AALBORG UNIVERSITY

Robustness Analysis of Multi-Storey Massive Timber Building

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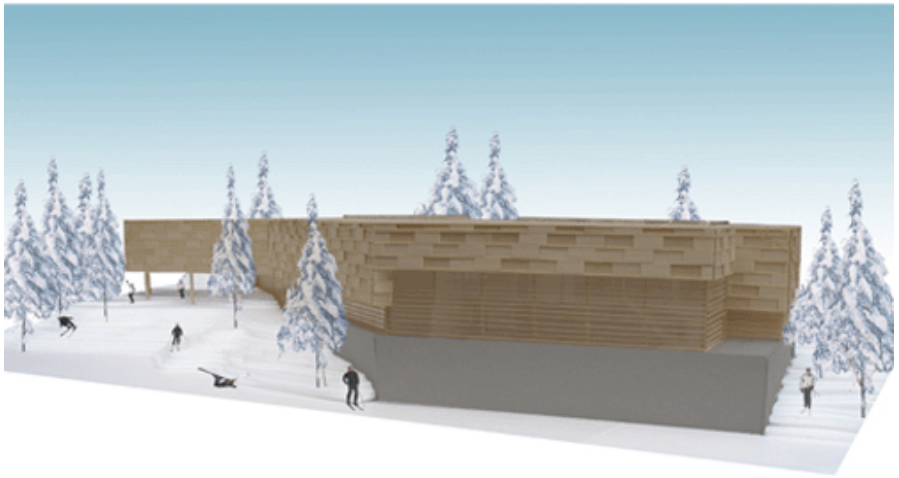
Content

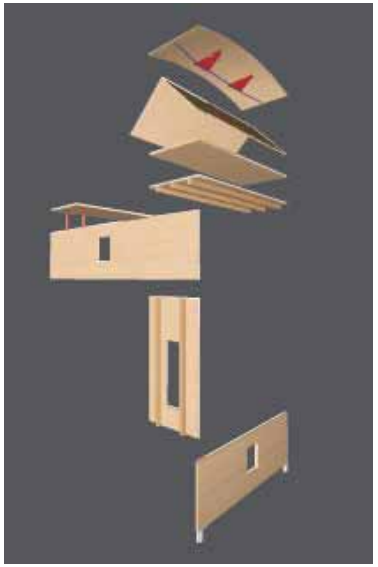
- Introduction – why multi-storey massive timber building ?
- WG3 – focus points – working questions
- Numerical analysis of multi-storey massive timber building
- Further work

M.Sc. projects




Växjö


Vienna




Sundsvall

Post & Beam

3D-box

Timber Frame

WG3 – focus points

- Characterisation of multi-scale variability in timber structures.
- Analysis of system effects for several types of timber structures.
- Qualification of robustness as a characteristic of timber structures.
- Establishing a framework for reliability based design and assessment of timber structural systems based on these considerations.

WG3 - Working questions

- How to model and assess reliability of timber structures modelled as systems?
- Ductile / brittle failures?
- Key elements – how to design? To which reliability level?
- Robustness index for timber structures?
- How is robustness requirements in Eurocodes handled for timber structures? Information in National Annexes?

Robustness – Danish code DS 409 ?

Definition of robustness and key elements

- A structure is robust:
  - when those parts of the structure essential for the safety only have little sensitivity with respect to unintentional loads and defects,

    or
  - when extensive failure of the structure will not occur if a limited part of the structure fails.

- Key element:
  - limited part of structure, which has an essential importance for the robustness of the structure in the way that a possible failure of the key element implies a failure of the entire structure or significant parts of it.

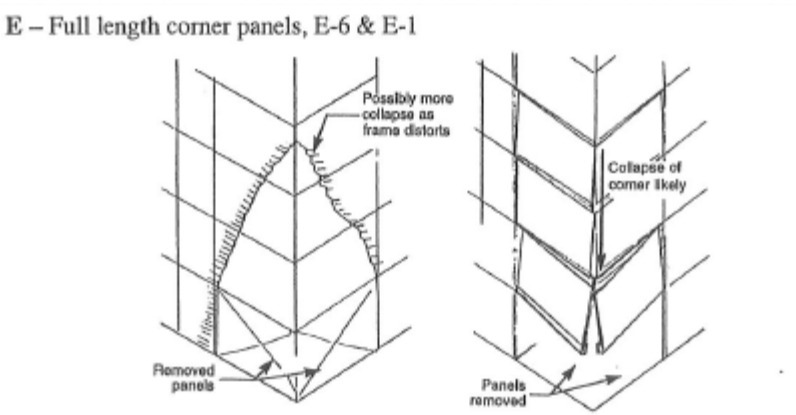
BRE – TF2000 Project

- The experimental testing included removal of selected load bearing wall panels. The goal of the testing was to "...verify by 'test' that the inherent stiffness of standard cellular platform timber frame construction can provide adequate robustness so that, in the event of an accident or misuse, the building will not suffer collapse to an extent disproportionate to its cause" (*Milner et al.* 1998).

