




# CESB16

Central Europe towards Sustainable Building 2016  
Innovations for Sustainable Future

A panoramic view of Prague, Czech Republic, showing the Vltava River, several bridges, and the city's historic architecture with red-tiled roofs and spires under a clear sky.

## LABORATORY STUDY OF DRIVING RAIN RESISTANCE OF FOUR FAÇADE SYSTEMS WITH WINDOW FITTINGS – EXPERIMENTAL RESULTS OF LEAKAGE FLOWS

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# Purpose



- To better understand the exact importance of seals and variations in installation and workmanship
- The rate of penetrating water (essential for designing and assessing the moisture safety)

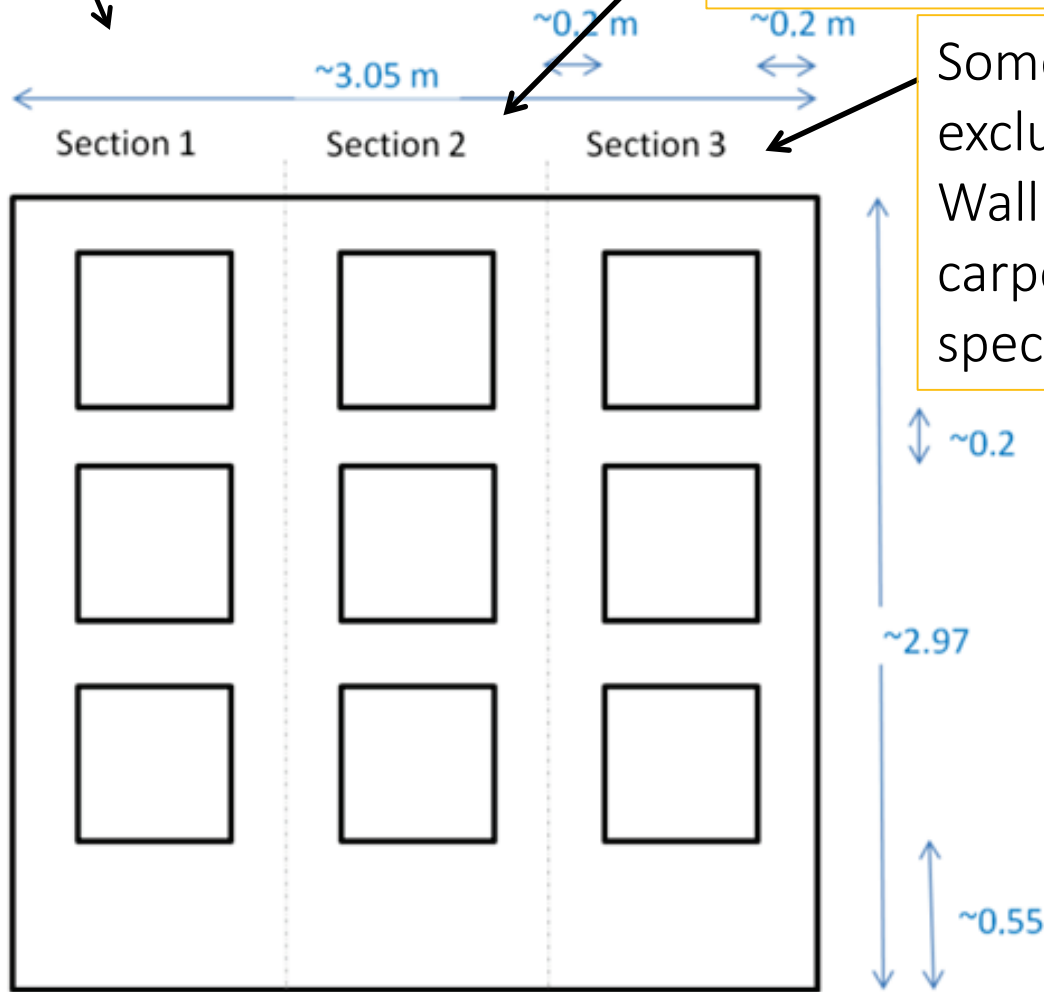
# Instructions for configuration experiment



