TALLINN UNIVERSITY OF TECHNOLOGY

# Fire Safety Regulations for Timber Constructions in Estonia

Alar Just

Riga 19.4.2017

# Estonia


**Tallinn University of Technology**
- Fire research of structures (timber, steel)

**Rescue Board**
- Prevention
- Regulations
- Safety

**Fire laboratory of TÜV**
- Full scale testing

**Estonian Academy of Security Sciences**
- Fire safety
- Fire prevention

**Training center for rescue teams**
- Polygon for large scale fire tests

# Estonia - Building regulations for fire safety

**BUILDING LAW**

**Ministry Decree No.54: Fire safety of buildings and building parts (replaced on 7.4.2017)**

- Acts from 2005
- Prescriptive rules
- Performance based design allowed

**Estonian Rescue Board**

- Special comission for bigger timber buildings

# Market

**Single family houses - 50 % in timber**

**Multy storey houses – 2 %**

**All buildings (incl office, industr etc) – 15..20%**

**Export of timber houses (2013) – 202,3 mEUR**

mostly Norway, Germany

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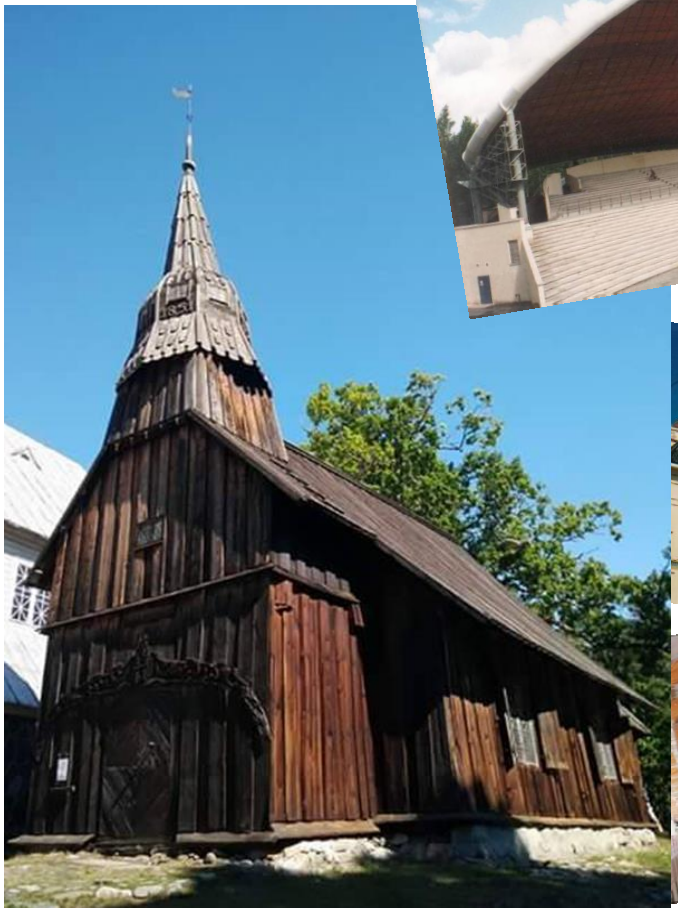
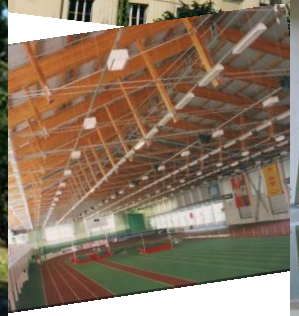
TALLINN UNIVERSITY OF TECHNOLOGY






Pühajärve Spa

# Fire safety requirements for buildings and requirements for firefighting water supply

**Chapter 1**
**GENERAL PROVISIONS**

**§ 1. Scope of application of the regulation**

This regulation sets out the fire safety requirements for an edifice to prevent a fire and any risk thereof (hereinafter: *the fire safety requirements*) and the requirements for firefighting water supply.

**§ 2. Definitions**

(1) For the purposes of this regulation, a fire is an uncontrolled combustion process outside the designated places for a fire, which is characterized by the emission of heat and smoke, and involves a risk to human life or health, property or the environment.

(2) For the purposes of this regulation, risk of a fire is a combustion process outside the designated places for a fire that does not involve a risk to human life or health, property or the environment. In the case of unobstructed development of this event, it may develop into a fire.

(3) For the purposes of this regulation, specific fire load is the aggregate heat produced per unit of area when an edifice burns, released by the burning of all combustible materials – including walls, floors or ceilings – in a room. The unit of measurement of its size is megajoule per square metre.

(4) For the purposes of this regulation, reaction to fire is the propensity of the material of an edifice, upon exposure to fire, to ignite, spread fire, produce heat, smoke, toxic gases or burning or hot drops.

(5) For the purposes of this regulation, fire resistance is the ability of a building structure or portion thereof to preserve, during the prescribed period in the event of a fire, its required load-bearing capacity, integrity and thermal insulation capacity, generally determined by standard fire tests.

