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From prescriptive arrival times to performance based fire service delivery:

Parallels of Fire Service Planning and Fire Engineering

PSAM12
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Project „TIBRO“

- **=** Tactical-strategic Innovative Risk-based Fire Service Planning
- ORBIT (1970s study still referenced and used today)
- Funded by the German Federal Ministry of Education and Research
- From April 2012 to March 2015
- **Objective**: scientific foundations for public fire service planning adaptive for future challenges

- Need for fundamental research

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Fire Engineering

- Historical
  - –Prescriptive building codes
  - –Accumulated experiences
  - –Hazard-based
  - –Deemed-to-satisfy objectives
  - –Easy to apply
  - –Generic solutions
  - –Limited flexibility & progress

Picture: http://www.traveldarkly.com/wp-content/uploads/2014/03/Great-Fire.jpg

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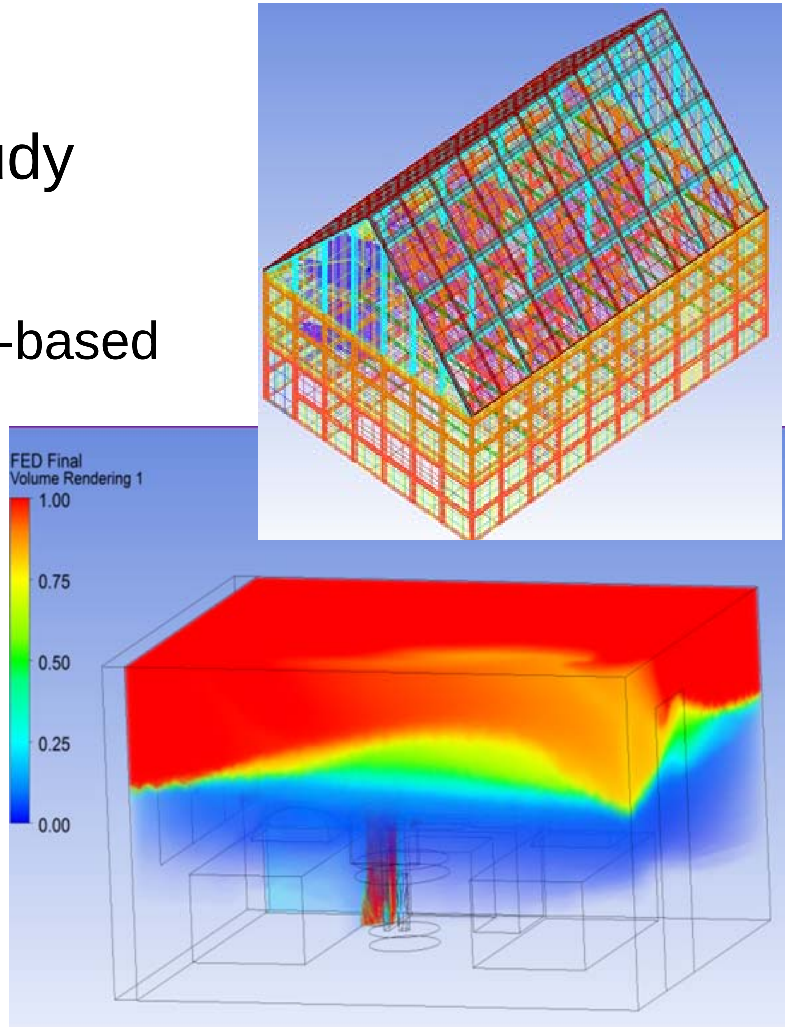
Fire Engineering

- Fire Engineering as science and study
  - –Deviation from codes allowed
  - –Alternative proof of safety: Performance-based
  - –Calculations & CFD
  - –Qualitative performance requirements
  - –Quantitative acceptance criteria
  - –„Risk-based“
  - –Tailor-made individual solutions
  - –More complex but innovation-friendly



