MULTISTOREY FRAME SYSTEM FOR ENERGY EFFICIENT BUILDINGS
concept of precast RC frame for energy efficient buildings
Basic idea

Nowadays increasing tendency

wooden based buildings from CLT (cross laminated timber)

Limitations: space rigidity of multistory structure

acoustic performance

fire safety

The combination of light concrete frame and wooden based other parts of structure (envelope, partitions, roof structure) could solve some of these problems.
concept of load bearing frame OSEEB

- subtle precast elements
- lightened floor panels
- flat ceiling
- flexibility – large spans up to 9 x 9 m
- fast construction
- design for dismounting

Conceptual solution:
- use of FC 70/85
- use of Peikko corbels joints
- prestressed flat girders and floor panels
- lightening elements from recycled materials
- transverse post tensioning
Load bearing structure
- subtle RC precast frame

Building envelope
- light timber frame structure
- heavily insulated by thermal insulation
- subtle columns integrated in building envelope
- C-shape of columns enable integration of thermal insulation
Comparison of linear heat transfer factor $\psi$ for assessed variants of building envelope

Ceramic blocks or foamed concrete blocks or timber building envelope (OSEEB)
floor structure – flat RC slab

STRUCTURAL SCHEME

cross post tensioning

prestressed pannels

RC lightened panells

prestressed main flat girder
floor panels – optimization of lightening

- Weight
- Acoustic – airborne sound
- Fire safety
- Environmental impact

*Expanded clays with hybrid cements based binder*
tubes for transverse post tensioning
prestressed floor girders
RC columns with Peikko corbels

Verification of cohesion of HPC and corbel of Peikko system
construction of experimental frame OSEEB
Construction of experimental OSEEB frame

- **Basic data of structure**
  - location: Bustehrad, Kladno, CTU in Prague, UCEEB
  - realization: February – April 2016
  - load tests: 30.06.16 and 07.07.16

Precast pocket footings from recycled c.
Construction of experimental OSEEB frame
Construction of experimental OSEEB frame
Construction of experimental OSEEB frame
Life Cycle Assessment of subtle frame
Life Cycle Assessment of OSEEB frame

- balance of input data of assessment variants
- two-storey experimental OSEEB frame

**V1** – reference precast RC frame C30/37 and C40/50, columns 400x400 mm, girders 550x650 mm, hollow core prestressed panels 265 mm

**V2** – experimental frame OSEEB, HPC 70/85, columns „C“ 180x250 mm, girders 500x300 mm and 700x300 mm, lightened floor panels 300 mm

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END OF LIFE PHASE calculates with the amount of waste from demolition, amount of demountable components that can be reused and related transport.
Life Cycle Assessment of OSEEB frame

aggregated LCA results

Results of Life Cycle Assessment

Vlastimil Bílek, I
conclusions
conclusion

• HPC – potential for the reduction of environmental impacts when used in **subtle thin shell structures**

• Environmental assessment should be based on **detailed LCA** of the entire structure (using specific regional data)

• **Optimal combination of materials** can result in more sustainable structures

Thank you for attention
Dear friends,

I am so sorry not to be with you in HongKong.

Petr Hajek