

Training workshop “Studying international practices in implementation of innovative energy efficiency technologies in the electric power industry. Methodology, goal and objectives of electricity and heat consumers energy survey”

SEIT building, 62 Bayram Khan st, Mary, 13-19 March 2024

# **The most common mistakes in the construction of passive buildings and technical measures in construction supervision to ensure energy efficiency**

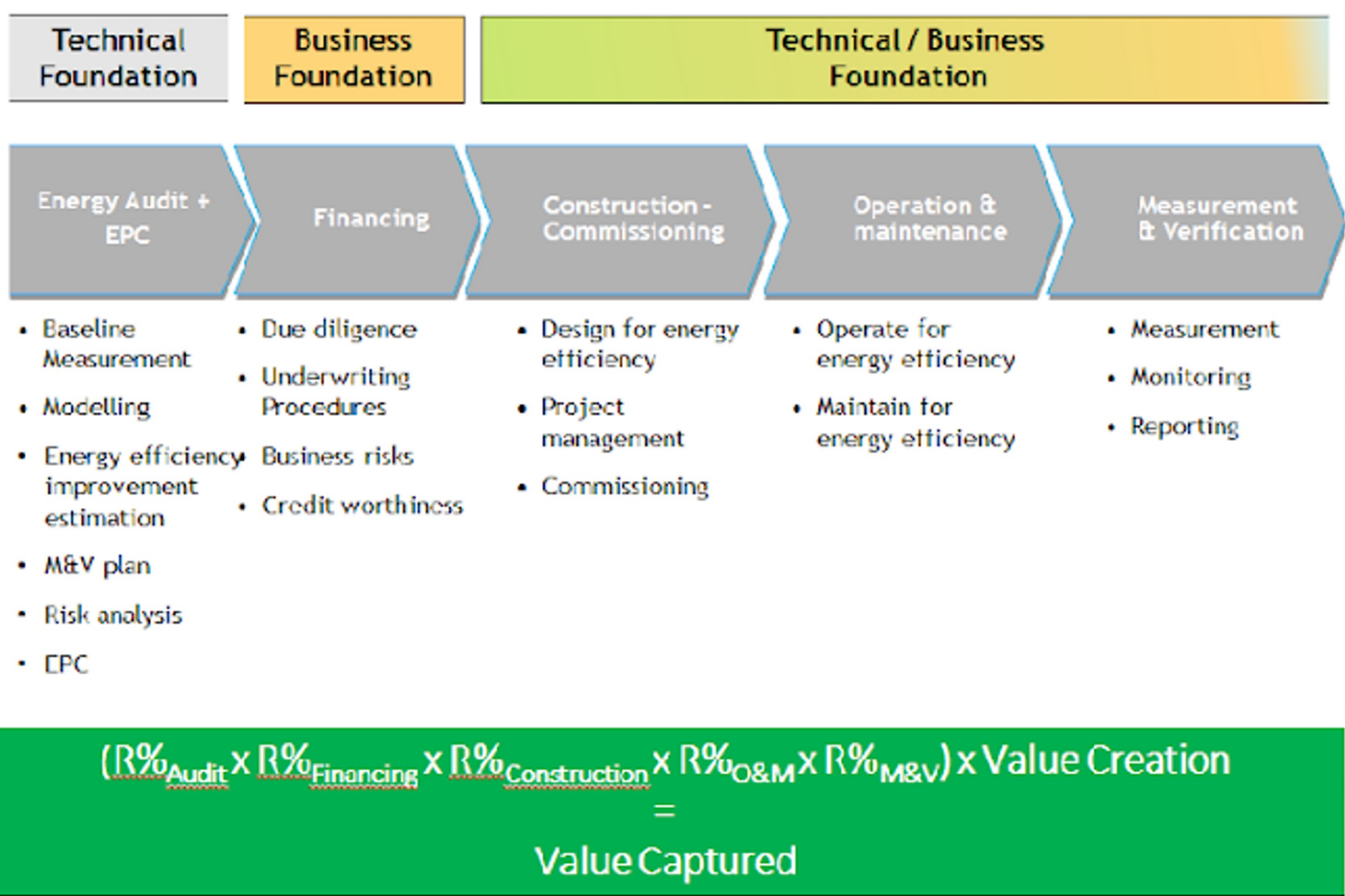
Agris Kamenders,  
International Consultant, SECCA

# How to achieve the intended results



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# Different Risks



# 1. ex-ante energy audits

- **Lack of Up-to-Date Operational Data:**

- Building models rely on outdated or unmeasured heat energy consumption data, undermining accuracy.

- **Theoretical Building Models:**

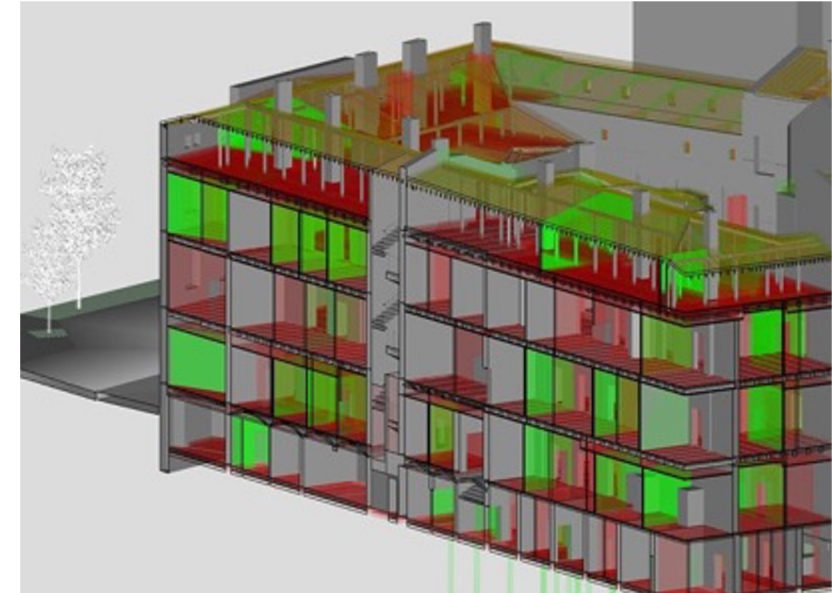
- Without validated data, building models remain theoretical and lack real-world validation.

- **Overestimated Energy Savings:**

- Theoretical calculations often lead to overestimated energy savings.

- **Proposed Energy Efficiency Measures:**

- Building fabric improvements are typically well-described, including:
  - Thermal insulation upgrades for exterior walls, basement ceilings, and attics/roofs.
  - Replacement of windows and doors, and closure of loggias.
- Space heating and domestic hot water system upgrades may include:
  - Replacement of distribution pipes, installation of balancing valves and thermostatic valves, and upgrading radiators.
- Ventilation issues are frequently overlooked in energy audits.



## 2. Technical design

- **Standardized Drawings:**
  - Design companies often utilize standard drawings across multiple buildings with minimal adjustments.
- **Misalignment with Building Specifics:**
  - Proposed solutions may not always align with the unique situations and geometries of individual buildings.
- **Lack of Solutions for Non-Standard Elements:**
  - The technical design frequently lacks solutions for non-standard building elements.