(6) For the purposes of this regulation, the structures of a building include the supporting, roof and fire barrier structures of a building.

(7) For the purposes of this regulation, a stiffening structure of a building is part of the supporting structure of the building.

New regulation
From 7.4.2017

# Fire safety requirements for buildings and requirements for firefighting water supply

The conformity of a building to important fire safety requirements shall be deemed to have been proven if, /…/

1) the building conforms to the limits stipulated in the regulation;
2) the building conforms to the relevant technical norms;
3) the building conforms to the relevant standards, or
4) conformity to important fire safety requirements has been proven analytically (*analytic proof*).

# Use of timber - Prescriptive rules

**Number of storeys allowed**

- 2 storeys
- 8 storeys for residential and office buildings

**Load-bearing resistance (general)**

- R30 for single houses
- R60 to R180 up to 8 storeys

# Prescribed rules

| | Fire safety class | | | | | | |
|---|---|---|---|---|---|---|---|
| | TP1 | | | TP2 | | | TP3 |
| | Specific fire load MJ/m$^2$ | | | Specific fire load MJ/m$^2$ | | | |
| | over 1 200 | 600–1 200 | below 600 | over 1 200 | 600–1 200 | below 600 | |
| Generally, a building with up to two storeys | R 120* | R 90* | R 60* | R 30 | R 30 | R 30 | – |
| –use types II and III and basements | R 120** | R 90** | R 60** | R 30 | R 30 | R 30 | – |
| generally, a building with 3 to 8 storeys | R 180** | R 120** | R 60** | - | - | - | - |
| buildings with 3 to 8 storeys with use type I or V | | | | | | | |
| –aboveground storeys | R 180** | R 120** | R 60** | R 180* | R 120* | R 60* | - |
| –basement levels | R 180** | R 120** | R 60** | R 180** | R 120** | R 60** | - |
| Buildings of more than 8 storeys | R 240** | R 180** | R 120** | - | - | - | - |
| Basement levels below the first underground basement level. | R 240** | R 180** | R 120** | R 240** | R 180** | R 120** | R 60** |
| Firewall | REI-M 240 | REI-M 180 | REI-M 120 | REI-M 240 | REI-M 180 | REI-M 120 | EI-M 60 |

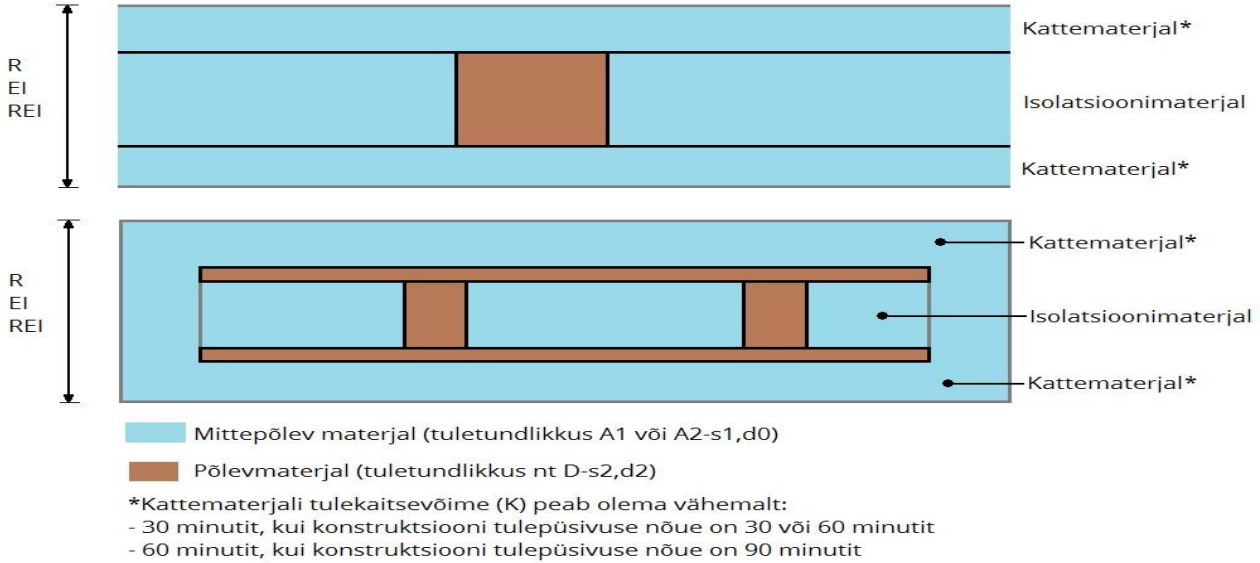
# Load bearing wooden structures

5 to 8 storey residential and office buildings

**Automated firefighting system is required**

# Encapsulated timber

handled as concrete or steel



# Wooden house?

# Use of visible timber

**Reaction to fire**

- Limitations of the linings in escape routes (B-s2,d0)
- Limitations for the 3 and 4 storey houses (B-s2,d0)
- Limitations on the escape routes

