Abstract

The dissertation focuses on the use of finite element analysis in the durability and reliability assessment of road restraint systems, with a focus on steel barriers subjected by heavy vehicle impact loading. The topic reflects authors several years of experience in simulating impact tests of road barriers for leading European manufacturers, carried out at TÜV SÜD Czech Ltd. In addition to classical analytical approaches based on normative bases and energy approaches, the thesis develops a methodology for the analysis of impact tests using nonlinear dynamic simulations. This approach is then validated on several case studies selected from the Road barrier impact test results database. The database has been developed for the purpose of this work with the support of accredited testing laboratory in Germany as an integral part of the results. The work defines the ultimate limit state for road barriers and similar structures, which has not been accurately described yet. For analytical models this represent a basic evaluation parameter. Furthermore, the thesis deals with explanation of the crash event modelling using nonlinear dynamic simulations. Next section is devoted to a determination and analysis of the model uncertainties in relation to crash tests. The effect of the selected model uncertainties on the test results is then quantified with the aid of simulations. The simulation approaches described and verified in the first part are further used to propose a probabilistic assessment of road barrier subjected to heavy traffic impact. Finally, the methods and models used in this thesis are applied to solve the task of determining the impact force from heavy vehicles on bridge support structures, mainly those protected by road barriers.

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