Risk reduction of large wooden roofs

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KLIMA2050

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CONSORTIUM

Private sector

SKANSKA
MESTERHUS
Multiconsult
Finans Norge
SKJÆVELAND GRUPPEN
NORGESHUS
weber SAINT-GOBAIN
isola
powel

Public sector

Statens vegvesen
Norges vassdrags- og energidirektorat NVE
AVINOR
Jernbanedirektoratet
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TRONDHEIM KOMMUNE

Research & education

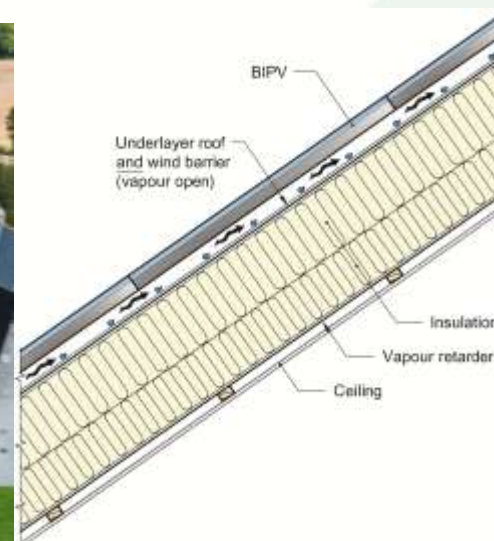
SINTEF
BI
NTNU
Meteorologisk institutt
NGI

Large ventilated wooden roofs - increased risks

Increased precipitation

Increased interest in large, low slope wooden roofs

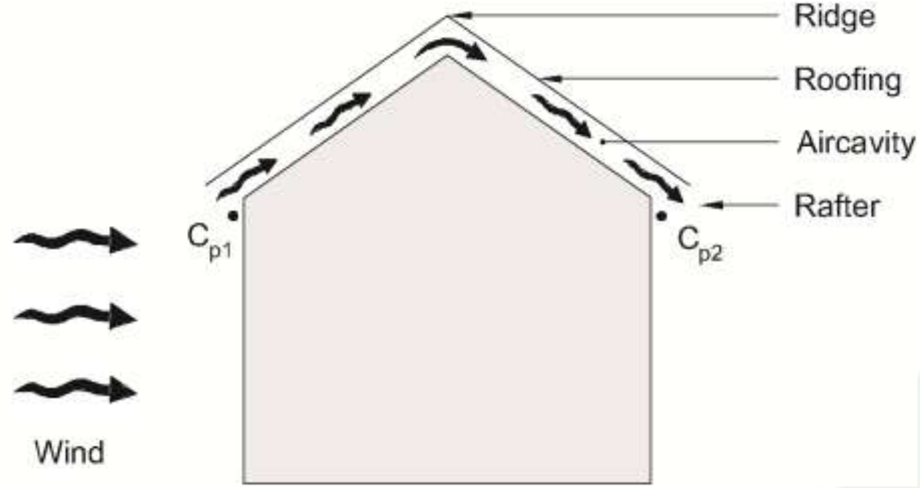
Increased insulation thickness



Climate adaptation of wooden roofs

Main task:
How can we build the robust wooden roofs of tomorrow adapted to the future climate?

Develop and increase the knowledge about venting and dry up of wooden roofs.