Trained installers  
Wall 1-4

Some of the seals were excluded, wall 3-4

Some of the seals were excluded in wall 4.  
Wall 3 installed by a carpenter without specialized knowledge



Sketch of test wall

# Walls 1-2



1

- Façade board (polymer composite board)
- 25 mm outdoor air gap + metal lath
- 300 mm mineral wool insulation
- 12 mm plywood board
- Plastic foil



2

- 15 mm prefabricated high-performance concrete element
- 15 mm mineral wool insulation
- 100 mm XPS-insulation

# Walls 3-4



- 20 mm render (plaster)
- 200 mm mineral wool insulation (drainage possibility)
- Water-resistant gypsum board (second line of defence)



- 8-10 mm render (plaster)
- 100 mm EPS-insulation with drainage possibility
- Paintable waterproofing layer and fiber cement board (second line of defence)

# Method

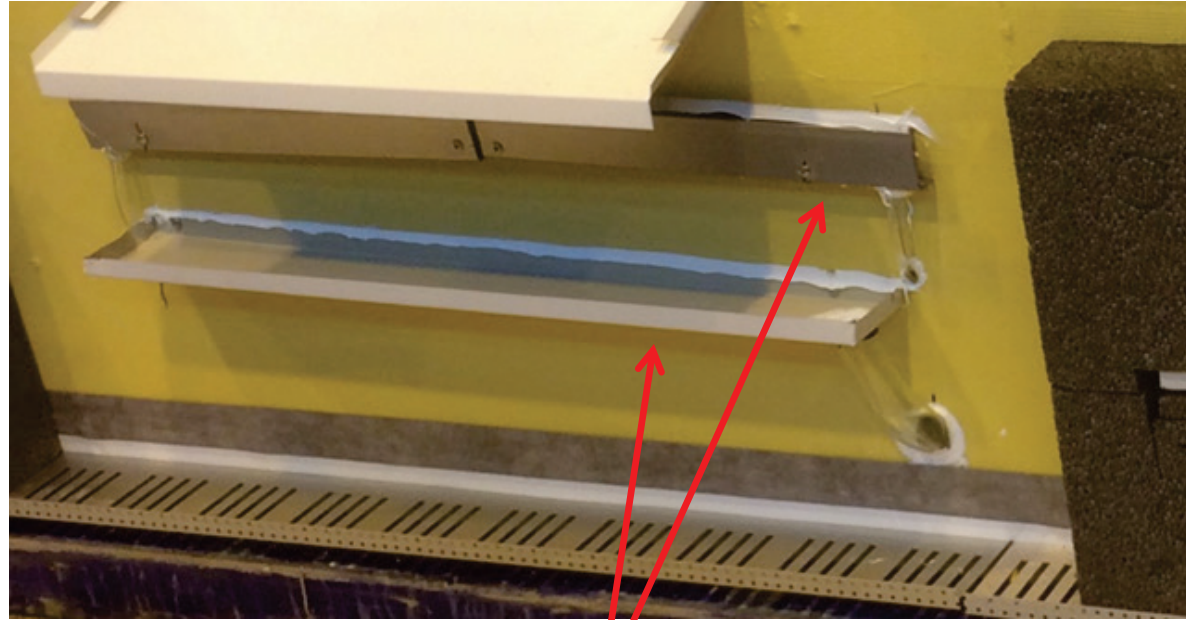


- EN 12865 *Determination of the resistance of external wall systems to driving rain under pulsating air pressure.*
- Procedure B (60 min), pressure stages:
  - (0 / 0-150 / 0-300 / 0-450 / 0-450 ) Pa
- (the bottom line of spray nozzles were moved down 100 mm for one of the walls)