**Facades**

- Up to 8 storeys

# Reaction to fire

| | Part of an edifice | Fire rating of an edifice | | |
|---|---|---|---|---|
| | | TP1 | TP2 | TP3 |
| use type I | walls and ceiling | Ds2,d2 | D-s2,d2 | D-s2,d2 |
| | floors | – | – | – |
| use type II | walls and ceiling | D-s2,d2 | D-s2,d2 | D-s2,d2 |
| | floors | – | – | – |
| use type III | walls and ceiling | B-s1,d0 | B-s1,d0 | D-s2,d2 |
| | floors | $D_{FL}$-s1 | $D_{FL}$-s1 | – |
| use type IV fire load up to 600 MJ/m$^2$ and | | | | |
| | | | | |
| –surface area ≥300 m$^2$ | walls and ceiling | D-s2,d2 | D-s2,d2 | D-s2,d2 |
| | floors | – | – | – |
| –surface area > 300 m$^2$ | walls and ceiling | C-s2,d1 | C-s2,d1 | D-s2,d2 |
| | floors | – | – | – |
| –fire load >600 MJ/m$^2$ | walls and ceiling | B-s1,d0 | B-s1,d0 | B-s1,d0 |
| | floors | $D_{FL}$-s1 | $D_{FL}$-s1 | – |
| use type V | walls and ceiling | D-s2,d2 | B-s1,d0 | D-s2,d2 |
| | floors | – | – | – |

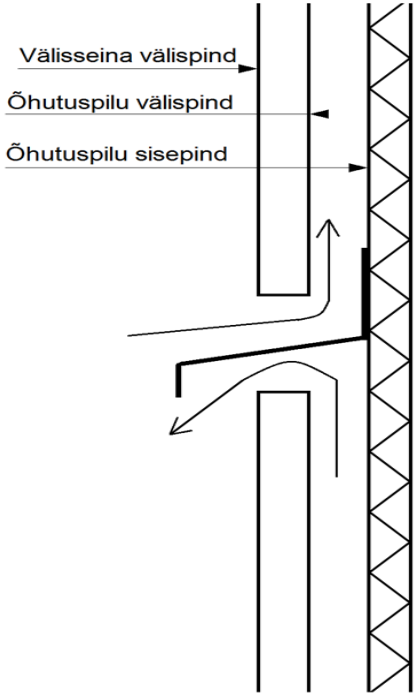
# Reaction to fire

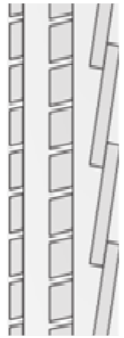
| | Part of an edifice | Fire rating of an edifice | | |
|---|---|---|---|---|
| | | TP1 | TP2 | TP3 |
| **use type VI** | | | | |
| **–fire risk class 1 (no fire risk)** | walls and ceiling | D-s2,d2 | D-s2,d2 | D-s2,d2 |
| | floors | $D_{FL}$-s1 | $D_{FL}$-s1 | – |
| **–fire risk class 2 (flammable) or fire risk class 3 (flammable and explosive)** | walls and ceiling | B-s1,d0 | B-s1,d0 | D-s2,d2 |
| | floors | $A2_{FL}$-s1 | $A2_{FL}$-s1 | $A2_{FL}$-s1 |
| **use type VII** | walls and ceiling | B-s1,d0 | B-s1,d0 | B-s1,d0 |
| | floors | $A2_{FL}$-s1 | $A2_{FL}$-s1 | $A2_{FL}$-s1 |
| **Fire escape way** | walls and ceiling | A2-s1,d0 | B-s1,d0 | B-s1,d0 |
| | floors | $D_{FL}$-s1 | $D_{FL}$-s1 | $D_{FL}$-s1 |
| **Internal corridors in edifices with use types II and III** | walls and ceiling | B-s1,d0 | B-s1,d0 | D-s2,d2 |
| | floors | $D_{FL}$-s1 | $D_{FL}$-s1 | – |
| **Saunas** | walls and ceiling | D-s2,d2 | D-s2,d2 | D-s2,d2 |
| | floors | – | – | – |

# Wooden facades

Fire spread should be avoided

- On the external surface
- In the structure of the exterior wall
- Through the joints/gaps



