

Summary of the research project

The present research project deals with the problem of gas explosions in buildings. Besides the development of a design proposal for the explosion pressure based on probabilistic analysis, rules for the construction of buildings are suggested. With the aid of these rules, the probability of a structure failure can be decrease in the case of a gas explosion in buildings.

With the new design proposal it is possible to calculate an equivalent load for the gas explosion effect in dependence of the ratio A_v/V (area of the pressure release panel/volume of the room considered). Based on the accomplished computer analysis it is assumed that for standard wall constructions the explosion effect can be assumed to be a static load, because the natural frequency does not reach the excitation frequency. The new proposal does fulfill the limit values of the probability of failure of structures considering the little probability of occurrence of a gas explosion. It is shown, that the design values for explosion loads according to DIN 1055-100 are smaller than the values calculated with the new approach. That means DIN 1055-100 does not lead to sufficient safe designs in some cases.

It can be stated that the intensity of the explosion pressure caused by gas explosions depends on diverse parameters whose influence is difficult to specify. Additionally it has to be considered that in some cases these parameters are depending on each other. Most of all the influence of turbulences concerning the resulting pressure has to be analyzed by experiments to get realistic results.

Using the results of the computer analysis the following rules of construction can be formulated to reduce the resulting explosion pressure and to strengthen affected structural elements: The resulting pressure in a room can be reduced by choosing a quadratic floor plan and large windows. Turbulences resulting from furniture etc. should be avoided. Most of all masonry walls without reinforcement are imperiled. The load bearing capacity of these walls can be increased significantly by activating a multiaxial load transmission. This can be archived by planning bracing reinforced (concrete) columns in distance of the wall's height. Reinforced concrete slabs should provide reinforcement on the top and the bottom which should be raised on the top of the slab in the area of the affected wall.