

## 2.26 Procedural method of application of engineering methods in Germany (short version)

Zehfuss J., Germany

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# Procedural method of application of engineering methods in Germany

## Fire design practice in Germany



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Dr.-Ing. Jochen Zehfuss is head of the Hamburg branch. For six years now, Dr. Zehfuss consults architects and owners in fire protection as well as implements construction projects in Germany and worldwide.

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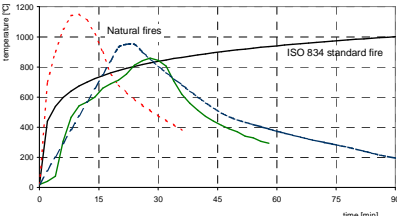
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## Introduction

### Material requirements in German building codes

- R 30 for buildings  $h \leq 8$  m
- R 60 for buildings  $h \leq 13$  m
- R 90 for buildings  $h > 13$  m and special buildings
- For common design of steel elements usually cost-intensive fire protection materials needed



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## Introduction

Safety targets anchored in building codes

- Prescriptive design
  - Material requirements according to building codes and guidelines
- Performance-based design
  - holistic fire design concept
  - Application of engineering methods

➔ Optimisation of fire protection

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## Application of performance based design

- Application of performance based method is a deviation of the building code
- Application of performance based method requires emphatic approval of the building authority and the fire brigade
- Performance based design is conducted by Eurocodes
- Annex A, E and F of Eurocode 1-1-2 was not accepted by building authorities
- National annex replaces informative annexes of Eurocode 1
- National annex is to published in August 2010

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## National annex of Eurocode 1-1-2

Nationaler Anhang - National festgelegte Parameter — Eurocode 1 - Einwirkungen auf Tragwerke — Teil 1-2/NA: Allgemeine Einwirkungen - Brandeinwirkungen auf Tragwerke

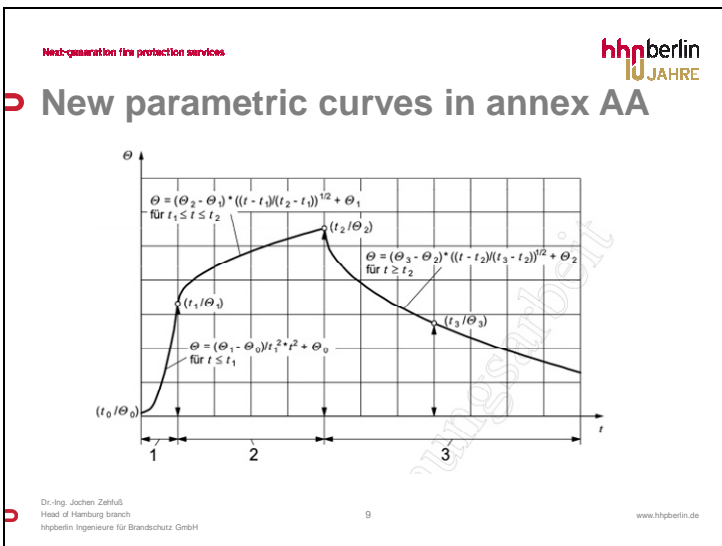
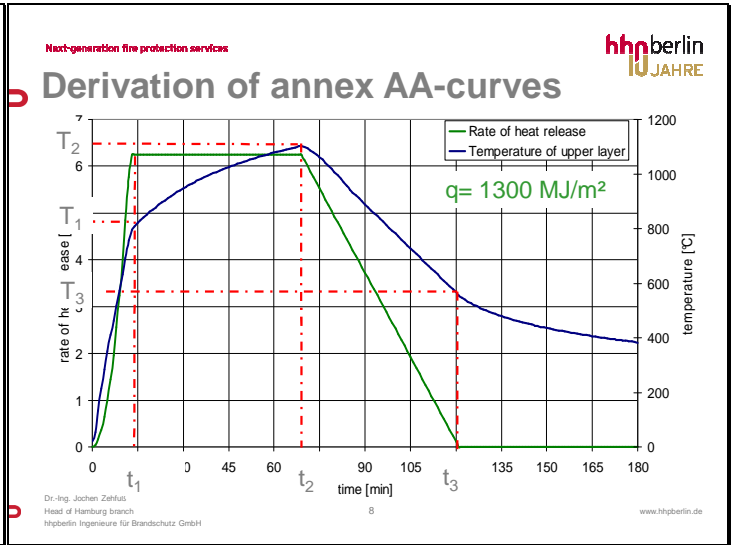
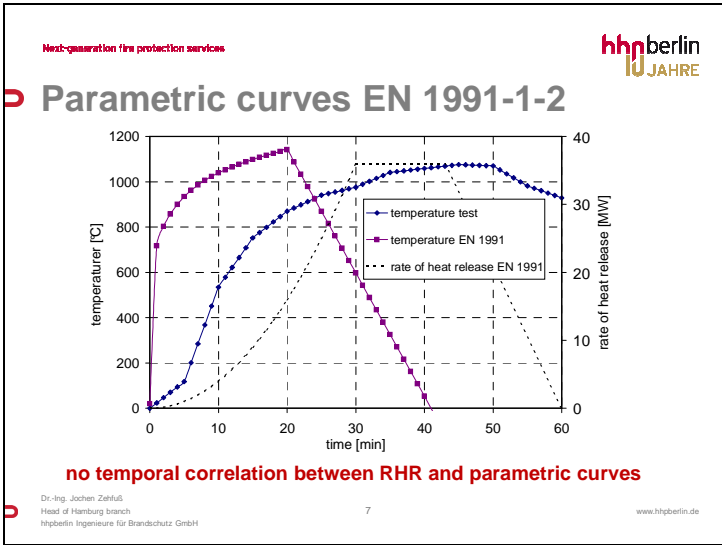
National Annex - Nationally determined parameters — Eurocode 1 - Actions on structures — Part 1-2/NA: General actions - Actions on structures exposed to fire

Annexe Nationale - Paramètres déterminés au niveau national — Eurocode 1 - Actions sur les structures — Partie 1-2/NA: Actions general - Actions sur les structures exposées au feu

- Annex AA Simplified natural fire model for fully-developed compartment fires
- Annex BB Input data for application of natural fire models (including a new safety concept)
- Annex CC (informative) Checking and validation of calculation programs for fire safety design by advanced calculation methods

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### New safety concept in annex BB

$$\dot{Q}_{max,d} = \dot{Q}_{max,R} \cdot \gamma_{f,Q}$$

- Probability of occurrence per year:  $P_{fi} = p_1 \cdot p_2 \cdot p_3$
- p1: probability of occurrence of an initial fire in a compartment
- p2: probability of failure of manual fire defense
- p3: probability of failure of fire protection measures
- accepted probability of failure (e.g.  $p_i = 1,3 \cdot 10^{-5}$  for medium damages)
- accepted conditional probability of failure:  $P_{t,fi} = p_i / p_{fi}$
- reliability index:  $\beta_{fi} = -\Phi^{-1}(p_{t,fi})$

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