# Visible wood

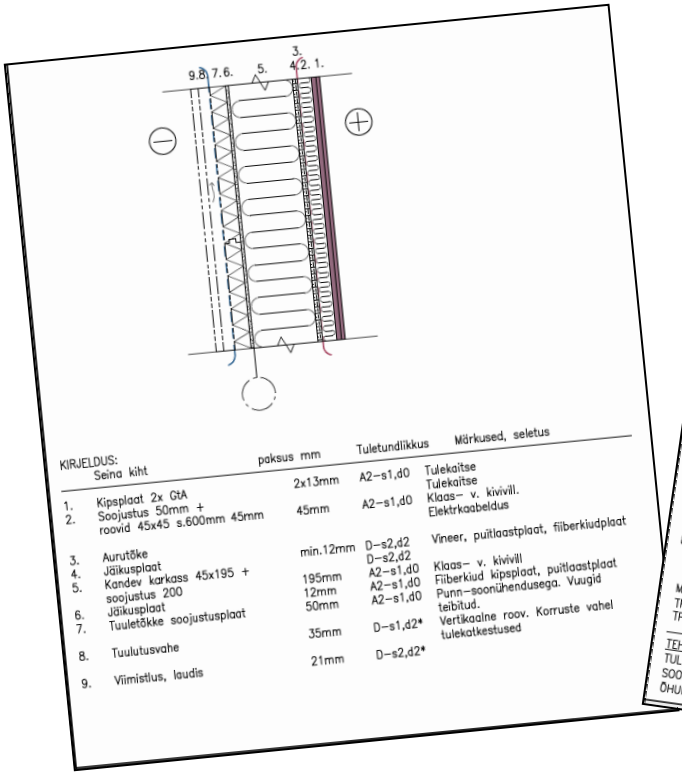
Reaction to fire requirement maybe lower for the small surfaces but not lower than D-s2,d2

1) If the risk for ignition and fire spread is small
2) If the evacuation is better than minimum requirements by this decree
3) When the automated fire extinguishing system is used

# Visible wood

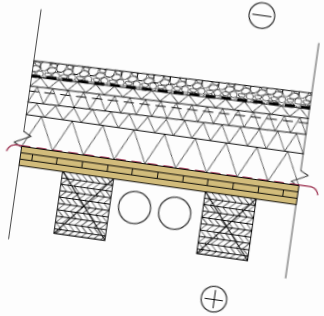
Reaction to fire requirements are not applied on load bearing columns and beams if their areas are relatively small compared to wall or ceiling area

# Guidance document




KIRJELDUS:
Seina kiht

| | | paksus mm | Tuletundlikkus | Märkused, seletus |
|---|---|---|---|---|
| 1. | Kipsplaat 2x GtA | 2x13mm | A2–s1,d0 | Tulekaitse |
| 2. | Soojustus 50mm + roovid 45x45 s.600mm 45mm | 45mm | A2–s1,d0 | Tulekaitse<br>Klaas– v. kivivill.<br>Elektrkaabeldus |
| 3. | Aurutõke | min.12mm | D–s2,d2 | Vineer, puitlaastplaat, filberkiudplaat |
| 4. | Jäikusplaat | | D–s2,d2 | |
| 5. | Kandev karkass 45x195 + soojustus 200 | 195mm | A2–s1,d0 | Klaas– v. kivivill |
| | | 12mm | A2–s1,d0 | Filberkiud kipsplaat, puitlaastplaat |
| 6. | Jäikusplaat | 50mm | A2–s1,d0 | Punn–soonühendusega. Vuugid teibitud. |
| 7. | Tuuletõkke soojustusplaat | 35mm | D–s1,d2* | Vertikaalne roov. Korruste vahel tulekatkestused |
| 8. | Tuulutusvahe | 21mm | D–s2,d2* | |
| 9. | Viimistlus, laudis | | | |