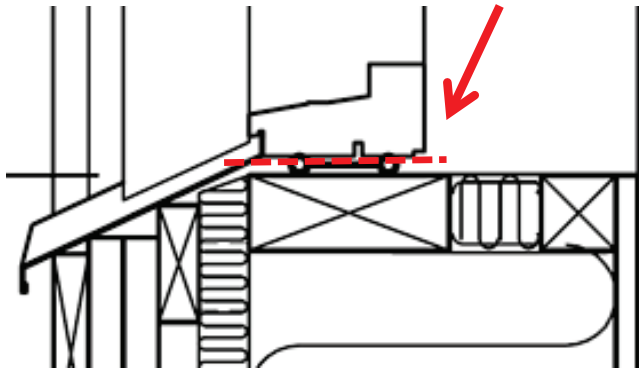
# Collecting devices



Collection tray



Catchment chutes



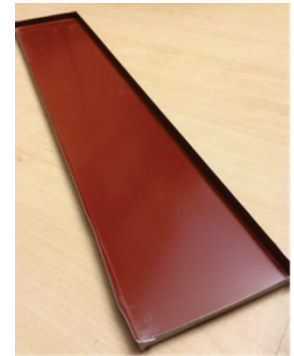
# Results



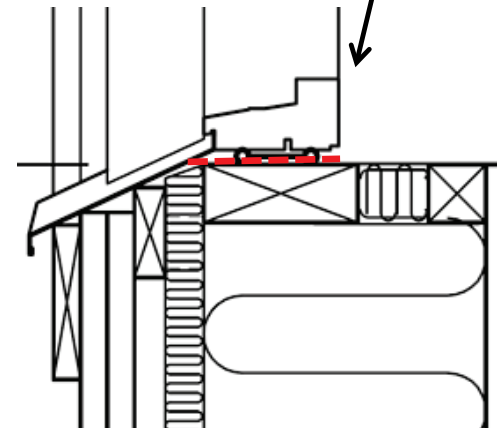
Driving rain during 5 hours

Number of trays	Mass of water leakage [g]
1	182
1	89
1	79
1	70
1	35
1	24
1	15
1	11
2	8
1	5
5	< 5, >0
11	0 No leaks!

