# Challenges and possibilities – stabilising timber buildings

Johan Vessby
Linnaeus University, Växjö, Sweden

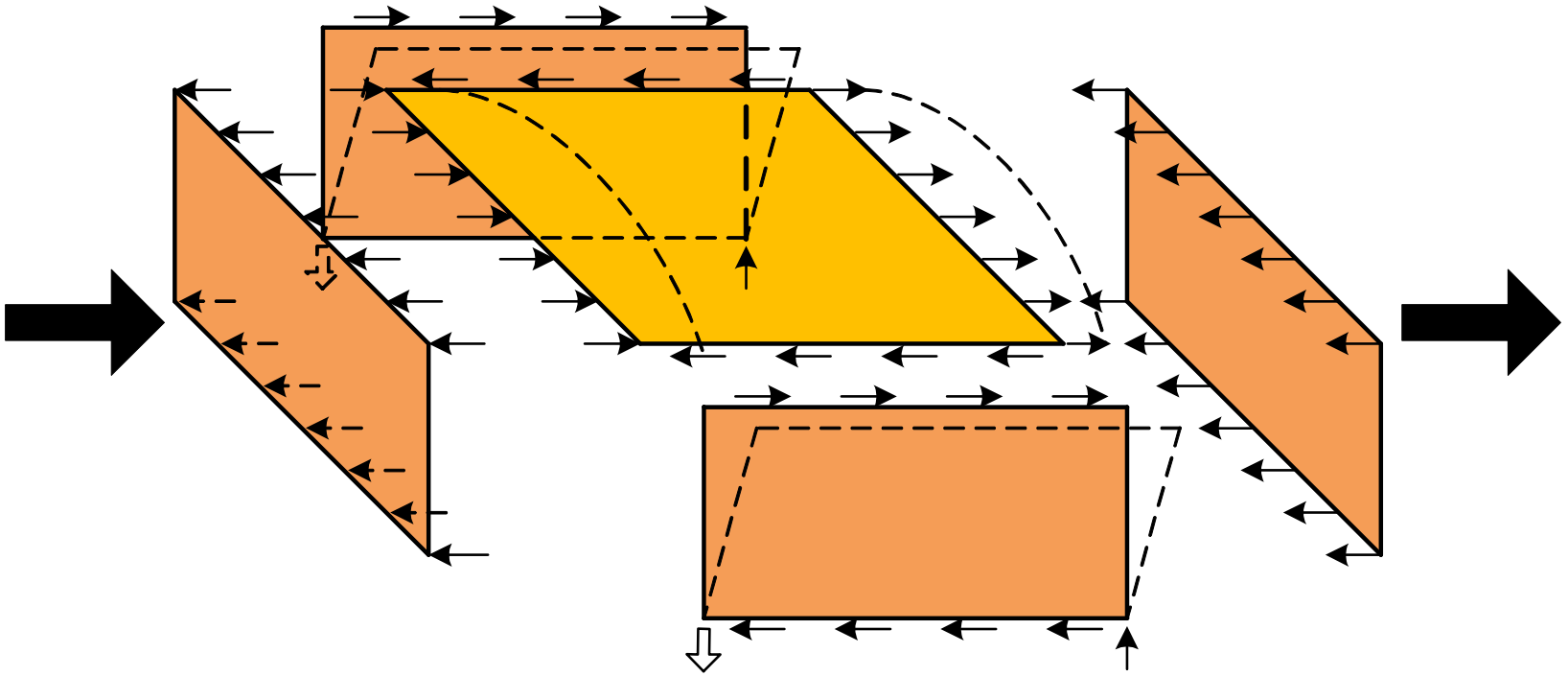
# From rural log houses…

Architect: ?
Developer: 90% of people in Värmland

# Many things have changed but some stay the same

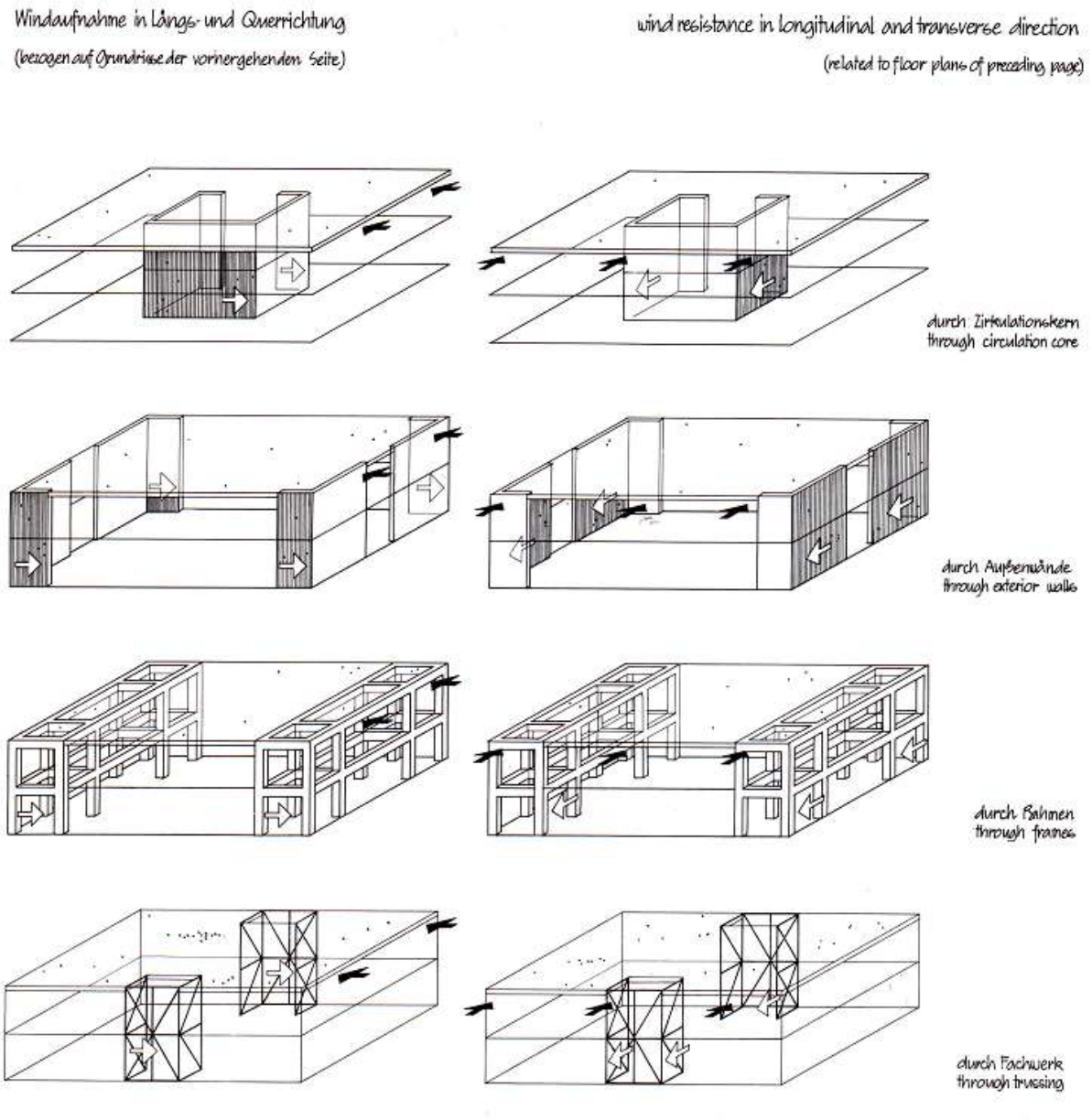
- The load on the building and how it is transmitted to the foundation
- The effect the load have on the building
- Methods to prevent disturbing effects and failure

# Schematic force distribution within a building



# Structure Systems, Heino Engel

Divides structures according to how they resist horizontal loading.