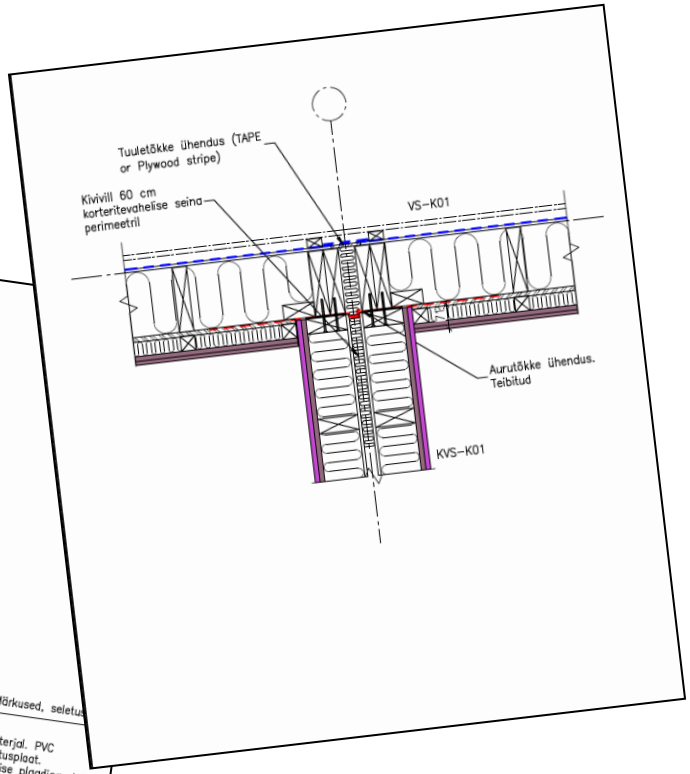


KIRJELDUS:
Konstruktsiooni kiht

| | | paksus mm | Tuletundlikkus | Märkused, seletus |
|---|---|---|---|---|
| 1. | Killustikust ballastikiht | min. 50mm | | |
| 2. | Katusekate | | | |
| | Soojustusplaat | | | |
| 3. | EPS soojustusplaat | 30mm | B–Roof | Nt. Bituumen rullmaterjal. PVC |
| 4. | EPS soojustus | | A2–s1,d0 | Punn–soonega tuulutusplaat. |
| 5. | Aurutõke | 50mm | | Tuulutussoonedalumise plaadiga risti |
| 7. | CLT plaat | 250mm | | Tuulutussoontega plaat. |
| 8. | Kandetalad | 0.2mm | | Kalde all. |
| | | 60mm | | |
| | | 140...200mm | D–s2,d2 | 3–e kihiline |
| | | | D–s2,d0 | Tala ristlõige valikul lähtuda jäädkristlõikest |

MÄRKUSED:
TP–2, kuni 8 korrust, (sprinkler)
TP–1, 2 korrust

TEHN. NÄITAJAD:
TULEPÜSIVUS: R60, EI60
SOOJAJUHTIVUS: u=0.18 W/m²k
OHUMÜRA ISOLATSIOONIINDEKS: R'w >47dB



# Role of the Rescue Board

* Prevention
* Supervision

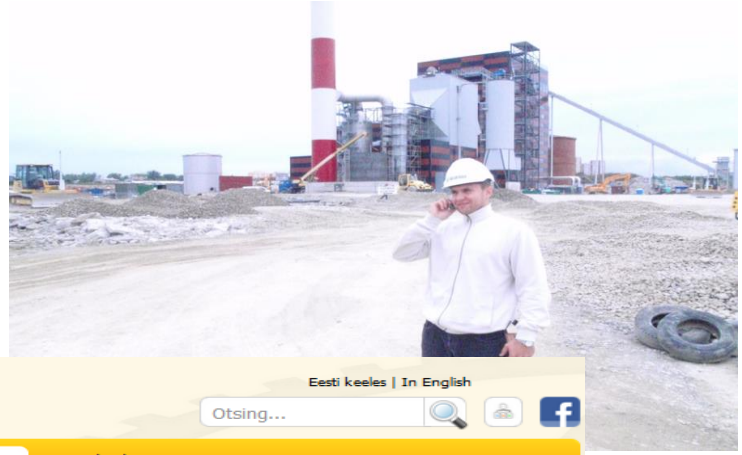
Fire safety concepts of the buildings is made by designers with help of Fire safety experts

# Fire safety and qualifications

Proof by analythical methods is provided by

**Fire safety expert, level 6**

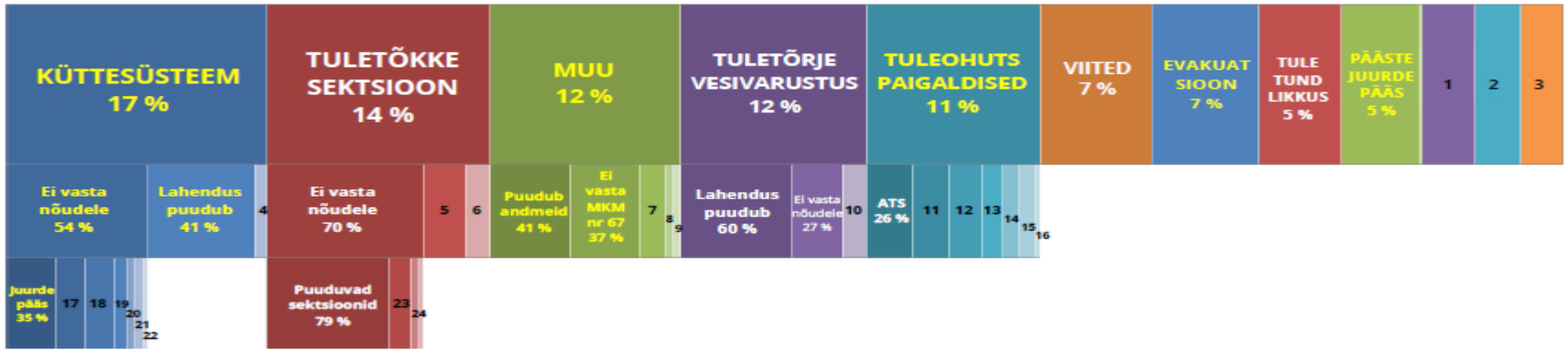
He/she can include specialists with specific knowledge for different areas.



