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Probabilistic model for fire department response

Based on fire brigade reports

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⊃ Introduction

- Fire fighting measures play an important role in the performance-based design of structural fire safety

- For that reason the safety concept in DIN EN 1991-1-2/NA (EC 1-1-2/NA) contains a probability of failure for fire fighting measures that influences the required protection measures

- In case the fire fighters are not able to control a fire, it spreads beyond the compartment of origin and can effect other units,
  ➔ the measures are assumed to have failed

- The probabilities given in EC 1-1-2/NA are based on a very simple model

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⊃ Model for reliability of fire fighting

- It is assumed that fire fighters are able to control a fire up to a certain size, depending on the usage of a building and type of fire brigade (e.g. professional fire brigade vs. voluntary fire brigade) and the overall response time

- A fire is assumed to spread radially with a certain speed

- A longer fire brigade response leads to higher probabilities of failure (reliability analysis)

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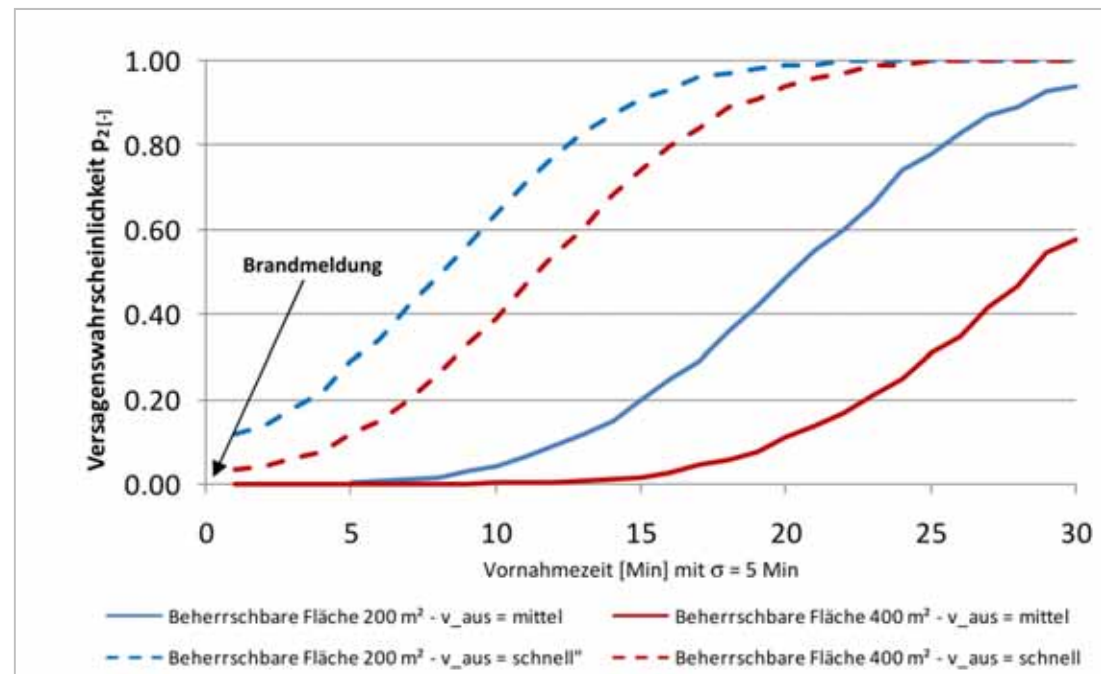
⊃ Improvement of the model

- It was assumed that the simple model was too coarse, as the reliability of the fire fighting measures is mainly based on the (assumed) overall response time to the scene
  ➔ a later intervention of the fire brigade leads to a larger fire size

- The values for typical response time and the controllable fire size had to be chosen based on reasonable assumptions as fire statistics are not collected systematically in Germany
  (Insurances and fire brigades often
  have no interest in publishing data)

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⊃ Improvement of the model (cont´d)

- The intervention time of fire brigades was investigated more deeply in a diploma thesis at Technische Universität Braunschweig

- The time interval „overall intervention time" was splitted into

  - detection time of the fire

  - dispatch time of the fire fighters

  - turnout time of the fire brigade

  - travel time to the scene

  - setup time at the scene and reaching of the fire

- Fire brigade reports of fire brigades of cities of different sizes and types of fire brigades were evaluated to improve the information

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⊃ Results

- The analysis of data from fire brigades in different cities allowed for the validation of the simple model for the reliability of the fire brigade response

- The analysis showed that there is a significant difference between voluntary and professional fire brigades due to the larger dispatch and turnout time

- In general it was found out that the results of the simple model were sufficient enough for the usage with the safety concept for performance-based structural fire design

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