# How can we learn from… history and adopt?



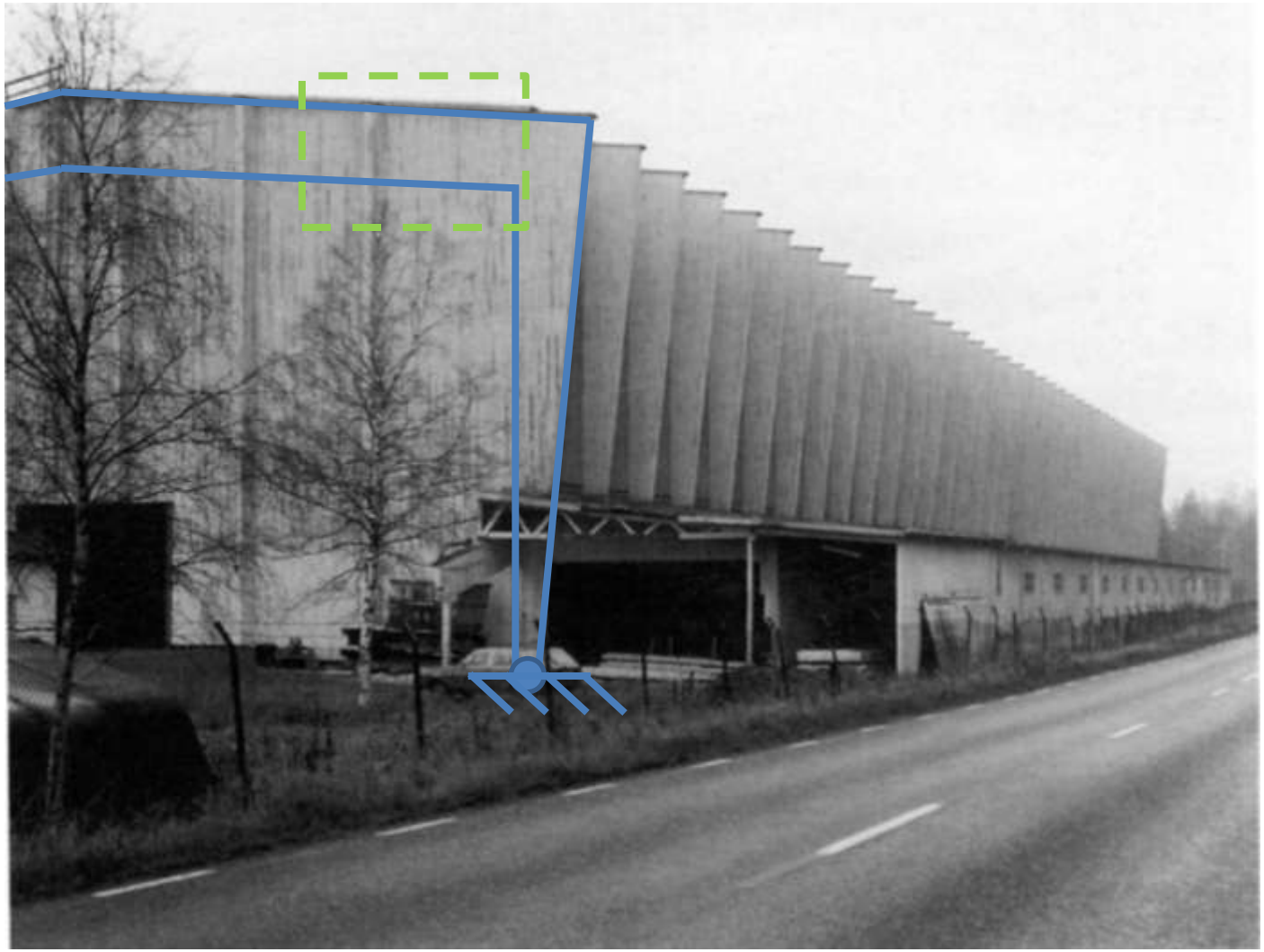
*30 St Mary Axe · London, England*

Tension rods/trusses

N- house, LnU, Architect: Jais-Nielsen och Mats White

Architect: Kresing Architekten, Münster

Frame

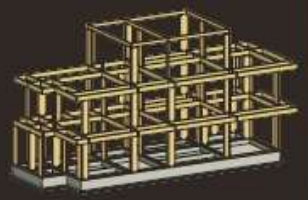


"Noaks Ark" from "Hundra år av rörelse, Smålandska Kulturbilder 2001"

Frame

# ”Big-frame”, Sumitomo forestry group, Japan

**"Big Frame Construction Method"**



With conventional house construction methods, the vertical load (building dead weight) is supported by posts and beams, while the horizontal load (lateral shaking from earthquakes, etc.) is supported by bearing walls. In contrast, the Big Frame Construction Technology uses a column (thick glue laminated timber) and beams to support both the vertical and horizontal load.

BF steel joint developed on the basis of scientific analysis: By using a screw shape, looseness and warping are eliminated by increasing the surface area of contact with the wood stronger joints.

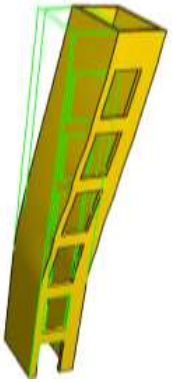
## 1. PRODUCT STRENGTH

**Differentiation by Means of Our Dream-Fulfilling Unique Technologies**

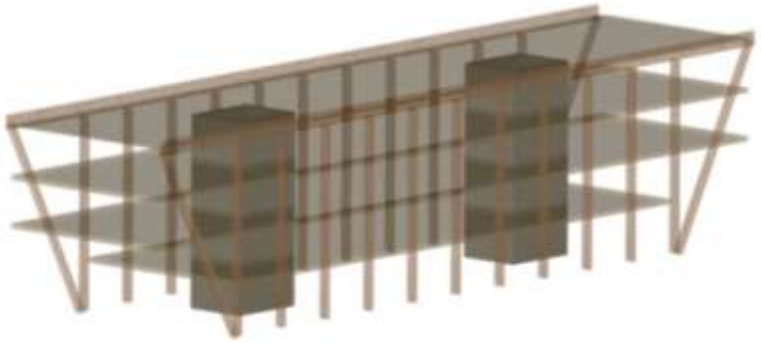
The natural blessing of wood has a deep connection with home life in Japan. Since our founding, the Group has been associated with forests for more than 300 years, and we have been seeking the benefit of wood for warmth and richness to residential life.

One major accomplishment in 2005 was the Big Frame Construction Method which has obtained structural type approval from the Minister of Land, Infrastructure and Transport. This method has applied innovation to wooden three-story house structures. It integrates our unique "Wooden Continuous Beam Type rahmen Structure" and steel joint technology, and achieves high earthquake resistance and rigidity without the need for bearing walls with posts and beams. It is an innovative construction method that can reduce the number of required walls and structures to less than half compared with conventional construction methods. By adopting this new method, wide open spaces, such as three-story well-hole types, can be designed, which was difficult with previous methods. Even with the small building sites commonly found in city centers, the method exploits sites' maximum potential and creates large spaces that give a feeling of openness. What's more, the method provides a high degree of variability that anticipates the transition between life stages and allows the building to be passed along to second and third generations as a high-quality asset. It was precisely such customer oriented ideas that brought about the Big Frame Construction Method.

Another product, *MyForest*, which was launched in fiscal 2005, incorporates a wealth of innovative technologies in order to bring out the highly refined atmosphere of wood. One example is Pure Molt Floor recovered and restored from one hundred-year-old white oak whiskey barrels. This floor not only offers great texture, but also boasts superb resistance to scratching. This material, however, is extremely difficult to obtain. To solve this problem, Sumitomo Forestry developed straightening equipment, to straighten curved barrel staves. Through this equipment, the Company has been able to obtain a stable supply of solid straight-grain board made of elegant hundred-year-old oak, which is something that other companies have not been able to produce.