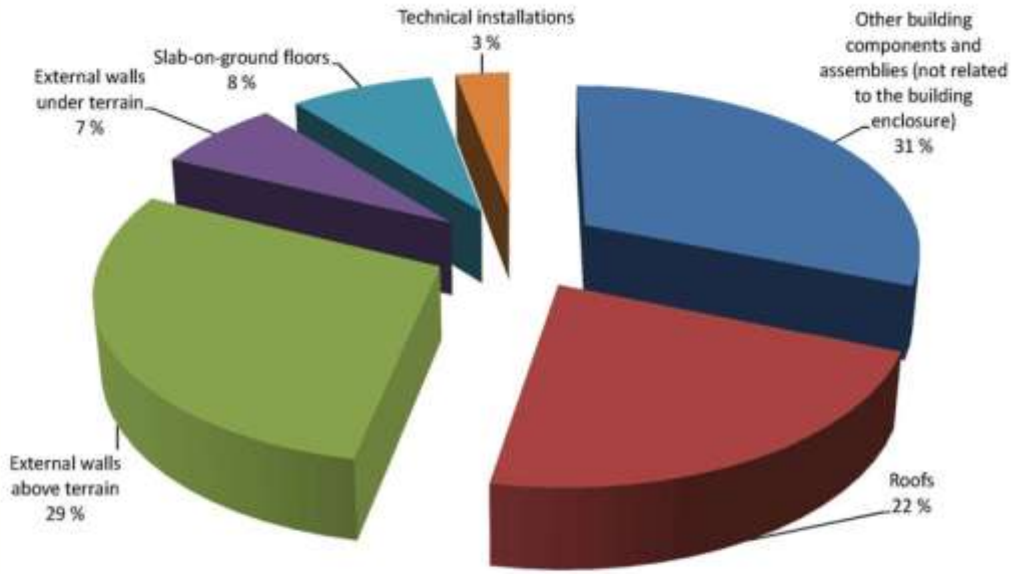


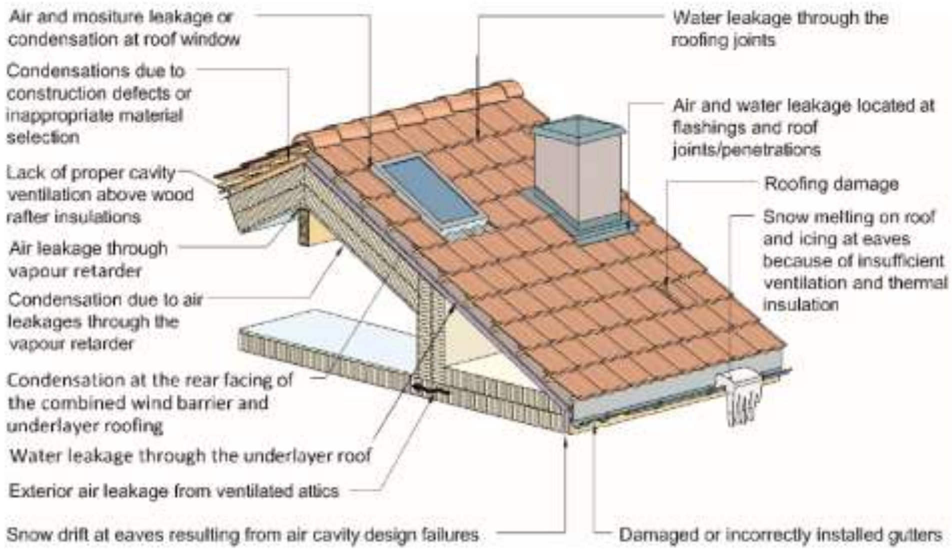
Building defects

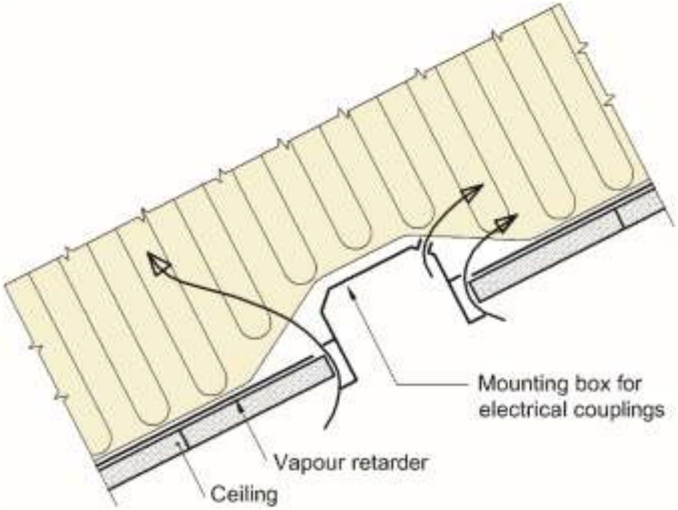
A large part located to roofs

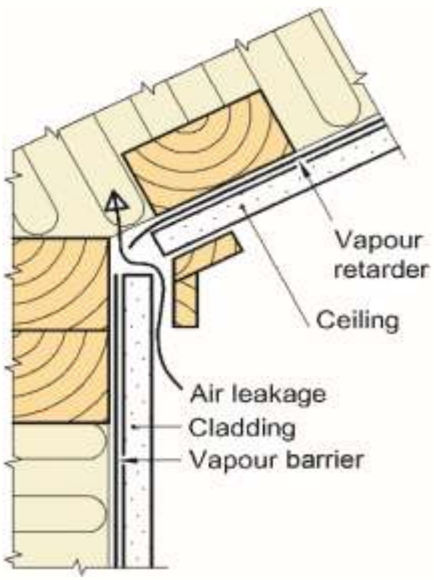
SINTEF Building defects archive consisting of more than 2000 reports