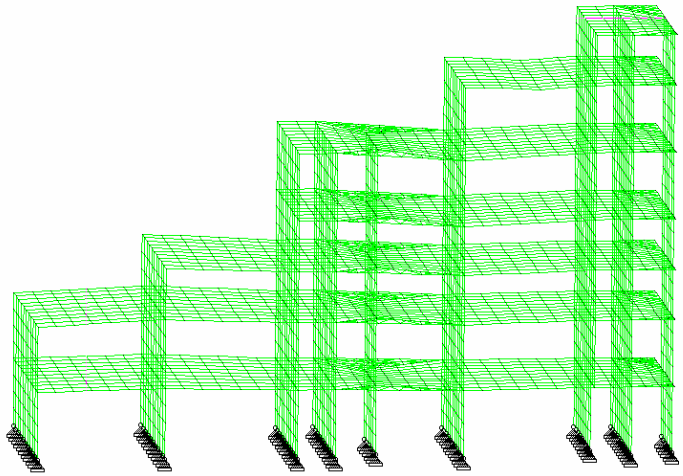
Brick Clad Timber Frame at BRE Cardington

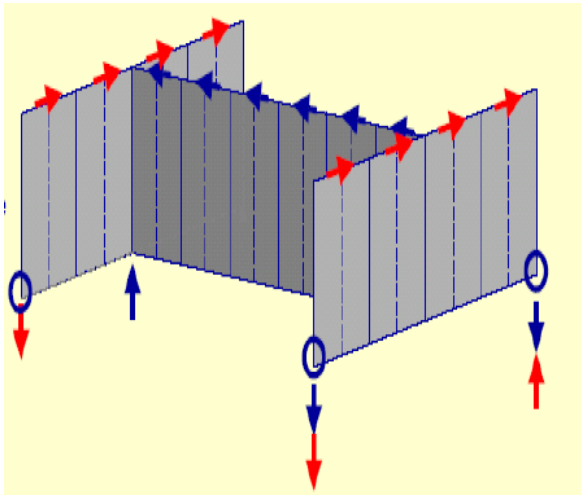
Numerical Analysis

- FEM – linear – timber (ortotropic)
- ultimate & service limite state
- Modelling joints
- Removing ”key element”



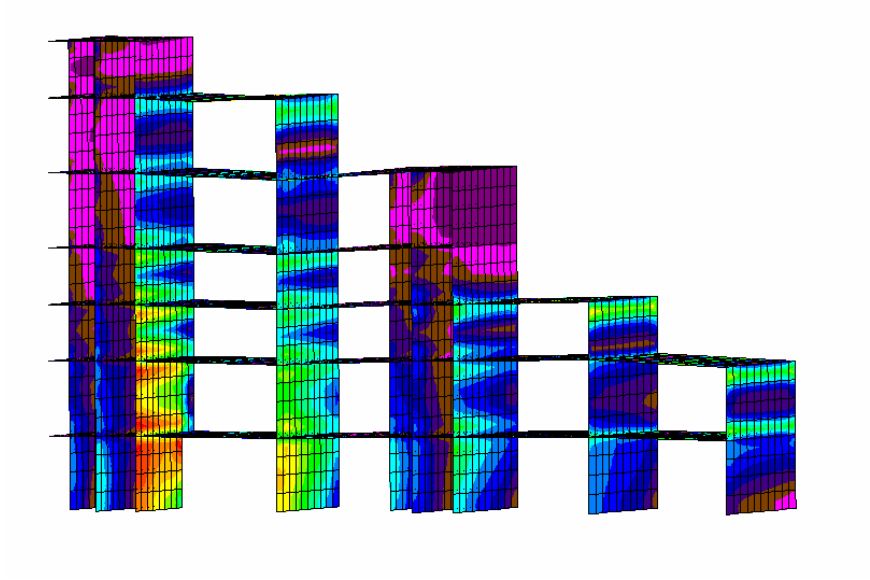
7 story massive timber building



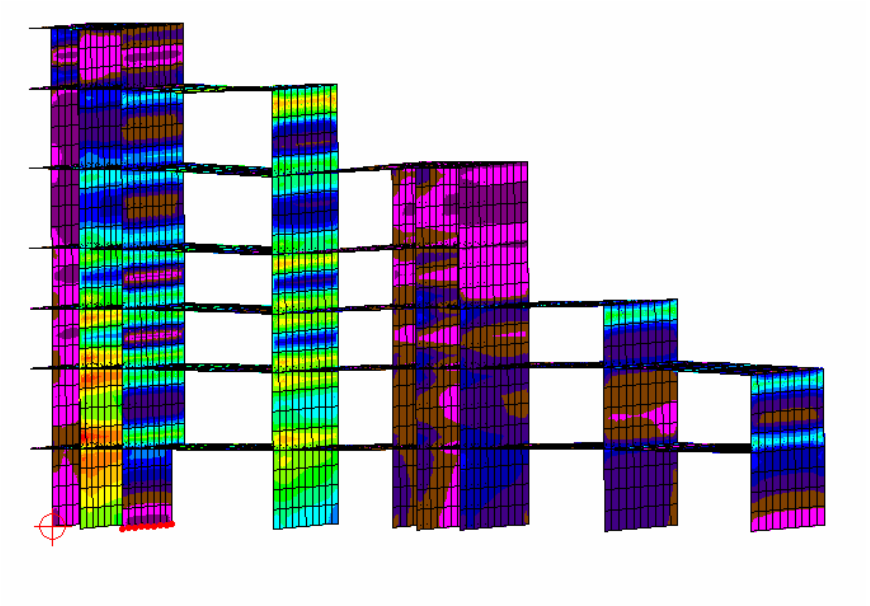


Anchoring - Växjö

Pinned Supports



Elastic Supports (1 wall)



Future work

- Obtain detailed information for massive timber buildings
- Exposures - unintentional loads and defects
- System modelling of massive timber building
- Reliability assessment

Thank You
for
Your Attention