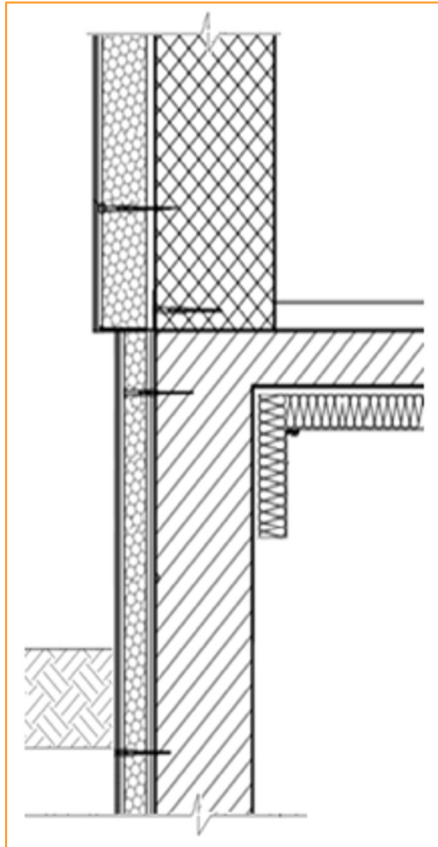
### While standardization can reduce costs:

- **Timely Supervision Essential:**
  - Project supervision should promptly identify violations.
- **Accountability for Errors:**
  - Design companies must be held accountable for errors in technical design and promptly modify or develop new solutions to accommodate building-specific conditions as requested by construction companies.

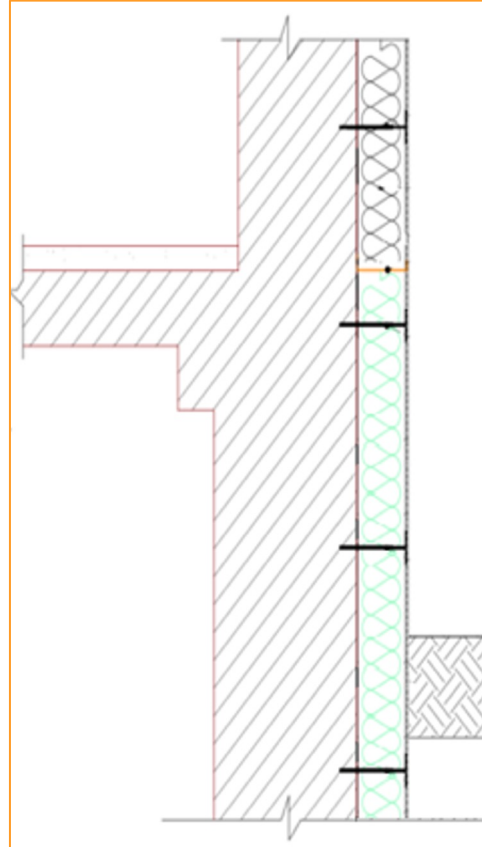


# Offset of plinth walls

Design solution



Design solution



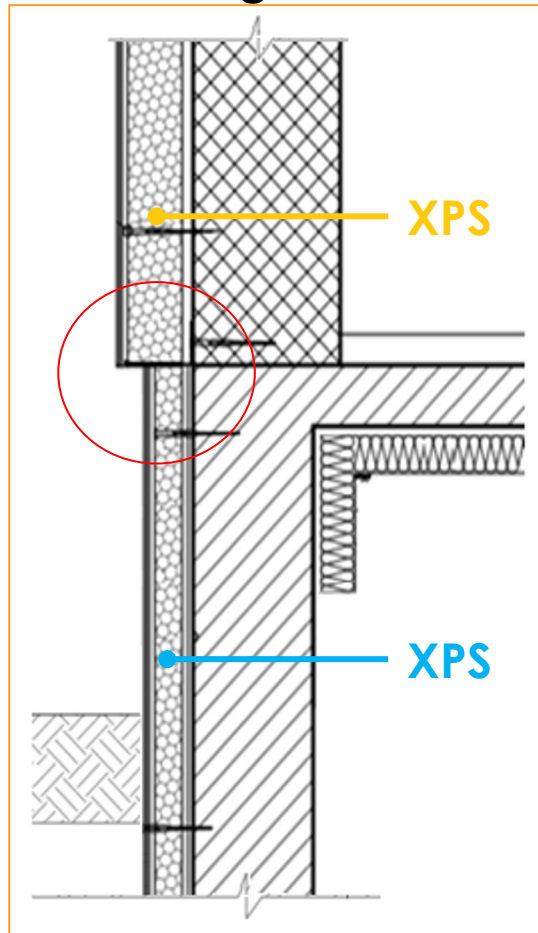
Implementation



Not insulated  
area  
Thermal  
bridge

# Offset of plinth walls

## Design solution

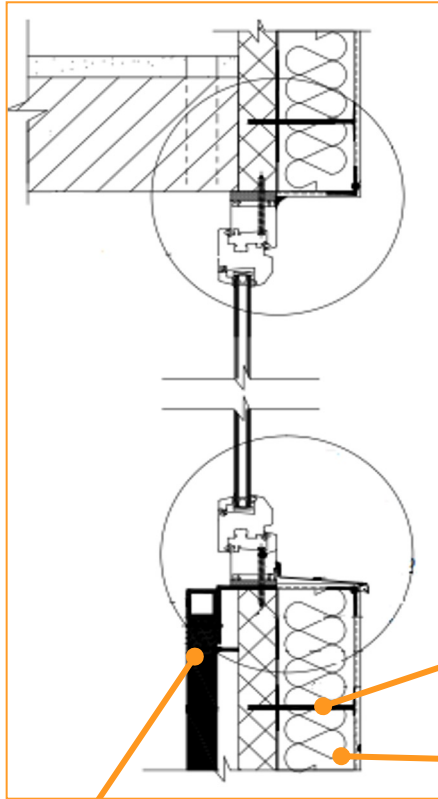


## Implementation



# Closing of loggias

## Design solution

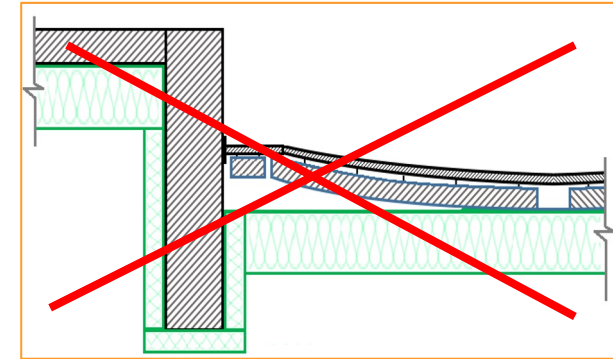


Metal frame

Prefabricated Cement block

EPS

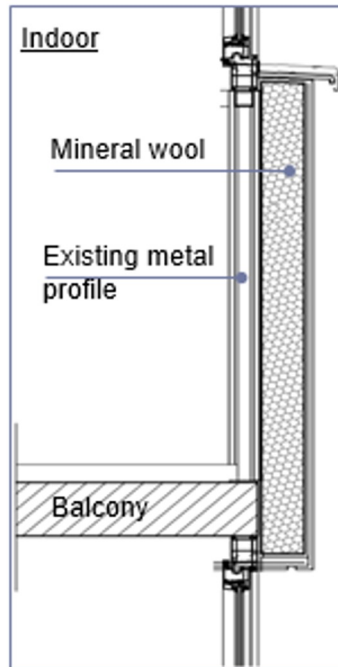
## Implementation



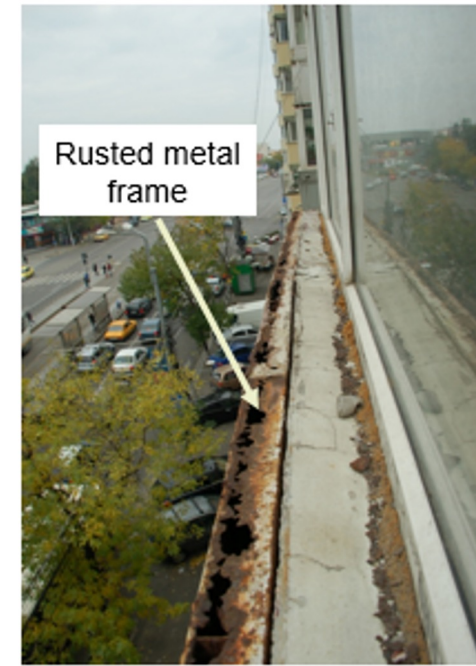
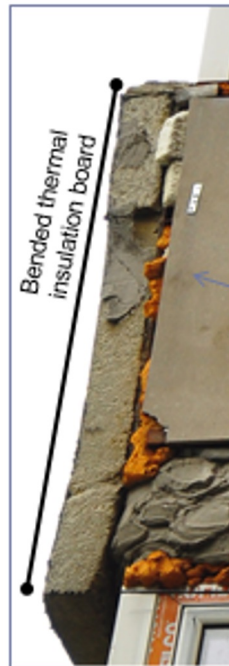