Overview of typical defects and causes






Mounting box for
electrical couplings
Vapour retarder
Ceiling


Vapour
retarder
Ceiling
Air leakage
Cladding
Vapour barrier

Research methods

Laboratory investigations

Field experiments

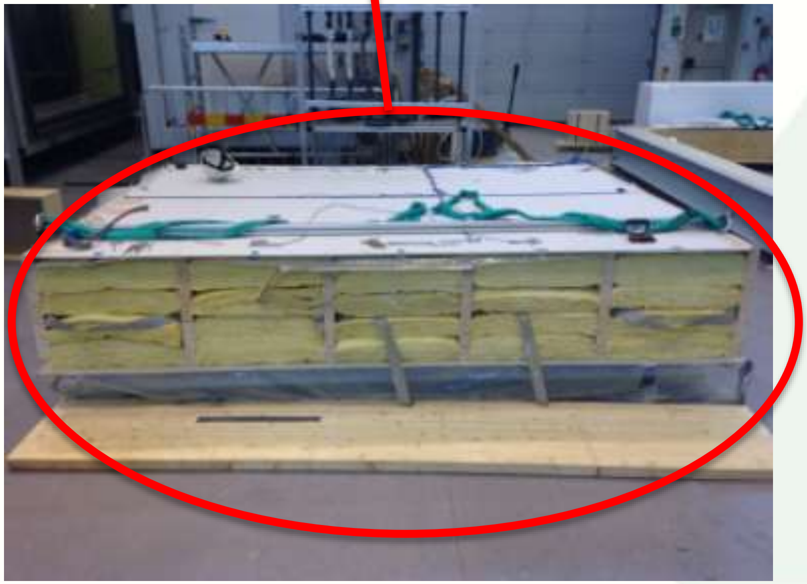
Calculations

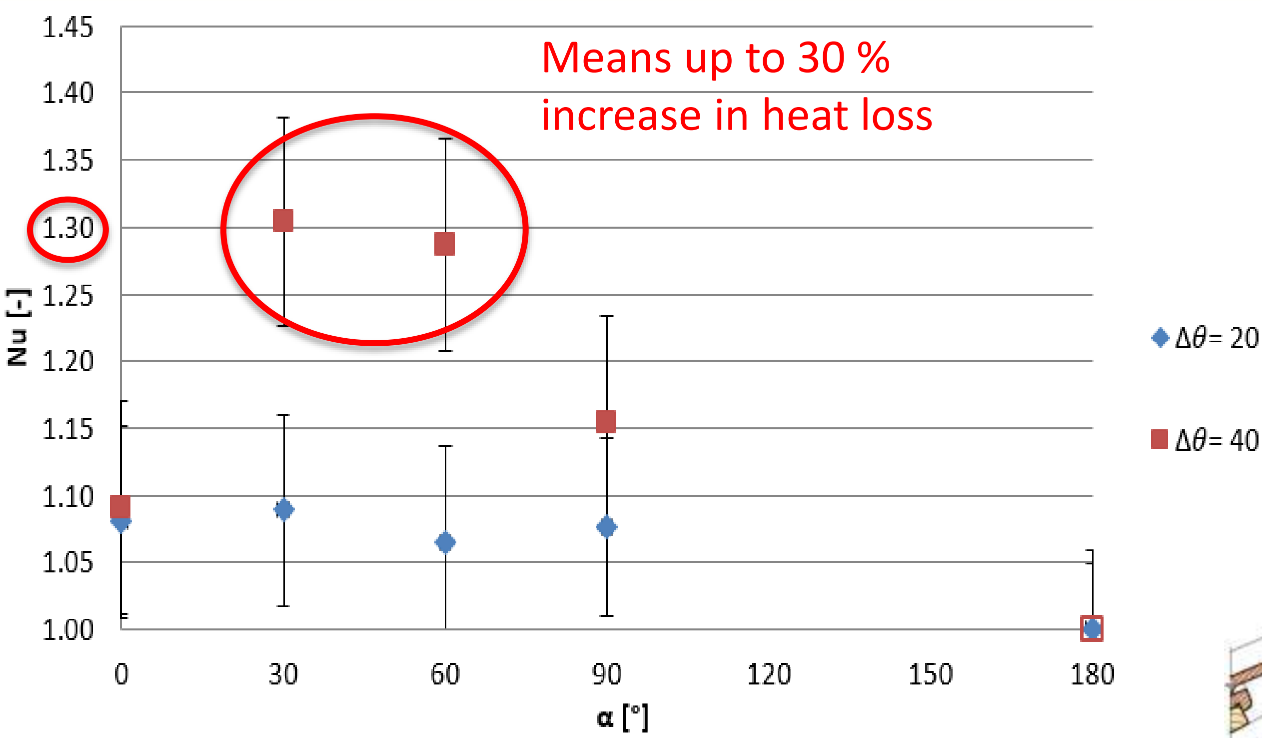
Highly insulated wooden roofs

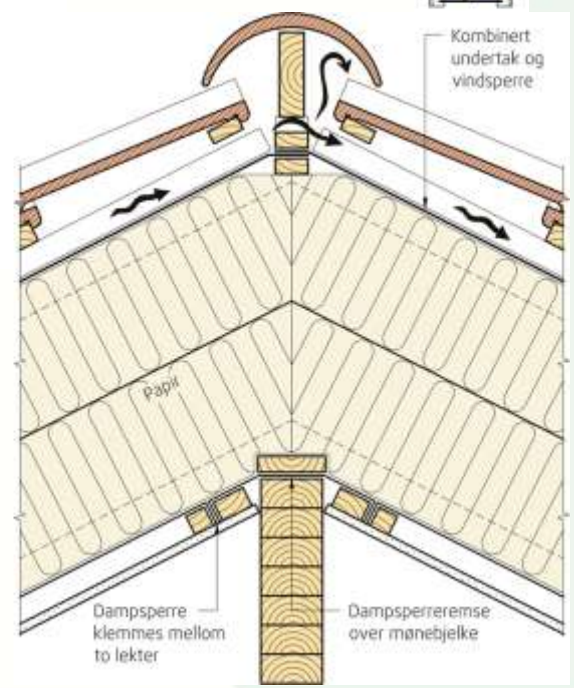