# Rejection for the certificates of the projects

1068 per year

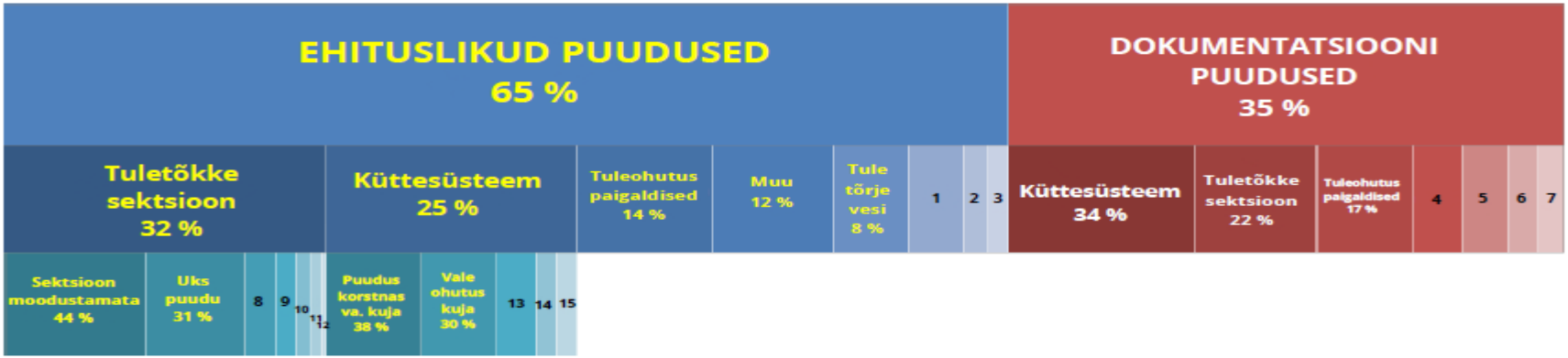
- Heating systems
- Fire compartments
- Water system for fire fighting



# Rejection for the certificates of occupancy

1018 per year

- Fire compartments
- Fire alarms and extinguishing devices
- Heating systems



# Fire safety of structures

"Requirement of safety"
(CPR/national building regulations)

**Full-scale testing of building construction**

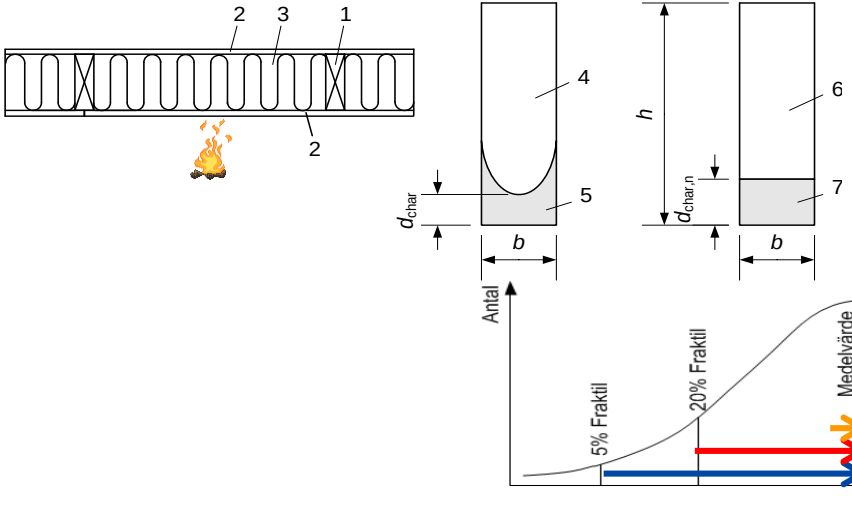
*Classification acc. to EN 13501-2*

**Design of building construction by means of calculations according to design standards**

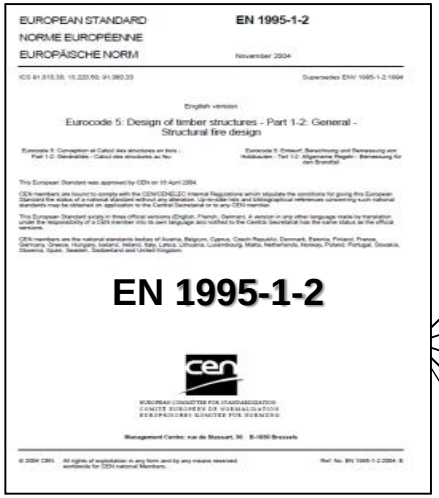
*e.g. acc. to EN 1995-1-2*

Fire safe use of construction

# Full-scale testing vs Calculations




- **Calculations**
  - time and money saving
  - Allow assembling components with nearly endless possibilities
  - On “safe side” in comparison to full-scale fire test results
- **Full-scale testing**
  - time and money consuming
  - Limited to tested build-up (complex EXAPs)
  - Good method for the optimisation of construction build-ups


EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

**EN 1995-1-2**

November 2004

English version

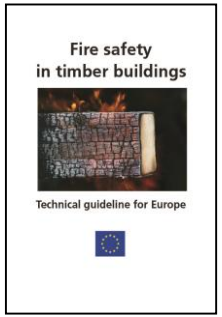
Eurocode 5: Design of timber structures - Part 1-2: General - Structural fire design

