-2 for the risk assessment of structures in track zones are considered. Procedures given in the UIC code are developer using event three method and Bayesian networks and further extended to determi resulting risks in the form of F/N diagrams.

It is shown that specification of the optimum distance of bridge column from railway lines can be based on the methods for risk analysis and assessment that may supplement currently used procedures for structural design.

Similarly the optimal retention levels for different intensities of heavy road vehicles considering several road categories are based on the methods for risk assessment.

It appears that the procedures proposed in the thesis may lead to cost effective structures and effective risks mitigation measures.

Further research topics related to application of risk assessment are outlined.