Risk of increased heat transfer (i.e energy use) and redistribution of moisture (i.e potential moisture problem)

Thick wood frame structures

Angle of inclination







Heat transfer affected by:

Temperature difference across structure

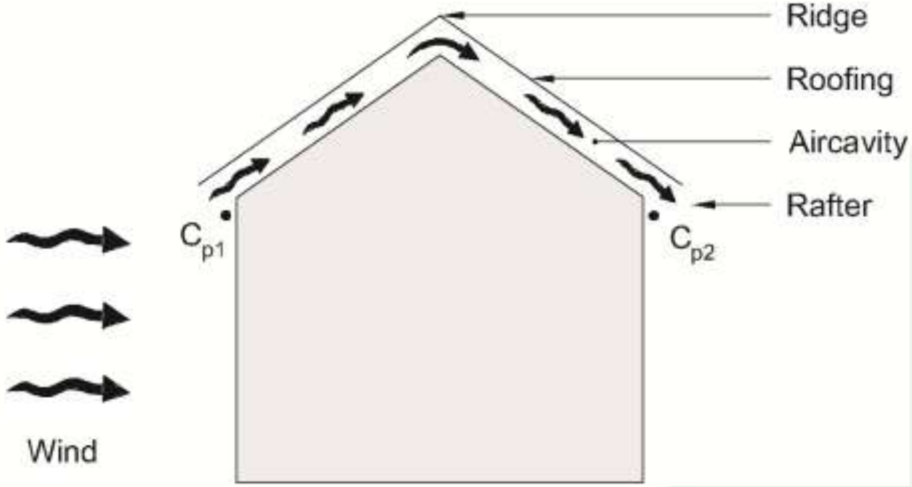
Angle of inclination

Roof ventilation

The ventilation of the cavity is given by:

Driving forces: wind and temperature differences (natural convection)