# Closing of loggias

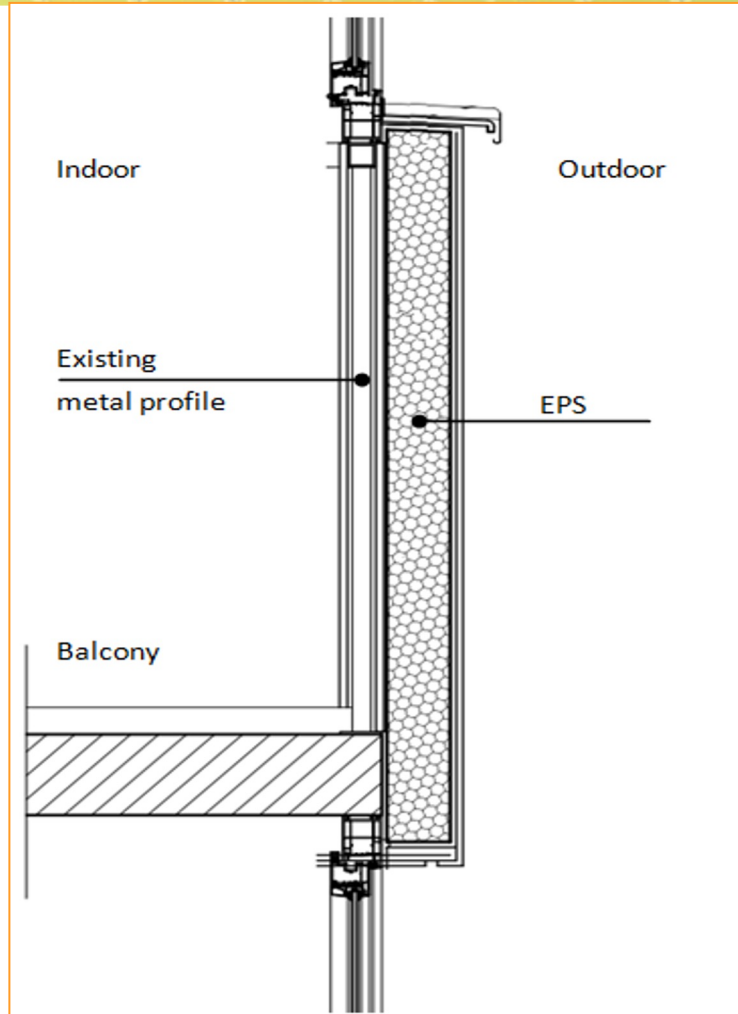
## Design solution



## Implementation?

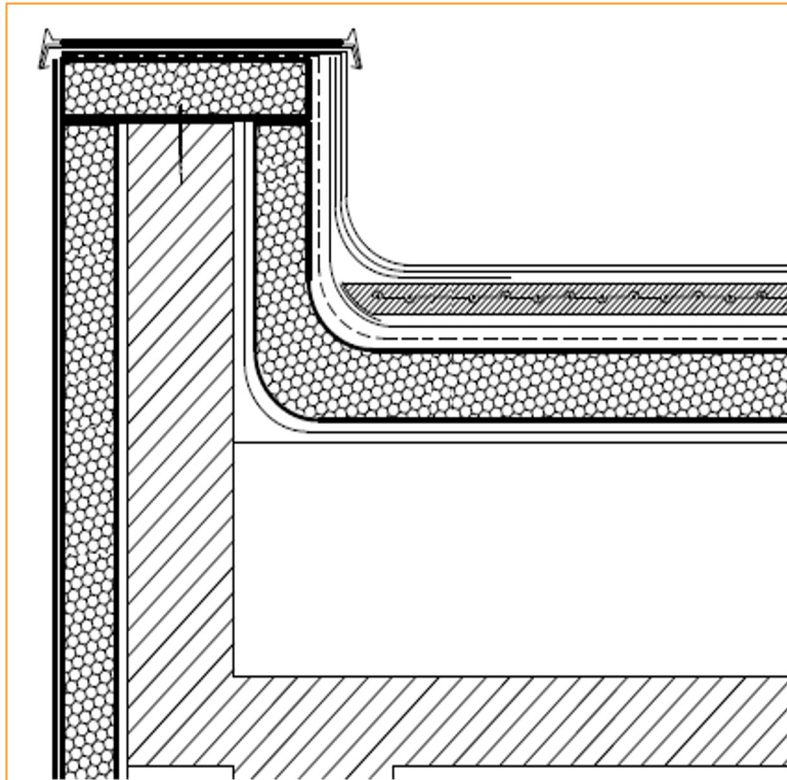


# Closing of loggias



# Fasade / roof insulation

Design solution



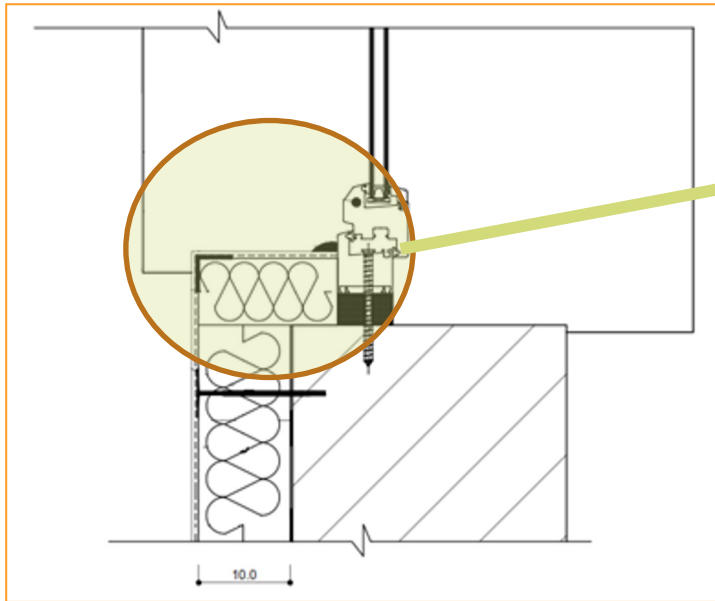
Implementation



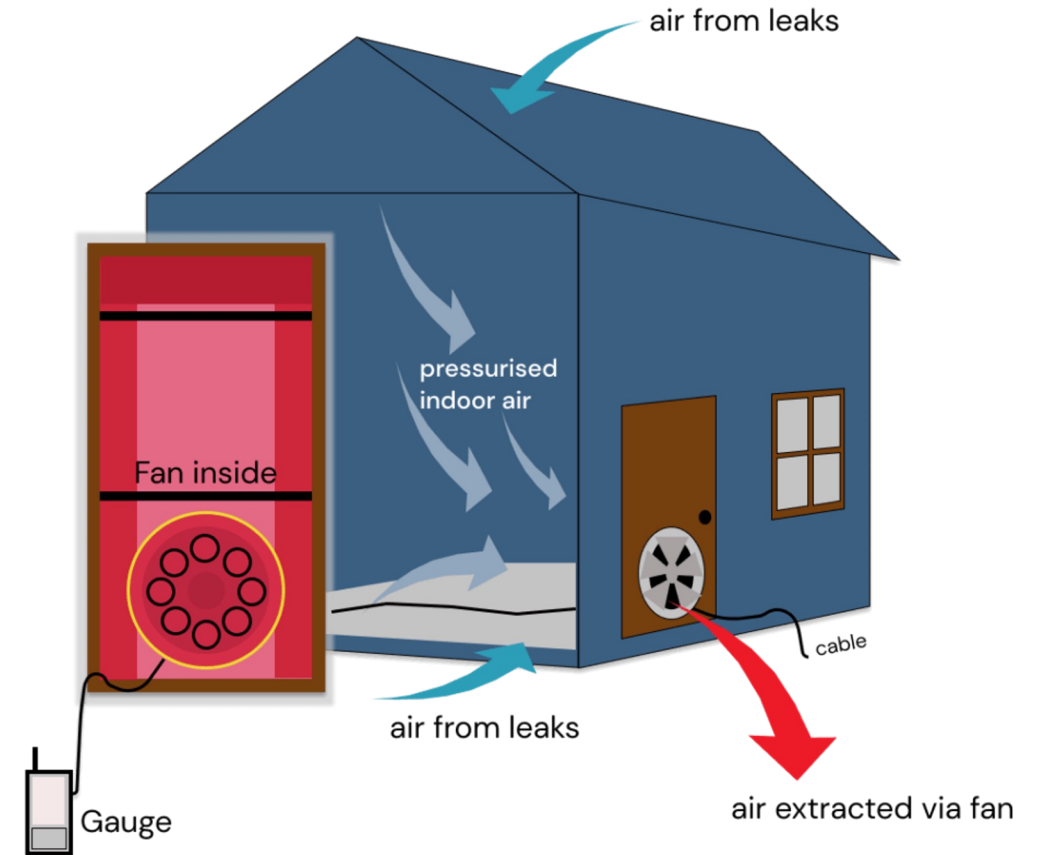
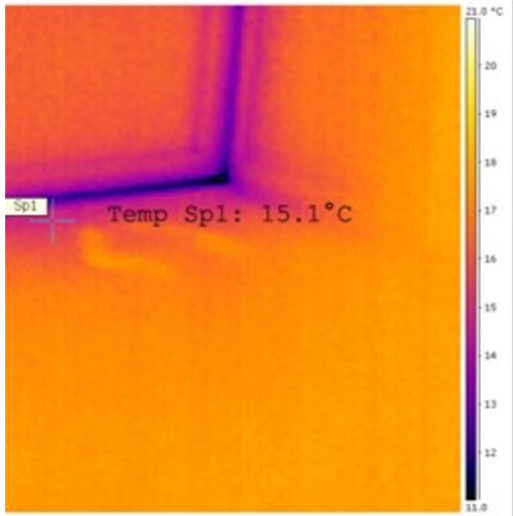
# Thermal insulation of windows sills and jambs

Difficult for windows already replaced by tenants

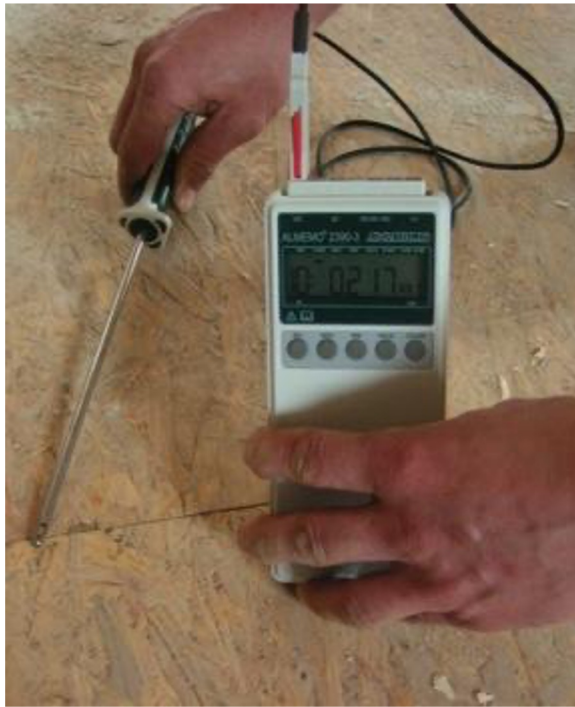