**EN 1995-1-2**

CEN

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels





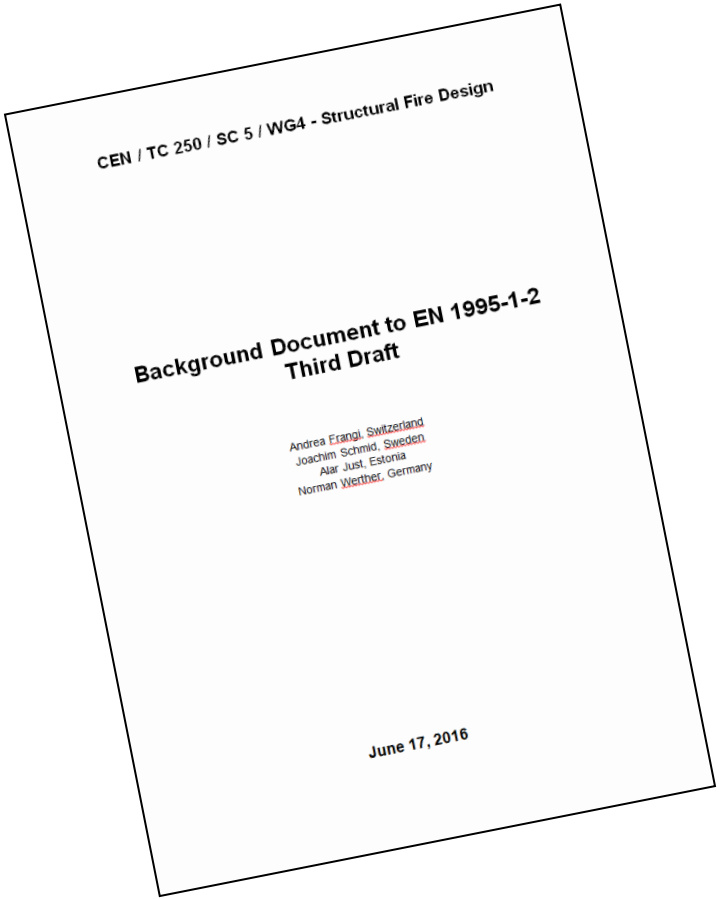
- EN 1990 Basis of design
- EN 1991 Actions
- EN 1995-1-1 Timber structures
  - Supporting EN standards
    - EN 338
    - EN 1194
    - EN 520
    - …
- Other Eurocode Fire Parts
- Supporting EN standards

# EN 1995-1-2:2022

CEN TC250 SC5
WG4 Fire design

Background document to EN 1995-1-2
(summer 2018)

Writing new EN 1995-1-2
(2018-2020)


CEN / TC 250 / SC 5 / WG4 - Structural Fire Design

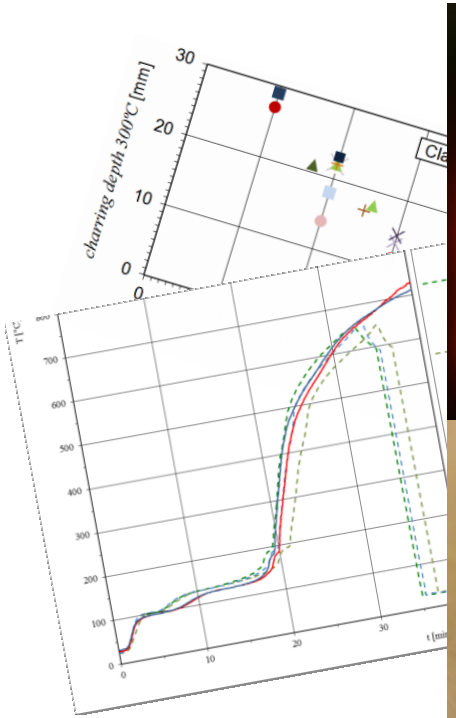
Background Document to EN 1995-1-2
Third Draft

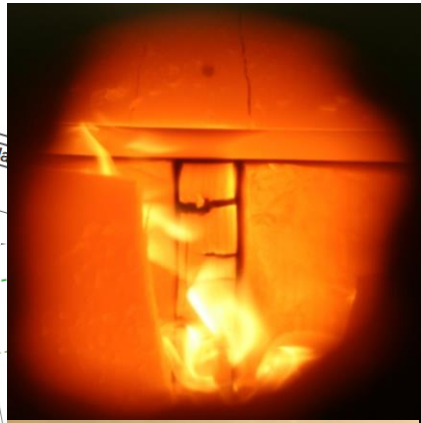
Andrea Frangi, Switzerland
Joachim Schmid, Sweden
Alar Just, Estonia
Norman Werther, Germany