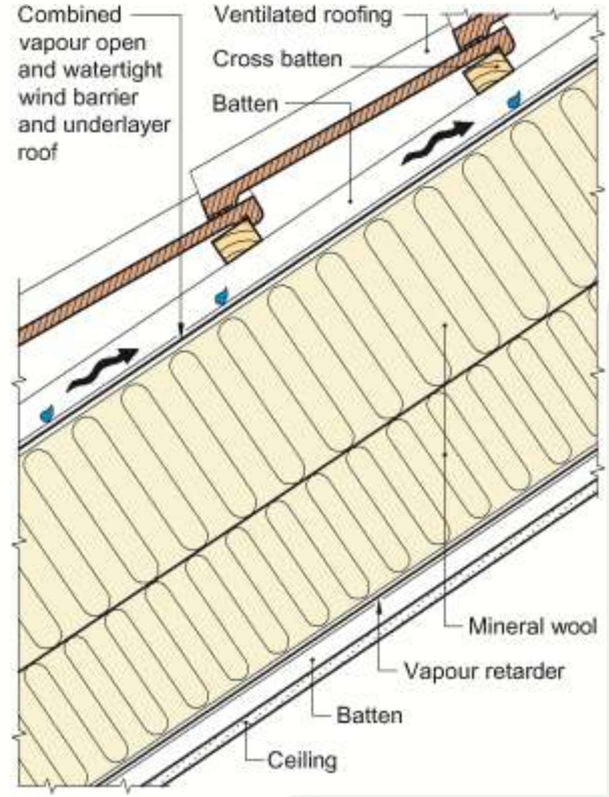
Pressure losses



Why ventilate roofs?

The basic principles for roofing ventilation is to transport:

- moisture from the roof and thus prevent moisture damages
- heat and thus prevent unwanted melting of snow and icing at the eaves



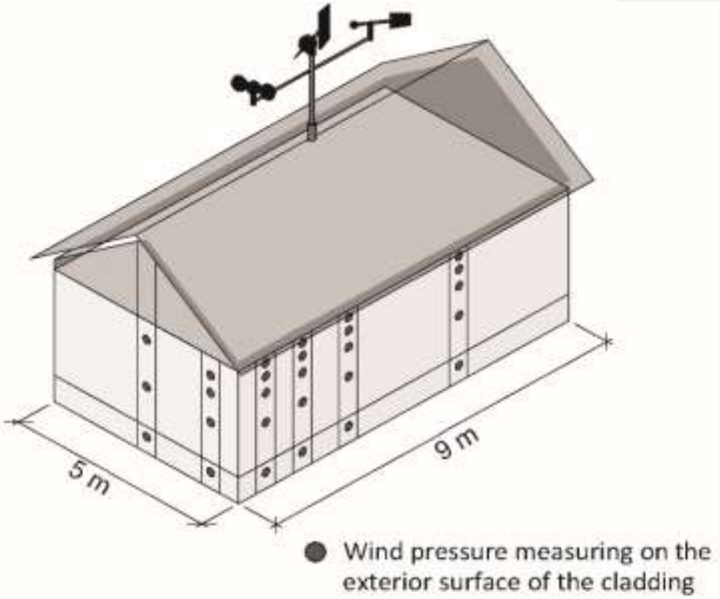
Driving forces - wind

Measurements performed by Sivert Uvsløkk in 1985!

Wind pressure measurements performed on a rotating test house situated at Tyholt

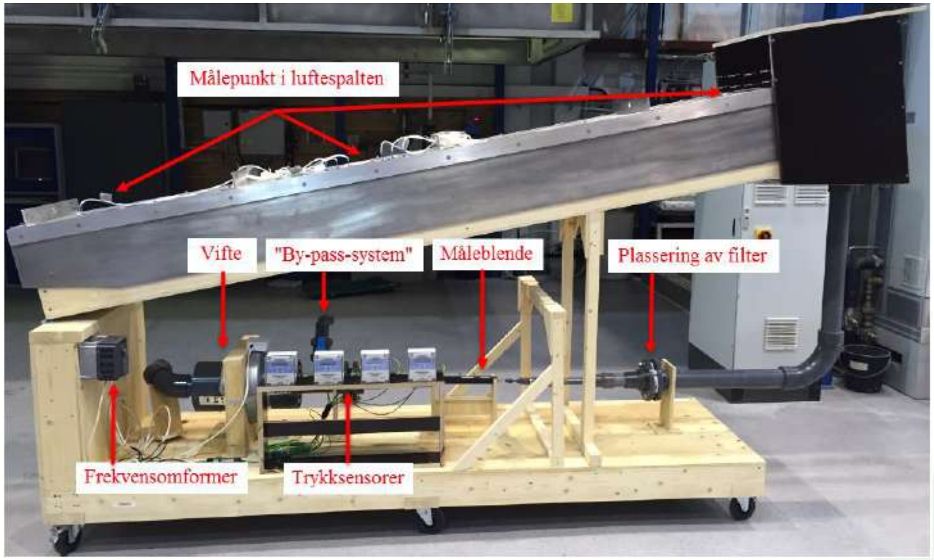
We found; New wind pressure coefficients for building facade helping us in our calculations of wind driven ventilation