Installed windows did not take into account the application of insulation



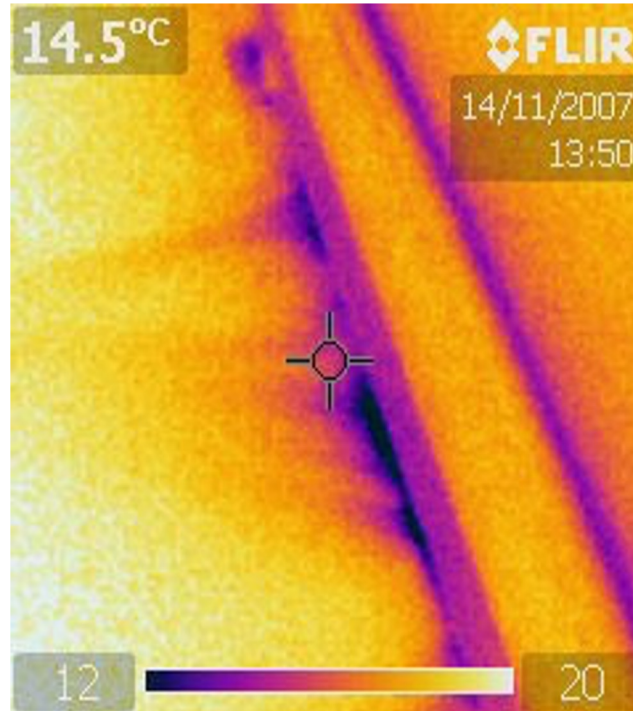
# Pressure test before finishing works are completed

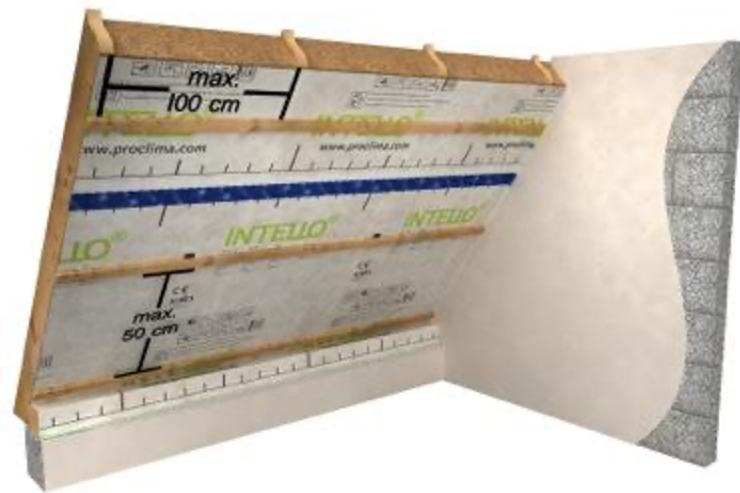


# Pressure test with thermography



Avots: Centrum pasivního domu





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# Density of structures



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# Window connections - lack of tightness, dirty surface



