New developments in Nordic countries in fire safety engineering guidance

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The Nordic Committee on Building Regulations – NKB 1994:07
A preliminary guideline

• Deterministic analyses
  – Some simple calculation methods and acceptance criteria

• Probabilistic analyses
  – ”Referring to the literature”

• NKB 1994 committee:
  – “International standardization has not yet come so far that it provides the tools necessary for design and control in order to be able to verify that the performance based requirements are met”

• 2011?
The Nordic Model

1A: Goals (political level)

1B: Functional requirements

1C: Operative requirements

2: Approved document

3: Performance based design

3A: Analysis methods

3B: Acceptance criteria

Design solutions (building)
1B: Functional requirements

1C: Operative requirements

2: Approved document

Design solutions (building)

The National Building Authority

"..stability and load-bearing capacity for at least the time required to escape and rescue persons being in and on the construction works."

"Acceptable solution" in a two-storey residential building

REI 30
The National Building Authority

1B: Functional requirements

1C: Operative requirements

2: Performance based design

Design solutions (building)

"...stability and load-bearing capacity for at least the time required to escape and rescue persons being in and on the construction works."

REI 30
1A: Goals (political level)

1B: Functional requirements

1C: Operative requirements

Design solutions (building)

2: Approved document

3: Performance based design

3A: Analysis methods

3B: Acceptance criteria
Most projects may be designed according to the “Approved document”, but deviations are frequently occurring!

The Building Code: “Construction works shall be designed and executed for rapid and safe escape”.

Is the functional requirement fulfilled?
Is the Performance Based Code fulfilled?

The Building Code: “Materials and surfaces not contributing to an unacceptable degree of development of the fire shall be used”
Experiences

• The verification of alternative fire safety designs is of poor quality
• No “agreed”/standardized method(s)
• “Rhetoric engineering”
• No authority surveillance
• No third party review in the majority of the projects
• ”Engineering shopping”
### Experiences

Disputes between the different stakeholders

<table>
<thead>
<tr>
<th>Fire safety designer</th>
<th>Third party reviewer</th>
<th>Client</th>
<th>Local authorities (AHJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Building authorities</td>
</tr>
<tr>
<td>OK</td>
<td>not OK</td>
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<td>? 1)</td>
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<td>OK</td>
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<td>not OK 3)</td>
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</tbody>
</table>

1) AHJ should not intervene, but leave it to the client  
2) The client has to protect his own interests  
3) The fire brigade finds the verification insufficient
The performance of Fire Safety Engineering

We have to get the engineers on the same track!
DISEÑO BASADO EN PRESTACIONES: AVANCES Y NUEVOS RETOS
Performance-Based Design: Advances and New Challenges

2: Approved document
   2A: Analysis methods
   2B: Acceptance criteria

3: Performance-based design
   3A: Analysis methods
   3B: Acceptance criteria

Engineering methods to verify deviations
CEN TC 127 TG 1 WI 3
> 95 %

Engineering methods to verify the building design as a whole
CEN TC 127 TG 1 WI 1
< 5 %
CEN TC 127 TG 1
Fire safety engineering

Work items:
WI 1  Assessment methods and acceptance criteria
WI 2  Design fire scenarios
WI 3  Use of FSE in connection with prescriptive regulation
WI 4  Content of documentations
WI 5  Data on materials and products to be used in FSE assessment
New developments in Nordic countries in fire safety engineering guidance

• Nordic project
  - Verifying Fire Safety Design in Sprinklered Buildings (2011)
    - How to verify deviations (Fredrik Nystedt, Lund Univ.)
    - Performance data on sprinkler systems (COWI Norway)
Verifying Fire Safety Design in Sprinklered Buildings
Fredrik Nystedt, Lund University

• Guidance on verifying trade-offs
• Step by step procedure
  – Control of fire growth
  – Control of smoke spread within the compartment of fire origin
  – Limit of fire and smoke spread within building and preventing structural collapse
  – Preventing fire spread between buildings

• In English
## Verifying Fire Safety Design in Sprinklered Buildings

**Fredrik Nystedt, Lund University**

<table>
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<tr>
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<th>Smaller fire compartments</th>
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<th>Comparative</th>
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<td>Comparative Absolute (ASET-RSET)</td>
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<td>Larger fire compartments</td>
<td>Quantitative-deterministic</td>
<td>Absolute (ASET-RSET)</td>
</tr>
<tr>
<td>Prevent fire spread between buildings</td>
<td>Building of fire origin equipped with sprinklers</td>
<td>Quantitative-deterministic</td>
<td>Absolute (radiation)</td>
</tr>
<tr>
<td></td>
<td>Both buildings equipped with sprinklers</td>
<td>Quantitative-probabilistic</td>
<td>Comparative</td>
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Sweden (Boverket)
- Guidance on performance based design (in progress – 2011?)
  - Verification needs – how to assess
  - Analysis methods - principles
    - Qualitative assessment
    - Scenario analyses (deterministic)
    - Quantitative risk analyses (probabilistic)
  - Compulsory design fire scenarios
  - Etc.
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**Norway**
- Mandatory third party review (2012)
  - Fire safety strategy
  - New standard
- Revised standard on risk assessment (2011)
  - Incl. comparative analyses *(new)*
    - Compare to a reference building which complies with “Approved document”
    - Fire scenario analyses; compulsory design fire scenarios
- Guidance on surveillance (2007)
  - To be performed by the local building authorities (AHJ)
  - Has also served as a guidance on fire safety engineering
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Association of Consulting Engineers (RIF), Norway

• Guidance on responsibility for the planning of fire safety design (interface issues)
• Guidance on fire safety engineering and control
  • Defining the “arena” of the fire safety engineer
  • Reduce the risk of conflicts on responsibility
• Ethical guidelines (in progress)
Gracias por su atención
Thanks for your attention

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