Architect: Arkitektbolaget, -02



Sheets

Architect: Arkitektbolaget

Mölnlycke, Derome förvaltning

# House N, Linnaeus Univeristy
# Moelven provided load bearing structure

Architect: Jais-Nielsen och Mats White

# Vallen, Växjö

Architects: Arkitektbolaget and LBE Arkitekter

Moelven provided load bearing structure

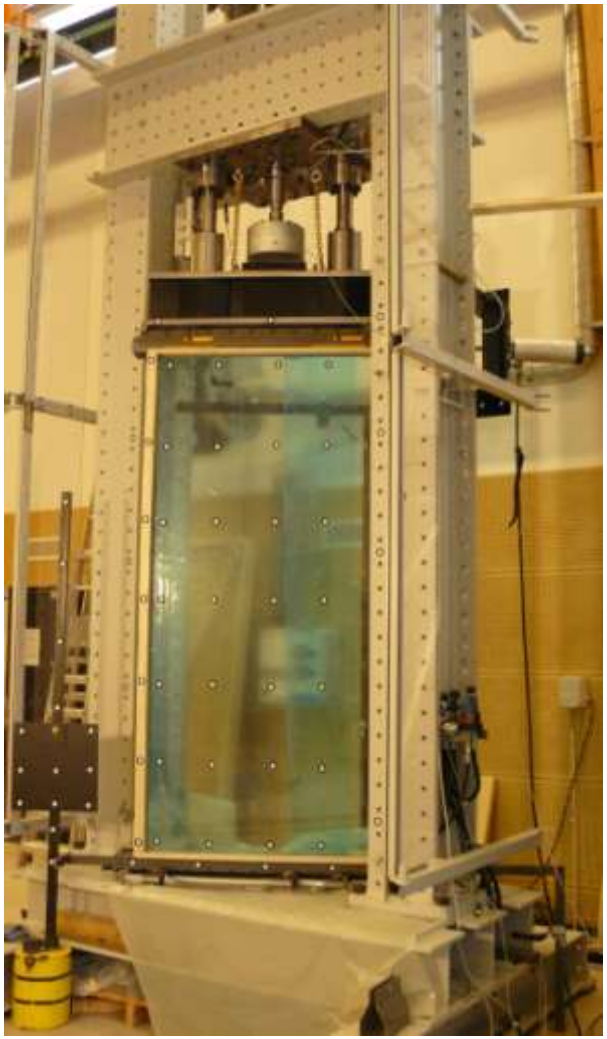
# Vallen, Växjö

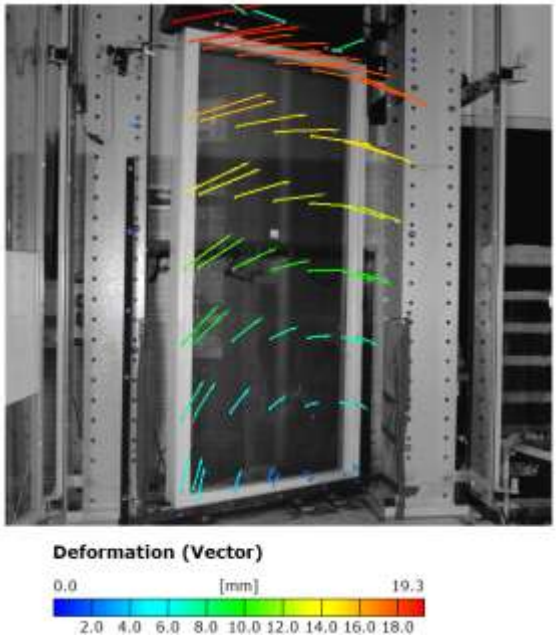
Architects: Arkitektbolaget and LBE Arkitekter