Avots: Niedrig Energie Institut, Detmold

### 3. Typical violation of construction companies

- Use of wrong material (EPS instead than XPS, or EPS instead than mineral wool)
- Thickness of thermal insulation (for examples 5-8cm instead than 10cm)
- Thickness of specialist render (very thin layer instead than 5mm)
- Wrong application of thermal insulation boards
- Anchoring the thermal insulation boards
- No use of support profiles for application of thermal insulation panels
- Installation of roof railing / metal sheets works
- Removing external appliances, pipes, electrical installation
- Heating and domestic hot water (technical insulation and valves)

# Use of wrong material

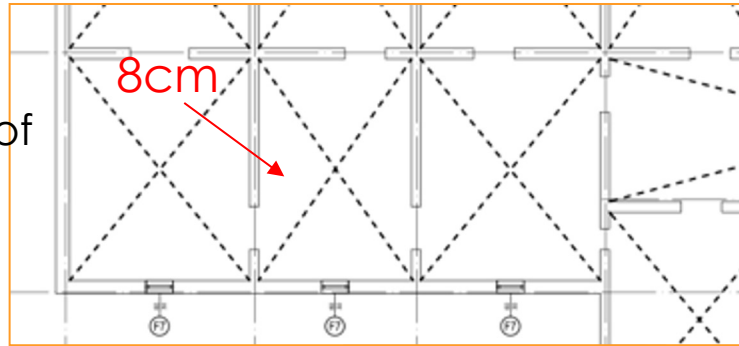
Project design: XPS for thermal insulation of building plinth  
Implementation: with EPS

- Project design: Mineral wool for thermal insulation of basement ceiling
- Implementation: with EPS



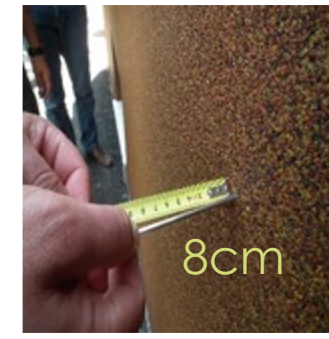
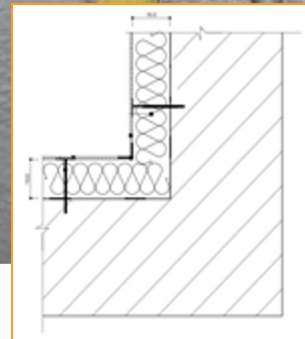
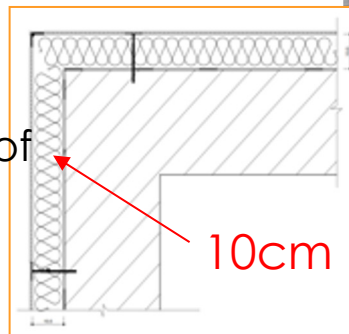
# Thickness of thermal insulation

thermal insulation of basement ceiling

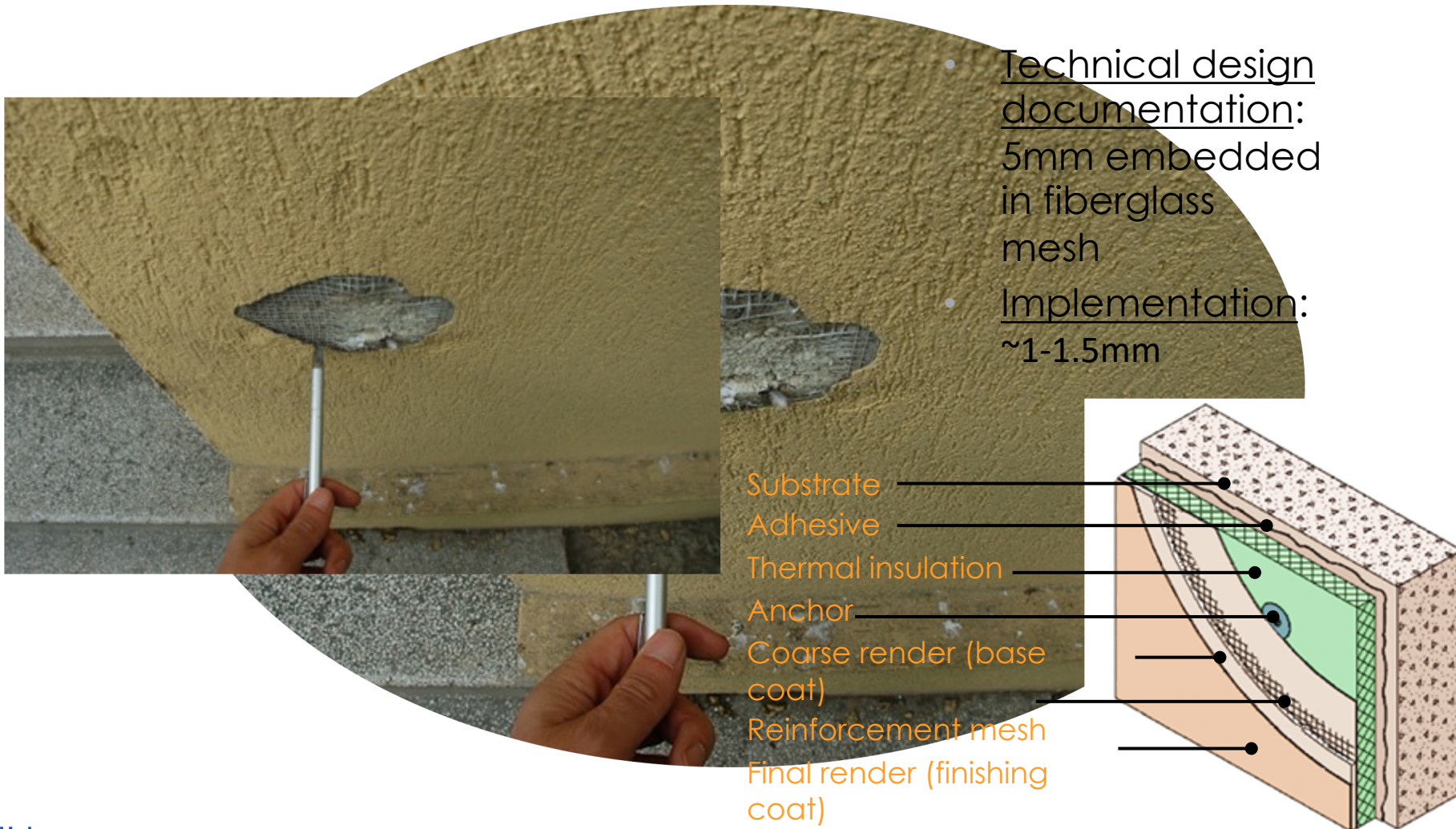


5cm →

thermal insulation of basement ceiling

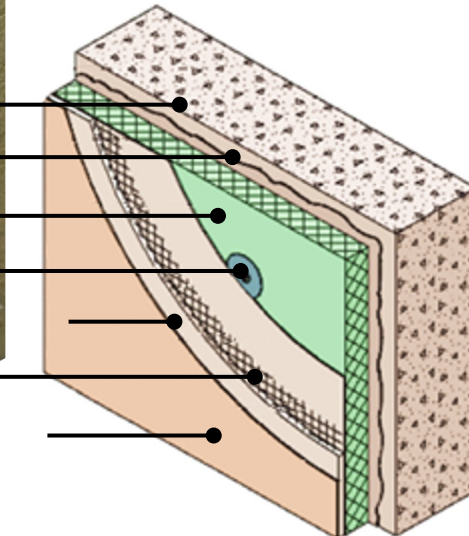


# Thickness of specialist render



- Technical design documentation:  
5mm embedded in fiberglass mesh
- Implementation:  
~1-1.5mm