Leakage in 16 of 27

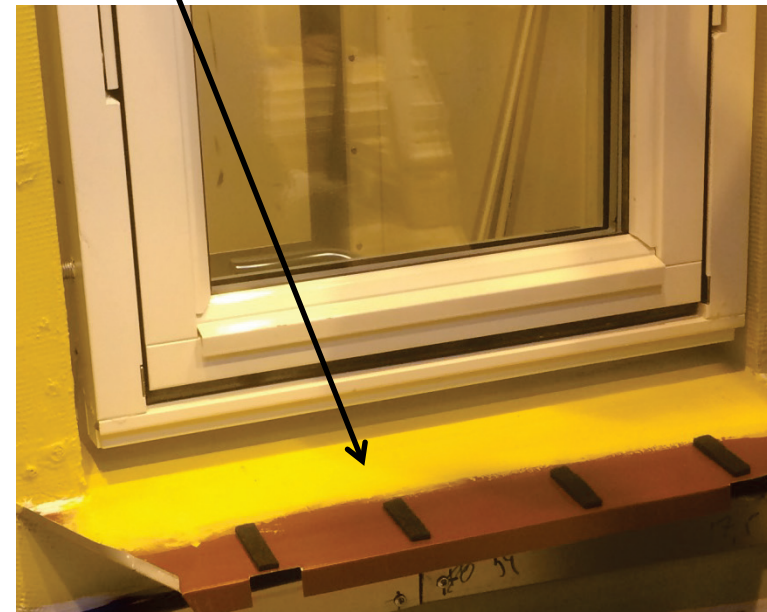
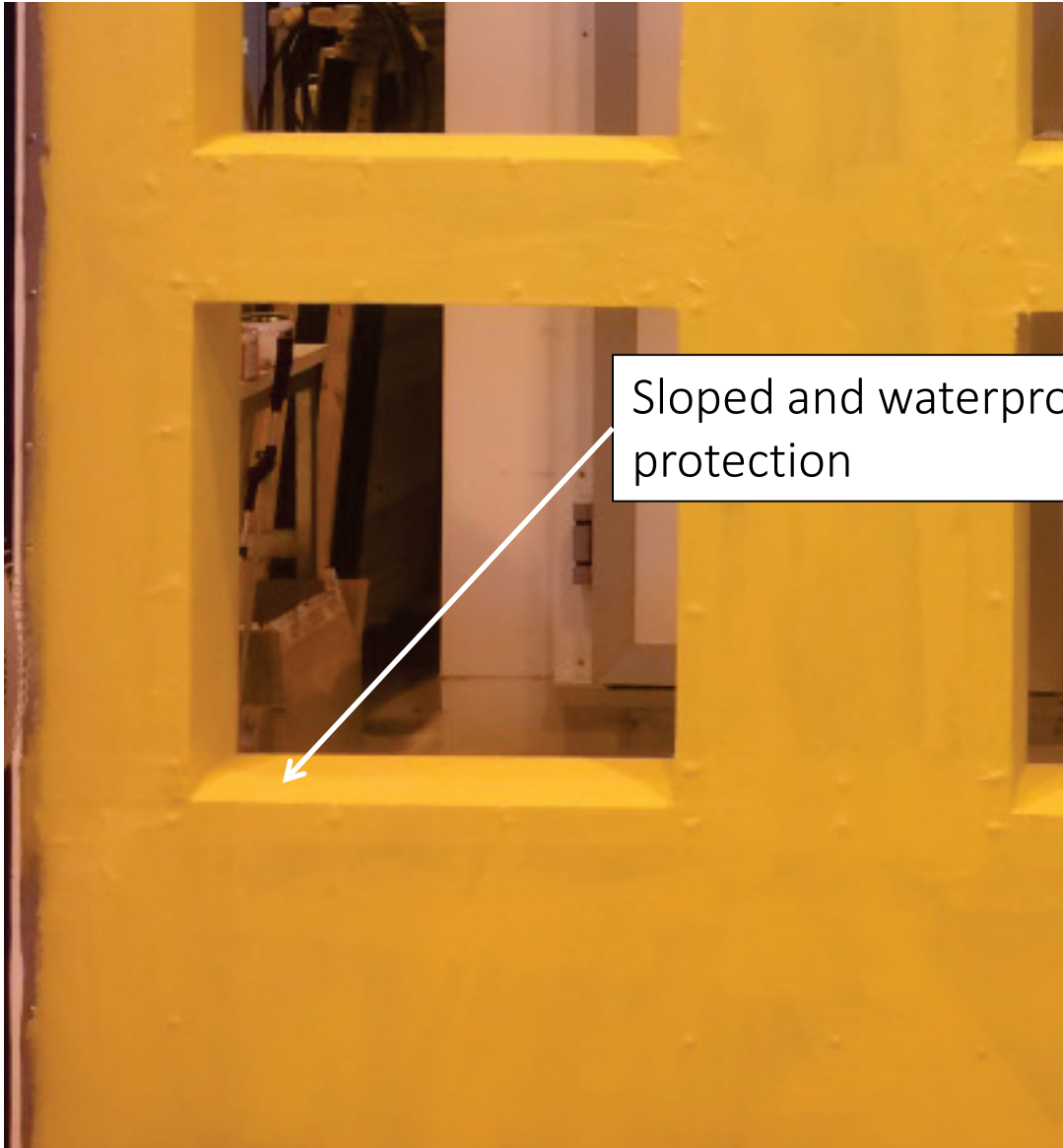


