



# FIRE LOAD SURVEY OF COMMERCIAL PREMISES IN FINLAND

Application of Structural Fire Design, 29th April 2011,  
Prague, Czech Republic

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29th April 2011



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# Introduction

- Fire load is an important parameter in performance based fire safety design (overall and structures)
  - calculations, e.g. fire development, structure heating and response etc. need fire load input data
- By using design fires (integral of which is fire load), temperatures in the vicinity of structures and further temperatures in structures can be calculated and the response determined
- In Finland and many other European countries the new Eurocodes (EN 1991-1-2, 2003) relating the fire load are being taking into account
- Eurocode fire loads not allowed to apply in Finland and many other countries
- Fire load data especially for shopping malls and shops needed
- **Fire load**
  - **movable (items of different materials in an enclosure)**
  - **fixed (linings: floor, walls, ceiling)**



## Material and methods

- Thirty shops and their relating spaces with different sizes and types in Seinäjoki and its surroundings were investigated in Finland
- The smallest shops typically special shops in shopping malls - the largest shops groceries, building material, household appliance and furniture shops
- Associated spaces mostly storages (17), social rooms (4) and offices (3)
- Investigated floor area almost 28000 m<sup>2</sup>.
- Smallest shops 54 m<sup>2</sup> – largest shop 4550 m<sup>2</sup> with a 800 m<sup>2</sup> storage
- Burning materials: wood, textiles, plastic, paper, miscellaneous
- Measuring devices: weighers, rulers, laser systems ...
- Masses were weighed or evaluated from the volume and density
- Fire load was calculated by multiplying the mass and the calorific value of the material
- Suitability of lognormal and Gumbel –distribution to measured fire load density data was considered



## Results

- Variation of the fire load of associated spaces bigger than in shops
- Fire load diversity of certain shop types very similar (e.g. in textile shops mostly textiles)
- Plastics most in household appliance and toyshop
- Wood most in furniture and decoration shops
- Miscellaneous most in groceries and chemists's shop
- Paper common in book shops and shoe shops
- Measured and calculated fire load density function follows lognormal distribution significantly more reliably than the Gumbel (minimum) distribution and slightly more reliably than Gumbel(maximum) –distribution
- The results are corresponding in the case of associated spaces
- The final result: Lognormal distribution describes the measurement based fire load densities in the most reliable way.



# Fitted density functions $f(x)$ and cumulative functions $F(x)$ for shops