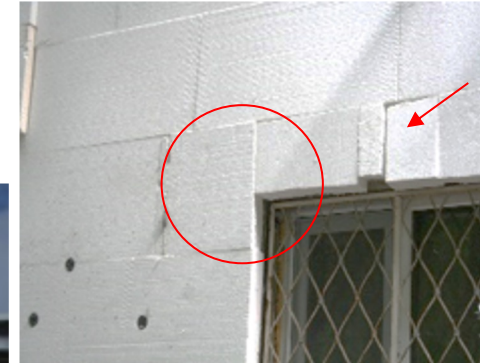
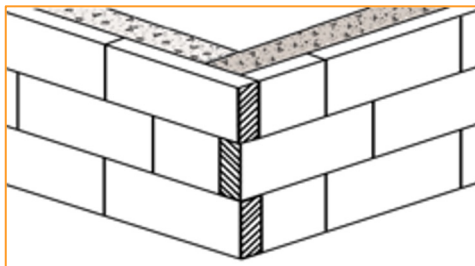
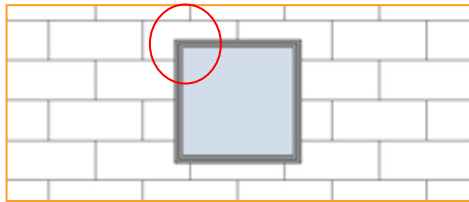
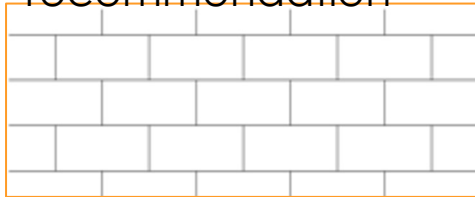
Substrate  
Adhesive  
Thermal insulation  
Anchor  
Coarse render (base coat)  
Reinforcement mesh  
Final render (finishing coat)



# Wrong application of thermal insulation boards

## Implementation

Manufacturer recommendation

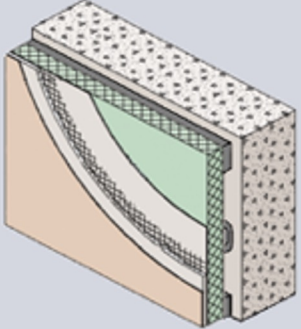
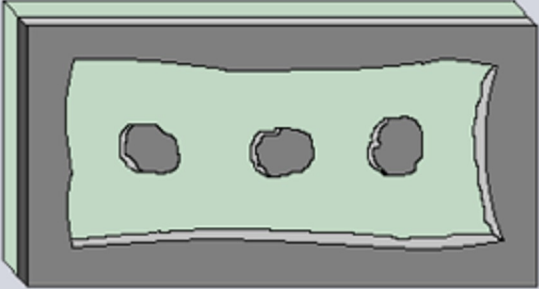
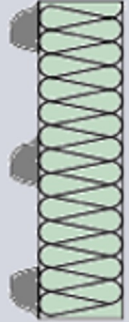
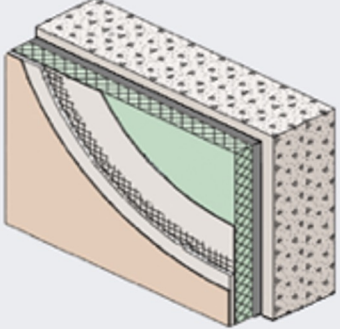
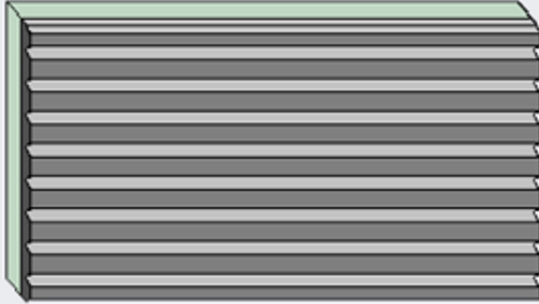
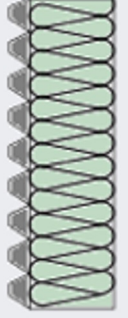


# Wrong application of thermal insulation boards



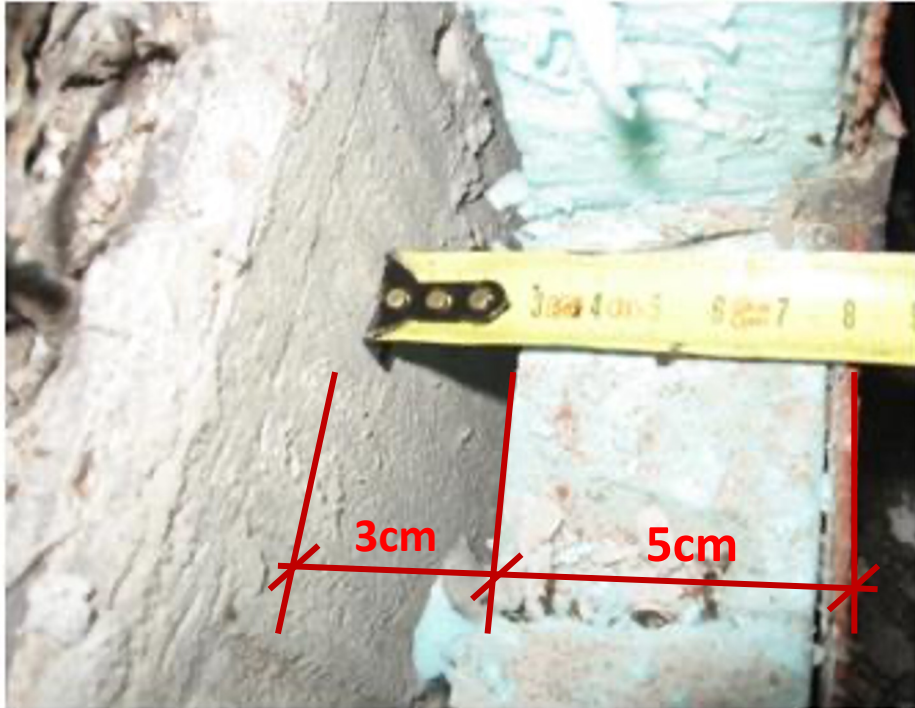
Substantial joint (>1 cm) between thermal insulation panels

# Adhesive mortar for installation of insulation boards

Method of application			
<b>Bead/spot method</b>			
<b>Full surface application</b>			



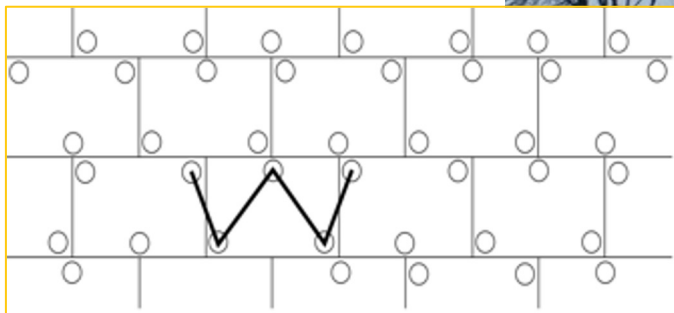
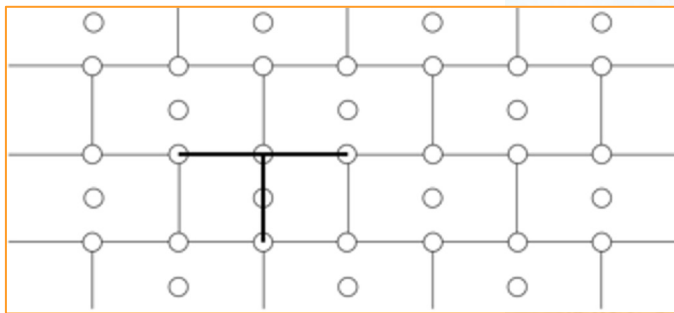
# Wrong application of thermal insulation boards