Collection tray

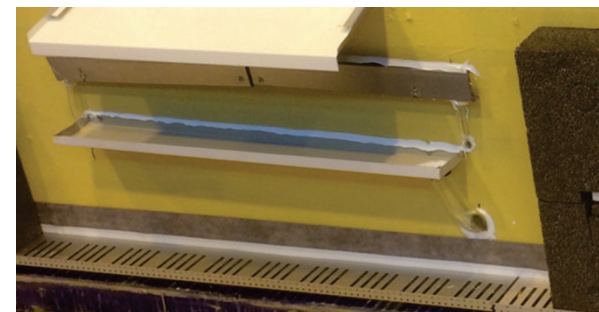
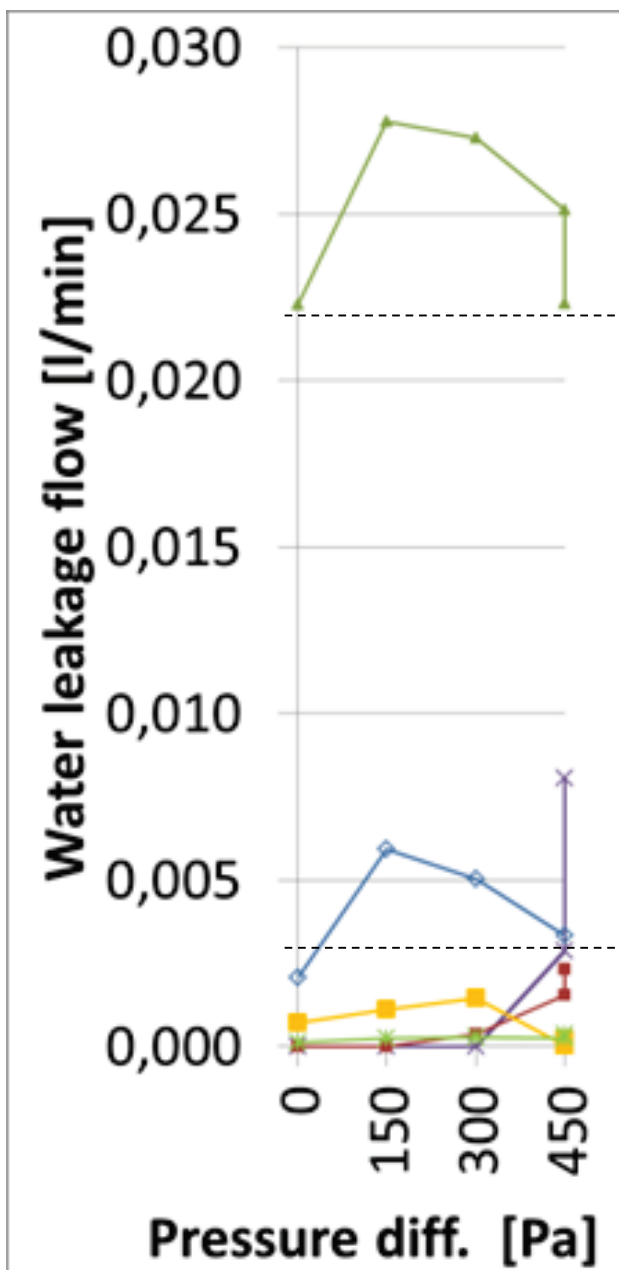




# Wall 3-4 Managing water to drain out



# Results



Catchment chutes

Same flow at 0 Pa and 450 Pa

6 out of 12 leakages are presented in the diagram

# Conclusions



- It is more of a rule than an exception that leakage occurs.
- Out of 27 window-wall interfaces 16 had water leakage (60%).
- Significant leakage flows (0.01 to 0.03 l/min).
- Many of the leakages started already at 0 Pa.
- No clear distinction between section 1 (trained installers) and sections 2-3 (some seals were excluded) – one reason; *small defects are not visible during installation.*
- The results could be used as point sources in 2D or 3D calculations.

# Thank you!



# Background



- During the last few decades rendered, unventilated and undrained (ETICS or EIFS) stud walls have been very popular in Sweden.
- Experiences from survey of (>1000) buildings in Sweden show that the problem is moisture entering the structure, at joints and window (door)-wall interfaces etc.

The damage is never visible on the surface of the wall, but hidden within the wall