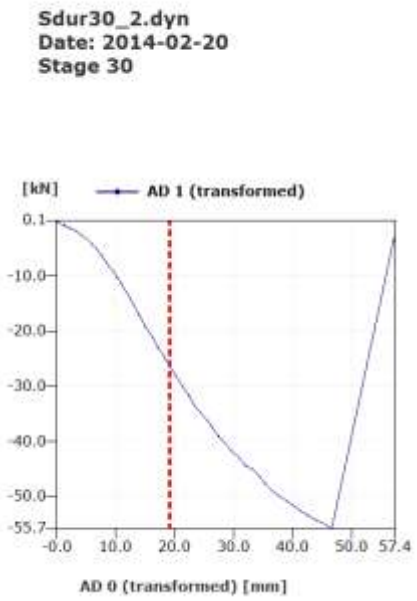
Moelven provided load bearing structure

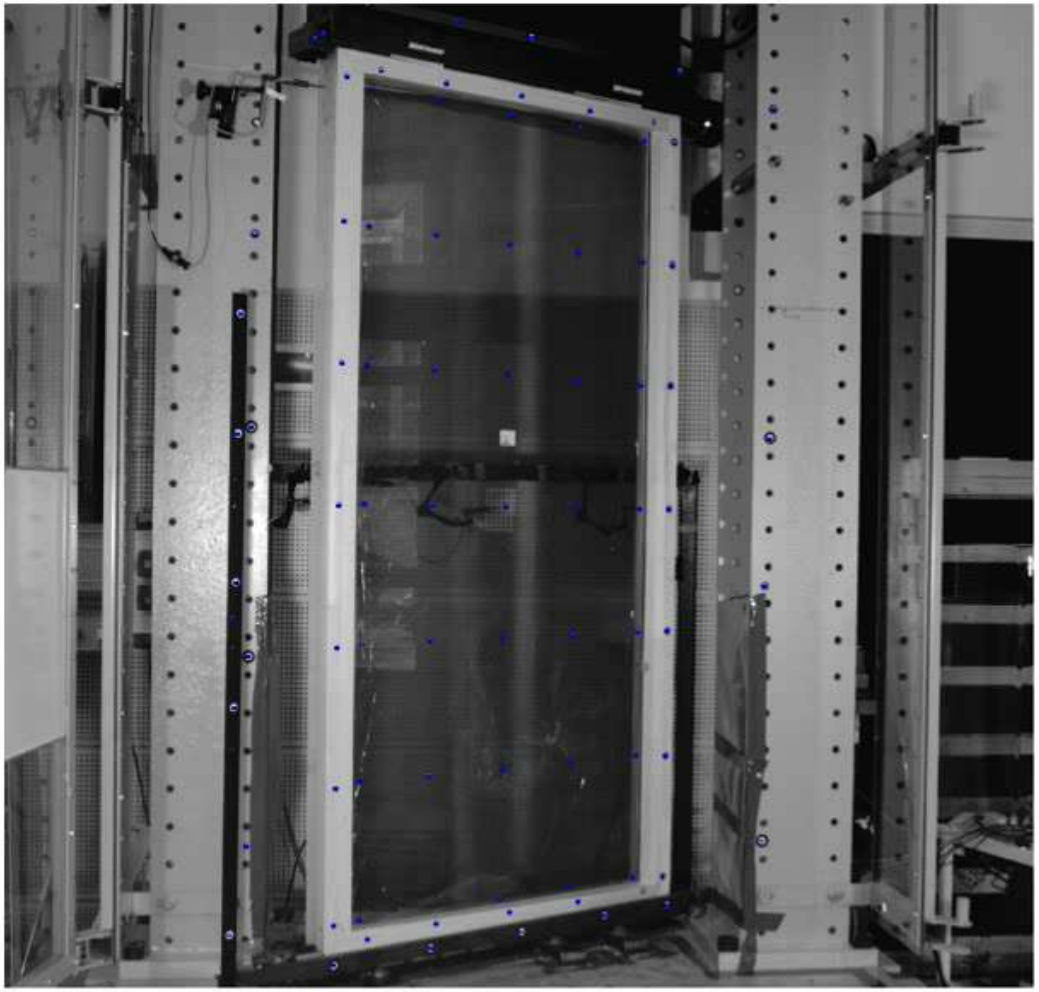
# Load bearing timber glass composites, LBTGC