Insulation board not in contact with the substrate and attached with spot adhesive only without bead

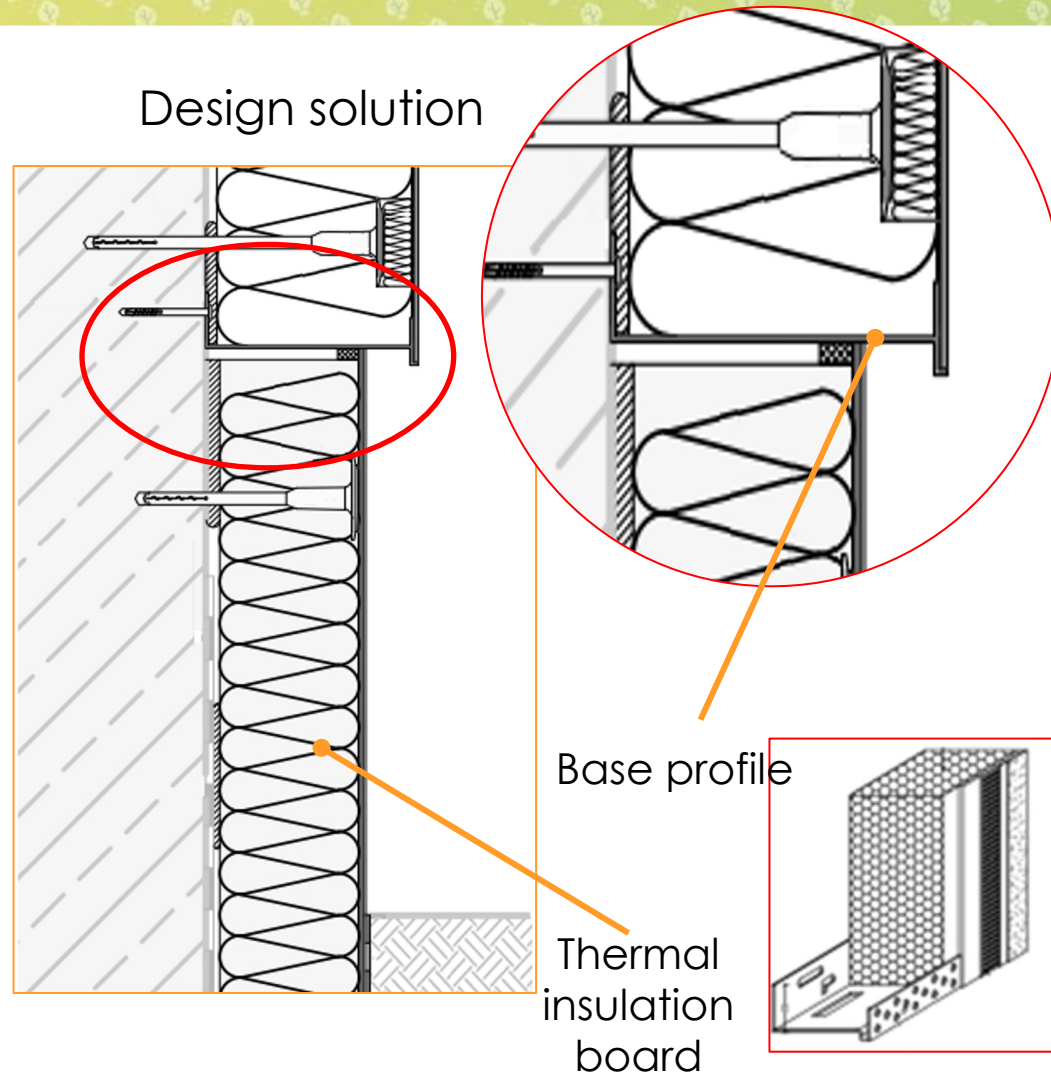
# Anchoring the thermal insulation boards