Pictures: Saupe, Schubert, Krause, University Magdeburg

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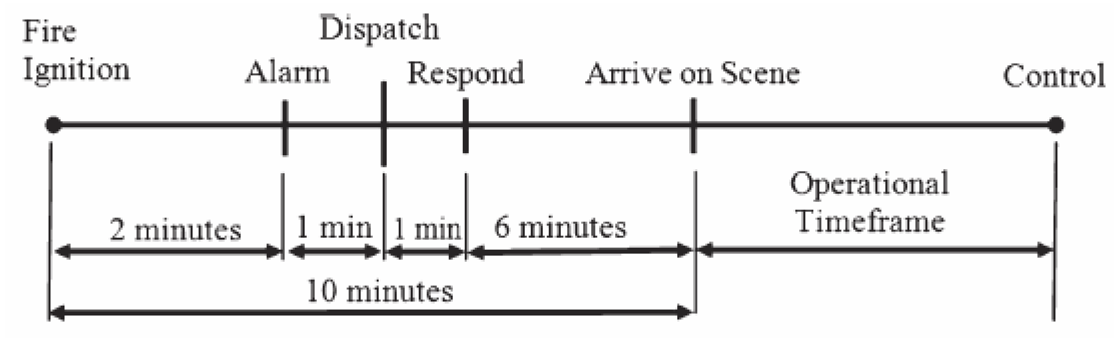
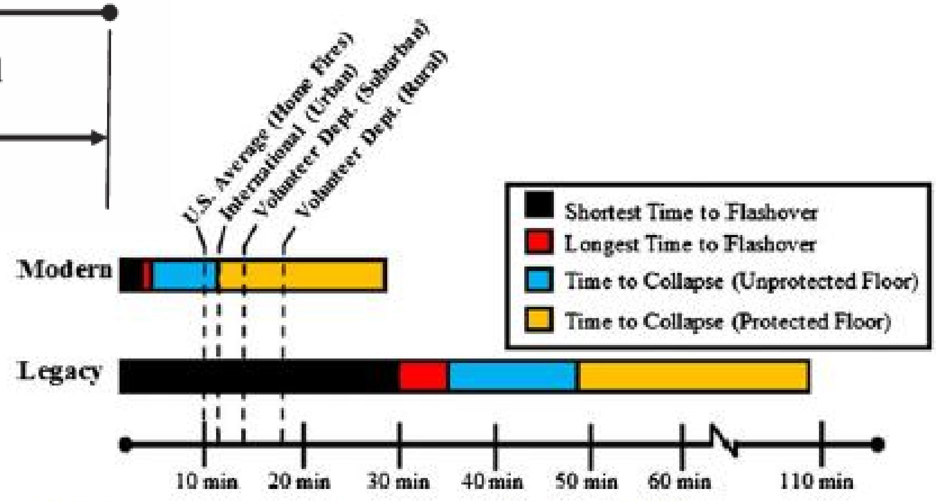
Strategic Fire Service Planning

- Prescriptive arrival times (8-15 min): Benchmark for „safety“
- No validated correlation between fire growth and benefits of arrival times