Prof. E. Serrano proj. leader







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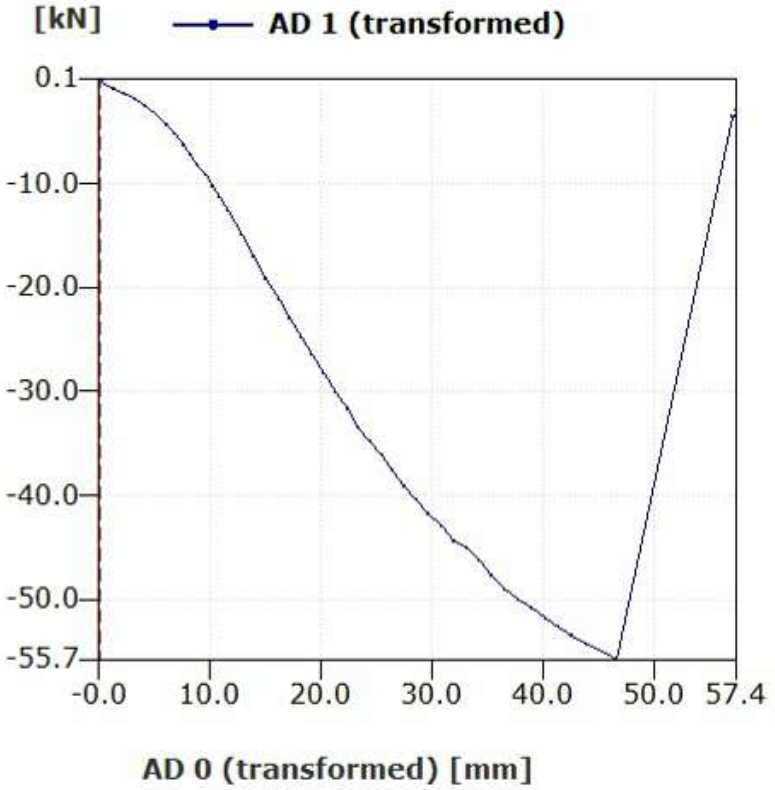
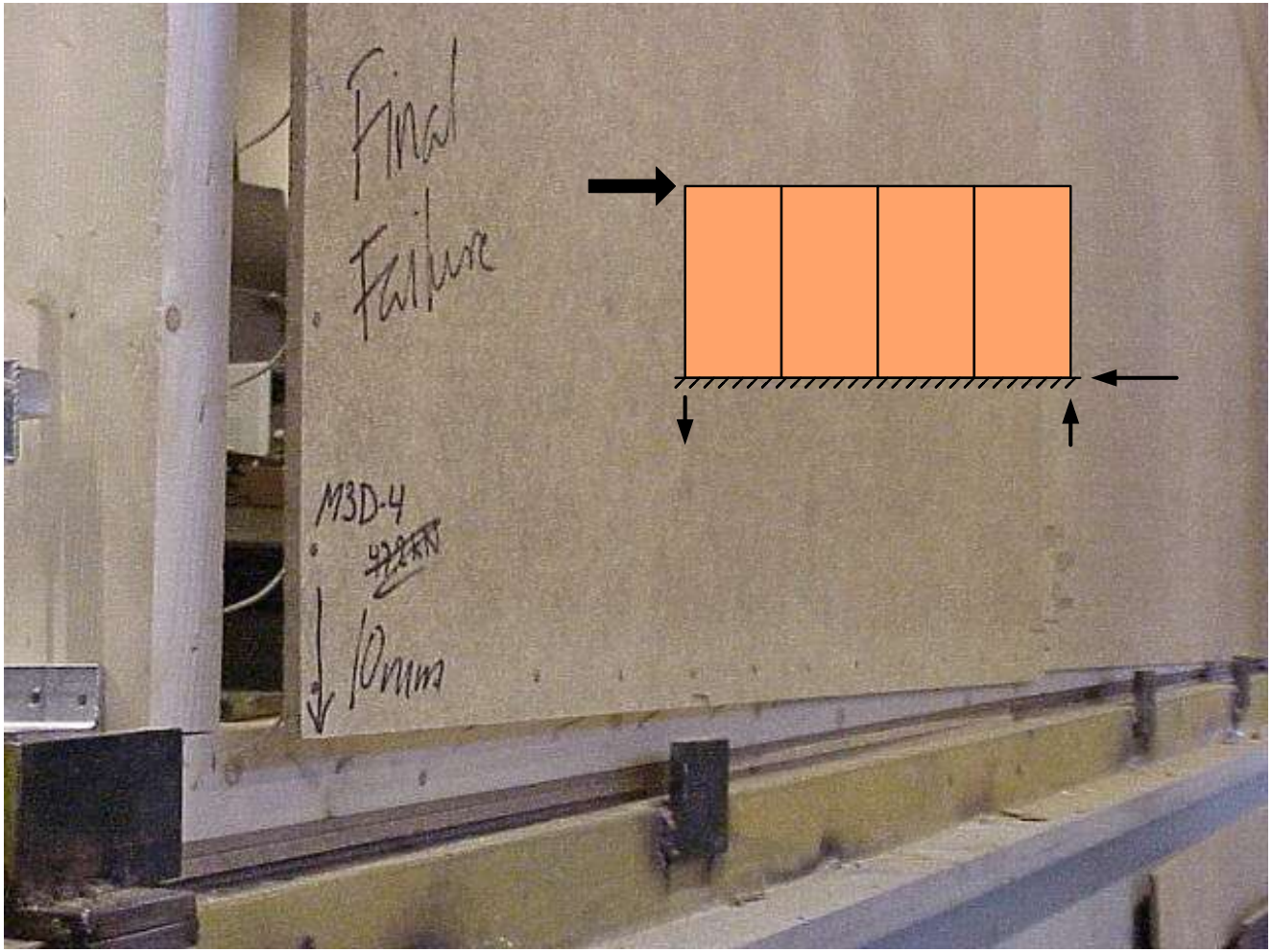
**Date: 2014-02-20**
**Stage 0**