Example of anchoring pattern recommendation



1. Wrong application of the adhesive mortar (lack of bead layer, only few spots applied)
2. Anchors were not installed

# Missing steel profiles

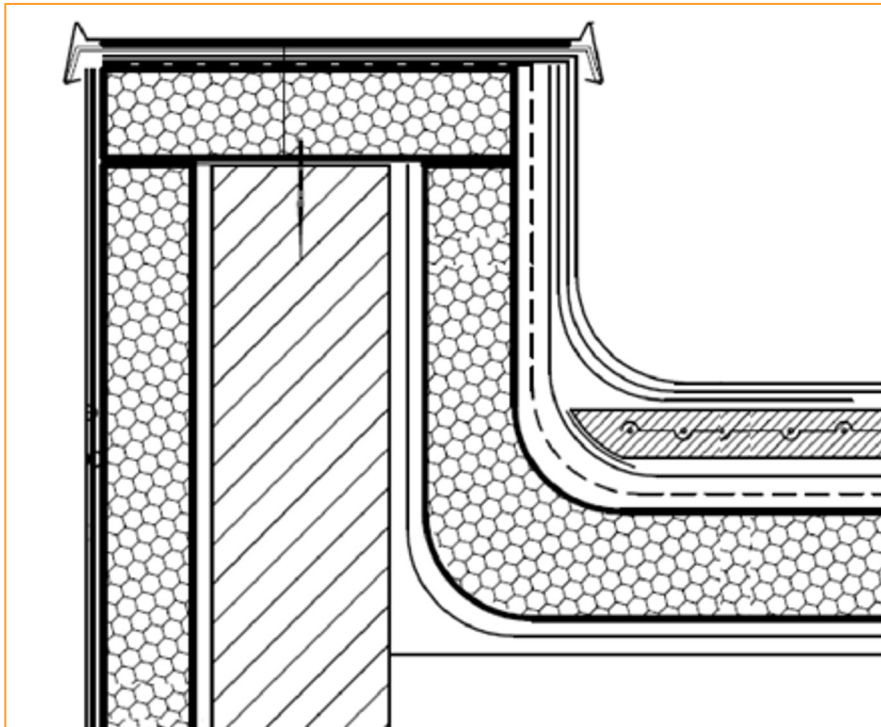


Implementation

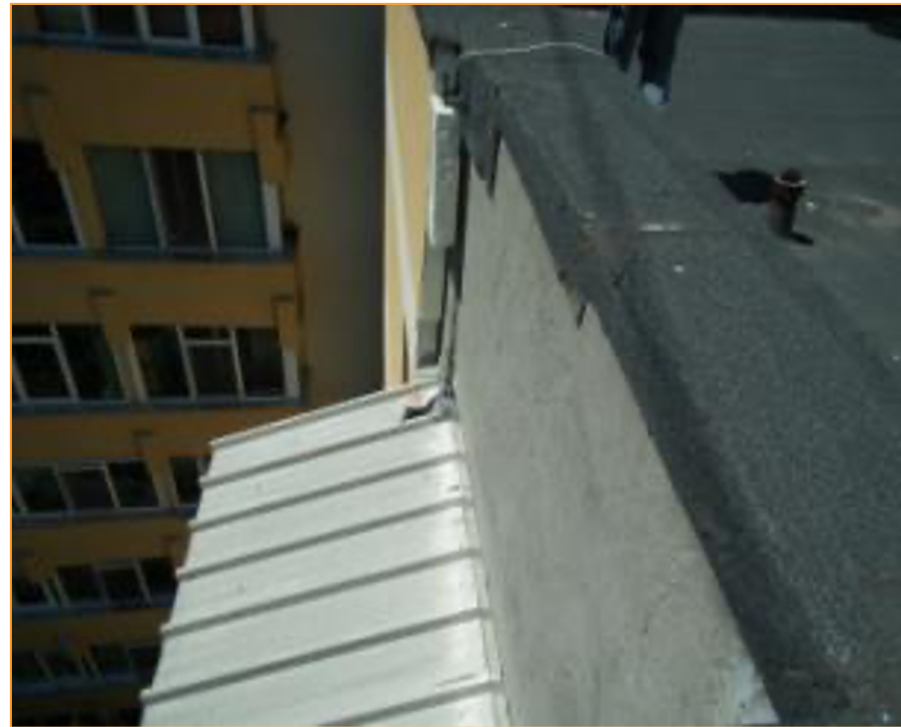


# Roof steel carpentry works

Design solution

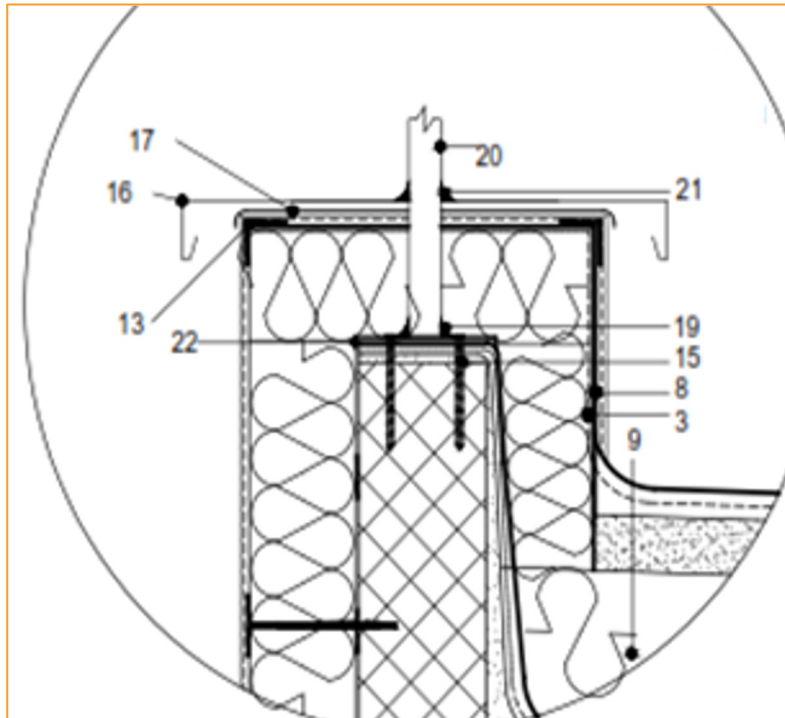


Implementation



# Installation of roof railing / metal sheet cover

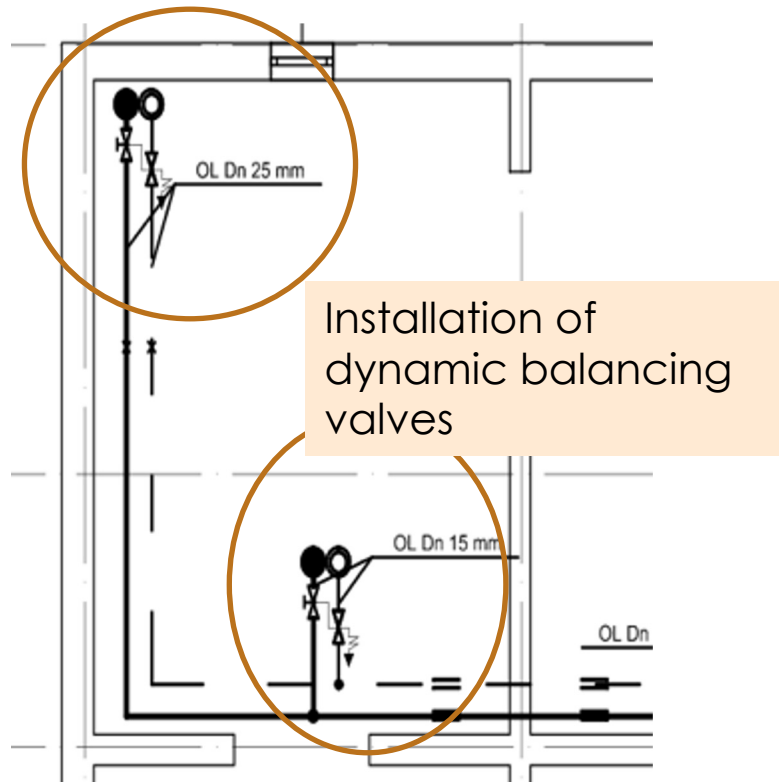
Design solution



Implementation



# Heating and domestic hot water



Poor quality of technical insulation



# Final finishing



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- Gas pipes and meters
- Electric installation
- Lighting installation
- Rain water pipes
- Air cooling units
- Antennas and SAT
- Ventilatioin grids
- Metal grids
- etc.





# Fire safety

- In most EU countries the use of EPS in basements for cellar slab insulation is not allowed
- Fire braking wool layers are not used if EPS is applied. (very difficult to check after construction works are finished)
- Electrical wires and luminaries are often embedded in the insulation layer

Use of EPS for cellar slab insulation Embedded wires and lighting fixtures



Examples with fire braking mineral wool layers



## 4. Project implementation process

- **Inadequate Preparation:**

- Lack of proper fencing, health and safety signs, debris protection nets, and site office/storage facilities.
- Preference for suspended scaffolding over fixed scaffolding.

- **Negative Impact:**

- Poorly organized construction sites affect construction quality and project completion time.

- **Reasons for Delays:**

- Lack of suitable planning and disagreements between contracting parties.
- Technical design inaccuracies and contractors bidding without thorough site analysis.
- Budget constraints leading to implementation delays.

- **Disorganized Activities:**

- Instances such as thermal insulation installation preceding window installation.
- Exposing EPS thermal insulation to sunlight for prolonged periods before plastering.

# Typical causes of violation

- Challenges:
  - Tenant resistance to necessary renovations such as window or sill replacements.
  - Restrictions on worker access for essential plumbing works.
- Causes:
  - Lack of detailed or inaccurate technical design.
  - Construction companies prioritizing cost-cutting measures.
    - Use of cheaper materials (insulation, paints, mortars, etc.).
    - Reduction in material usage (mortar, coating, anchors, etc.).
    - Employment of unqualified staff and workers.
- Impact:
  - Availability of workmanship affected by poorly trained workers.
  - Incorrect installation of thermal insulation, defective plastering, inaccurate window installation, etc.
  - Lack of supervision exacerbates observed violations.
- Solutions:
  - Effective supervision can prevent many violations.
  - Timely and adequate supervision is essential for ensuring compliance and quality.

# Conclusion

- **Site Visits Essential:**

- Design and engineering firms must conduct regular site visits to verify alignment between standard technical drawings and specific building conditions.

- **Detailed Execution Plans:**

- Include additional instructions for thermal insulation of windowsills and jambs in confined spaces.

- **Loggia Thermal Insulation:**

- Evaluate existing parapets carefully before insulating loggias.
- Consider removing old parapets and installing sandwich panels or constructing new lightweight parapets conducive to insulation.

- **Plinth Wall Insulation:**

- Ensure proposed insulation solutions are free of thermal bridges.
- Apply suitable waterproofing measures to prevent moisture infiltration.



...and

After renovation remember to tune your heating system, otherwise 27°C in the staircases and 30°C in apartments can be expected