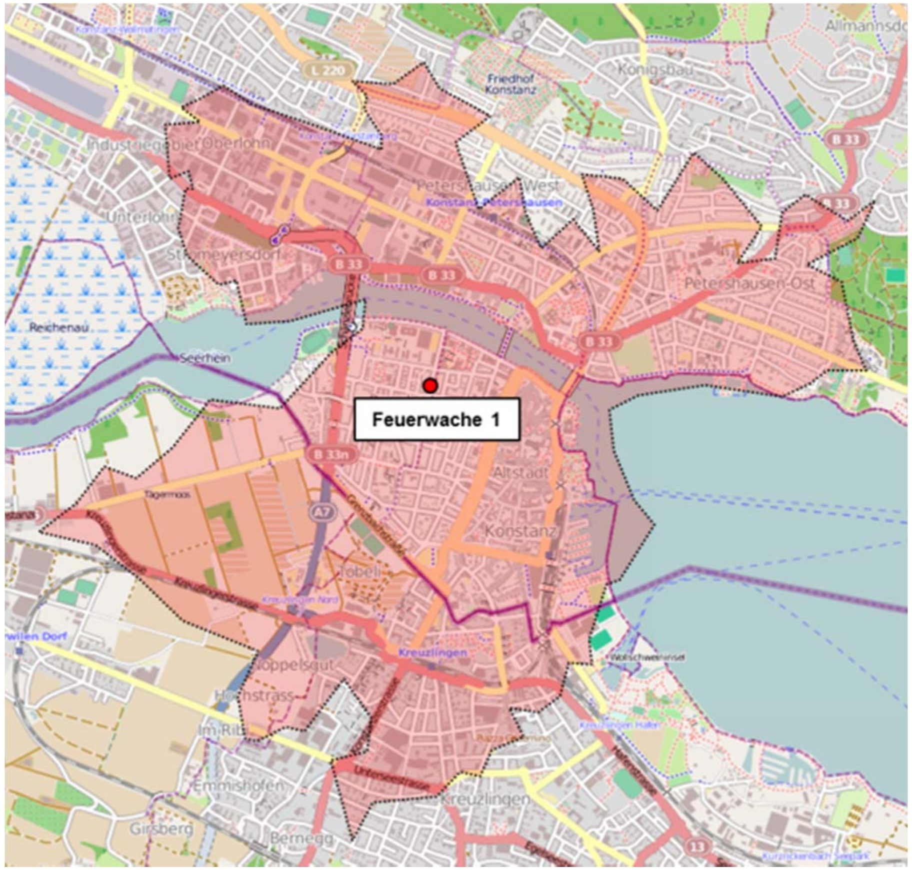


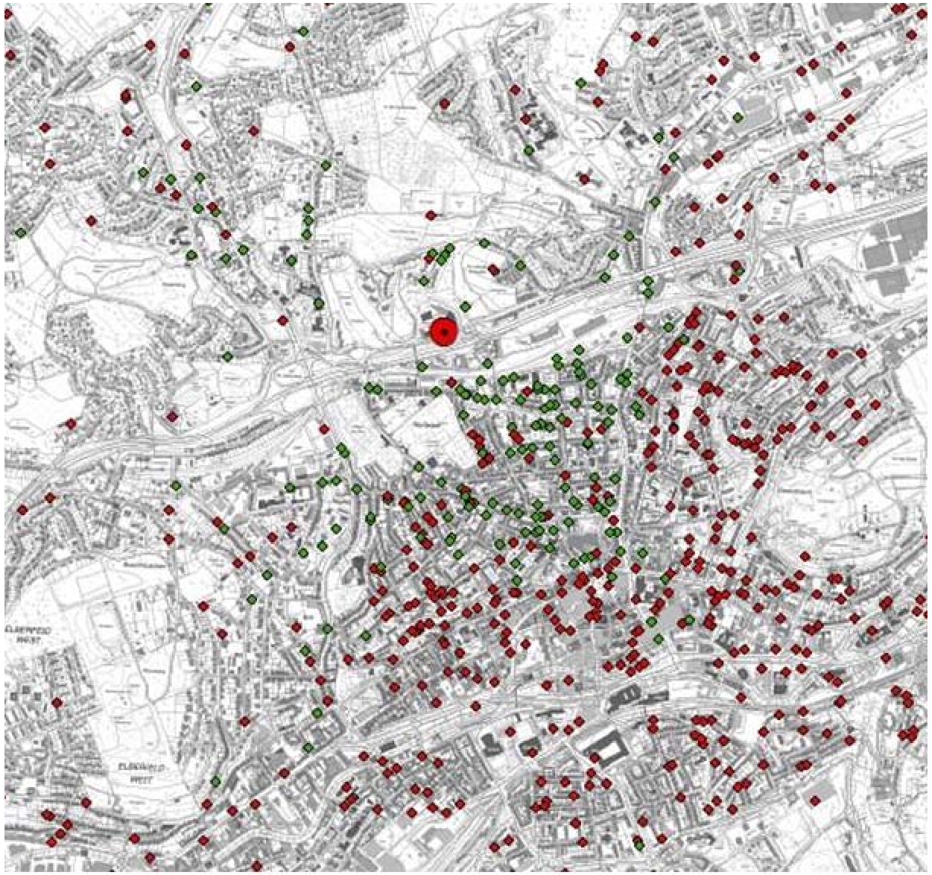


Pictures: [33]

Arrival times: Isochrones

- More complex models, Geographical Information Systems





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„Performance-based“ Fire Service

- Risk-based approach
  - More fire service where necessary, less in safer areas
  - Only in its infancy
- Inputs
  - Hypotheses on risk parameters (population, height, occupancy and construction type of buildings, fire calls, rescues/injuries/deaths etc.)
  - Databases of fire service and other agencies (Police, Ambulance, Public Housing, Statistics Office, Traffic department etc.)
- Performance Measurement & Management

Similarities

- Common questions:
  - How safe is safe enough?
  - How much money must be spent on adequate safety?
- No holistic answers yet
- Uncertainties must be clearly communicated

- Example common link: Structural integrity
  - Performance requirement: Enable efficient fire service operations
  - Speed of fire service response
  - Load-bearing capabilities of structure

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Validation and Verification Issues

- Increasingly complex software packages (CFD, GIS, etc.)
- Still many assumptions because of insufficient knowledge
- A lot of „operational experience" and „expert judgement"
- Lack of
  - empiric data and evidence
  - methods for verification of results
  - awareness for limitations and validity of results
  - manpower and knowledge to check solutions by AHJ
  - clarity in communication of results (formulae as smoke screens?)

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Conclusions

- Fire Engineering and Strategic Fire Service Planning face similar problems
- More sophisticated models don’t necessarily bring more clarity and accuracy
- Results should be viewed conservatively and compared to best practices and operational experiences
- More fundamental research is paramount for both areas

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Thank you

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