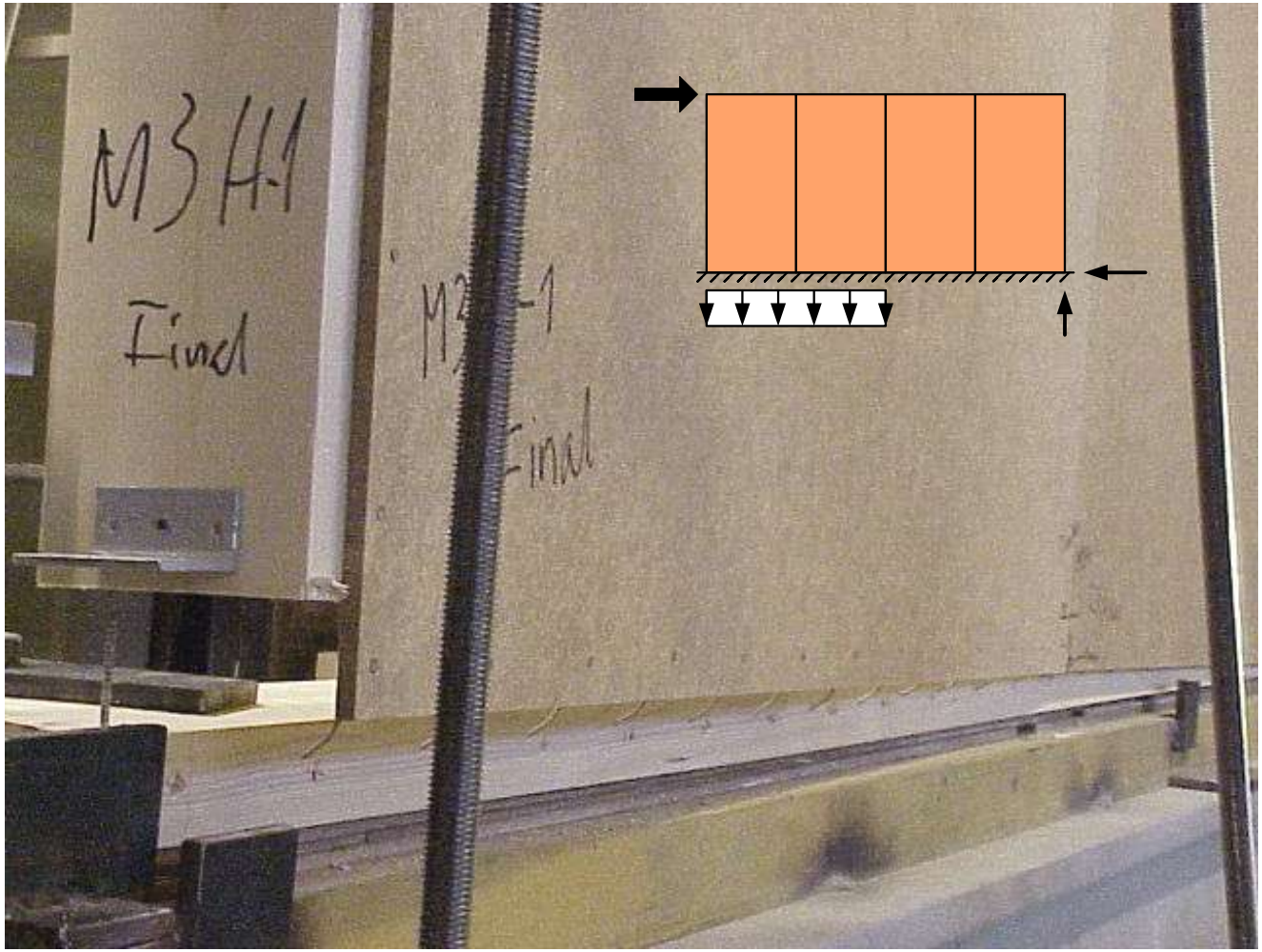

Linnéuniversitetet

# Fully anchored

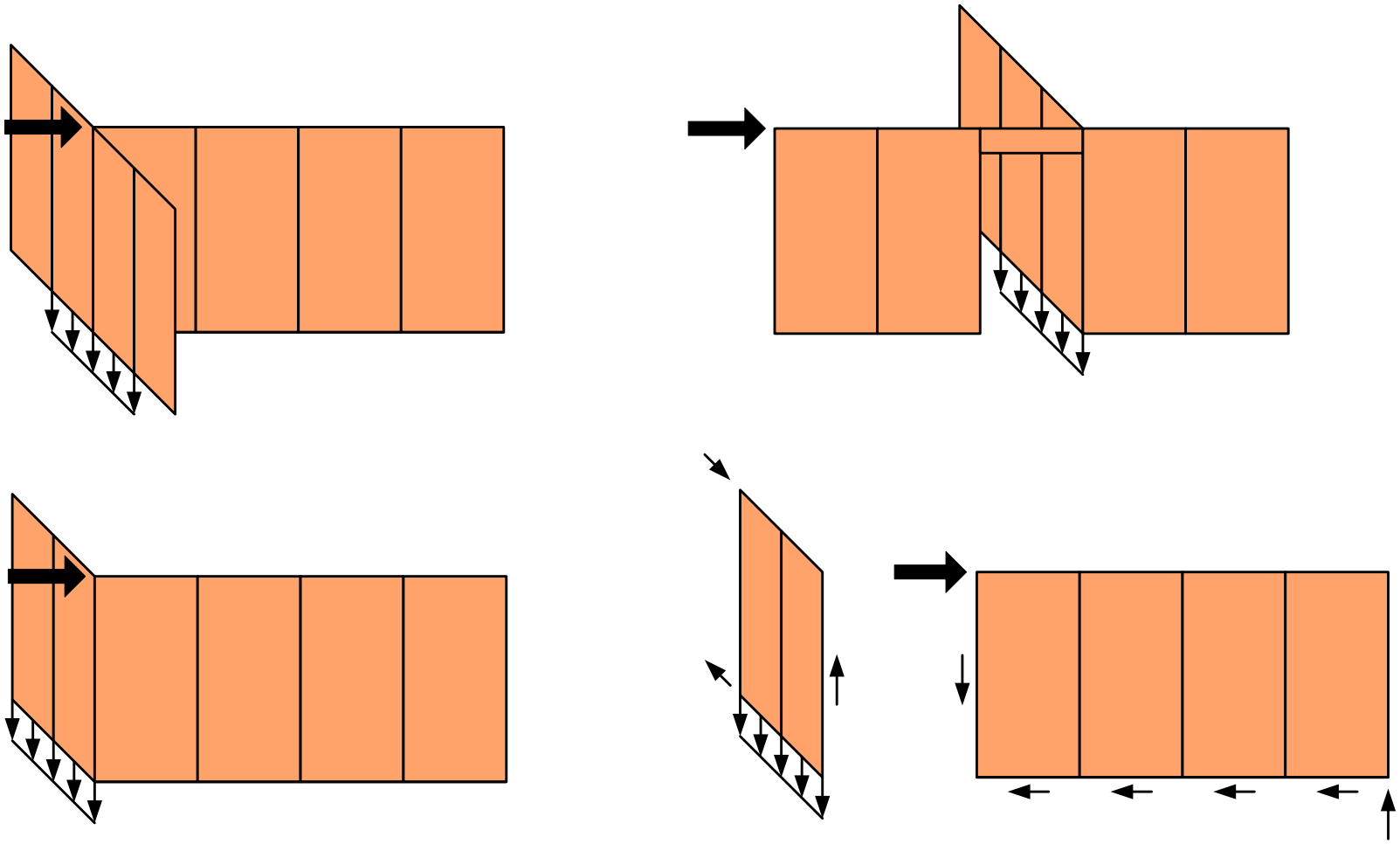



Prof. B. Källsner and U.A. Girhammar

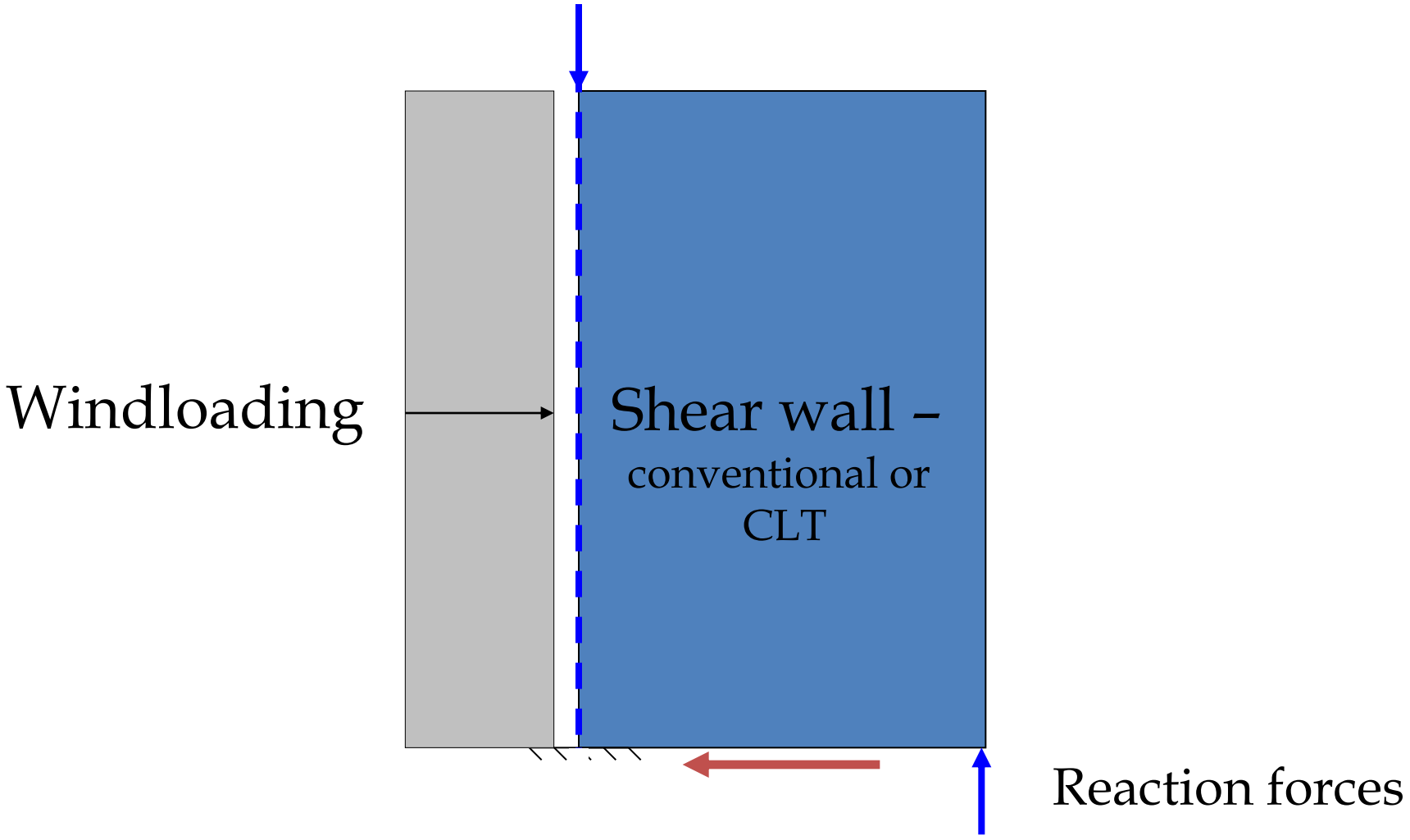
# Partially anchored



# Anchoring by transverse walls

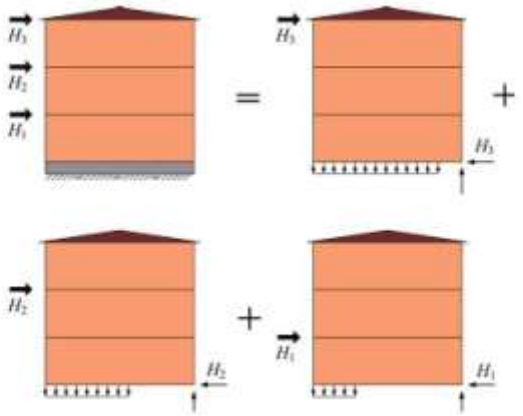


# Tie down rods



# Horisontalstabilisering av träregelstommar

## Plastisk dimensionering av väggar med träbaserade skivor




Bo Källsner och Ulf Arne Girhammar

SP Trätek

Forskningsrådet Formas

Linnæus University

# Concluding remarks

- There are several alternative ways of stabilising timber buildings (shear walls most common).
- Ensure ductile plastic behaviour in all fasteners.
- Avoid sudden losses in strength, e.g. fracture of members.
- The strength and stiffness of the horizontal diaphragm may need to be addressed.
- Methods should enable varying boundary condition in the leading stud.