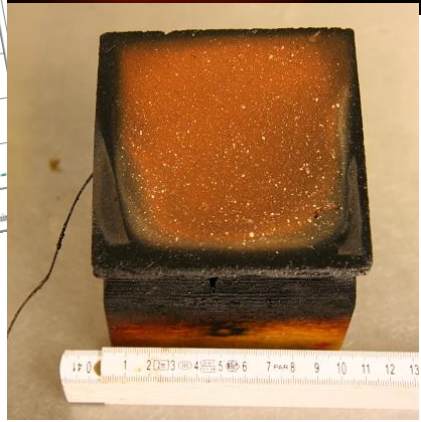
June 17, 2016

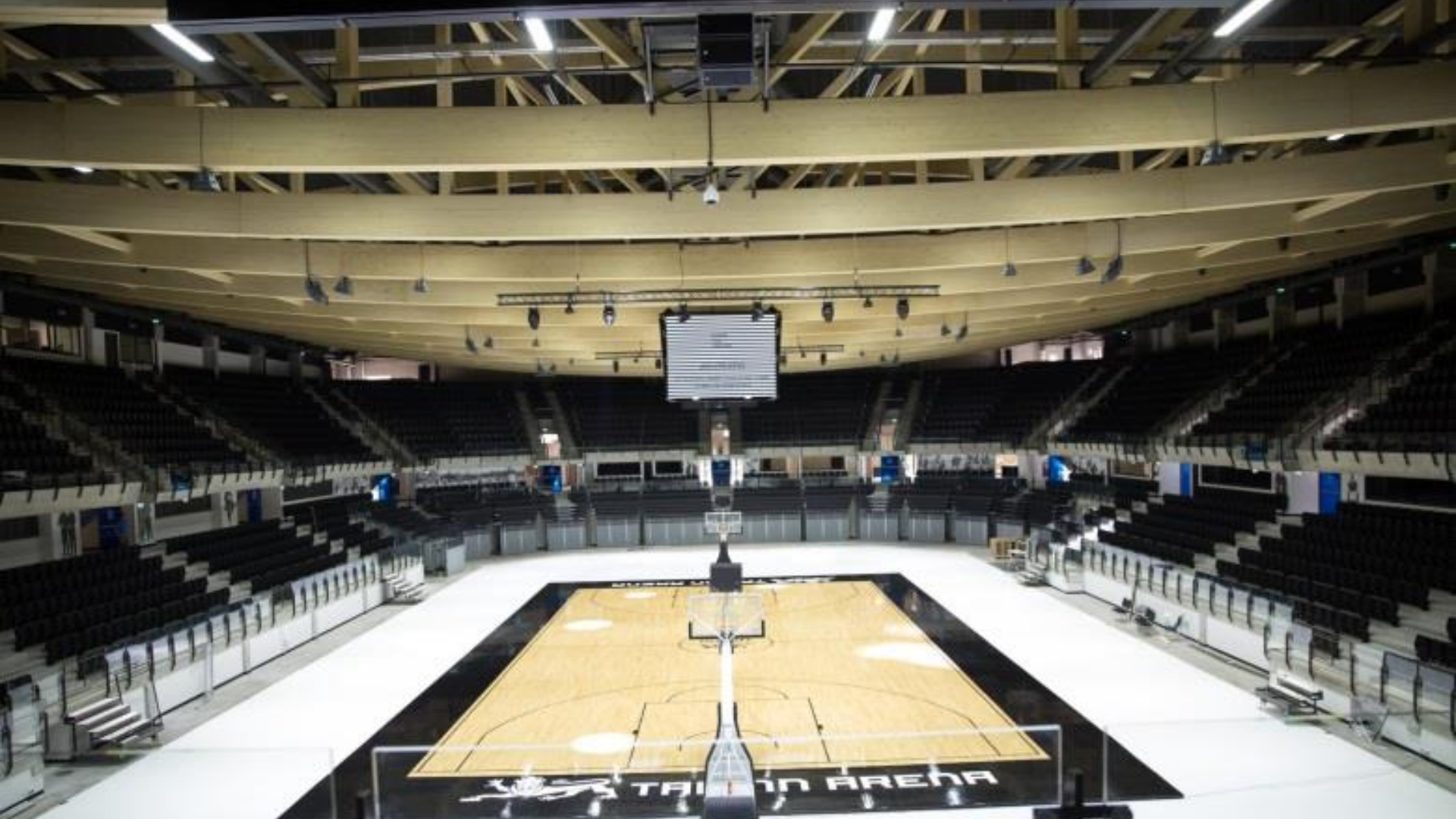
# Projects – ongoing at TUT

- Protection by claddings
  - Gypsum plasterboards
  - Clay plaster
- Protection by insulations
- Analysis of the real fires
- Revision of Eurocode 5
- Fire Safety and Execution (Nordic project)






TA ARENA

Riding arena (designed)
Tallinn

# Treet,
# Bergen (Norway)


**2nd tallest timber building in the world**

TALLINNA TEHNIKAÜLIKOOL
TALLINN UNIVERSITY OF TECHNOLOGY

**UBC**
**Vancouver**


SAFE!

# THANK YOU!
# PALDIES!

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