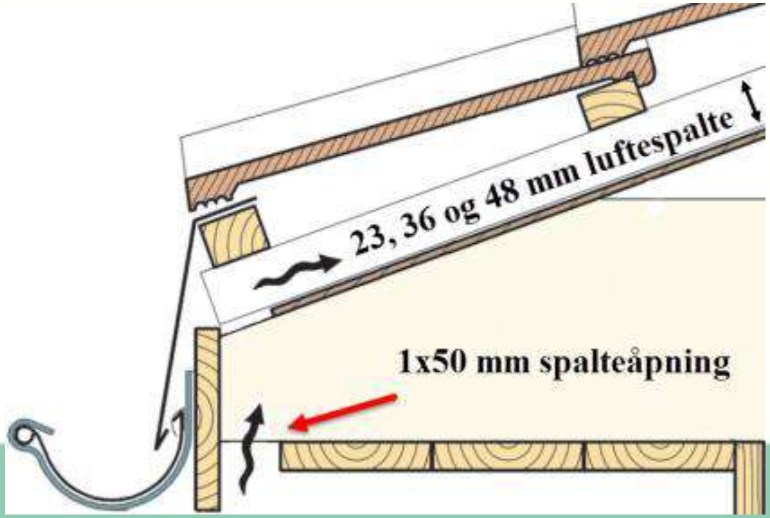
Picture by Sivert Uvsløkk, SINTEF

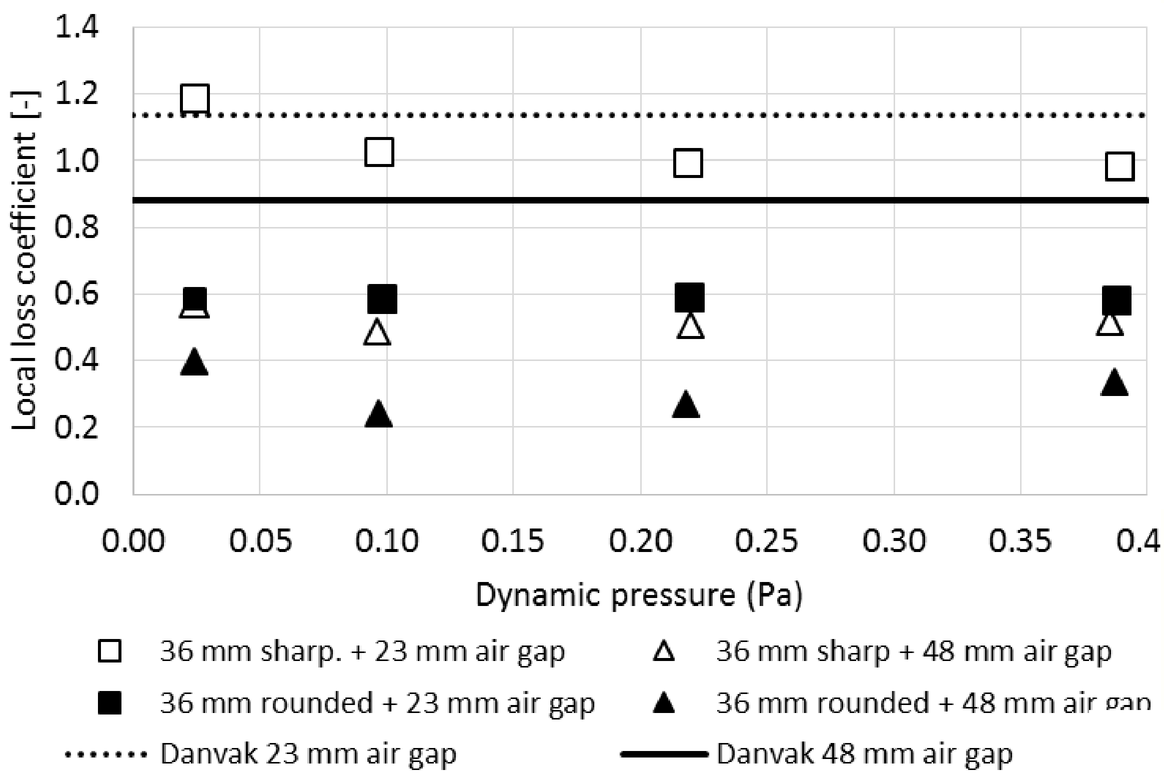


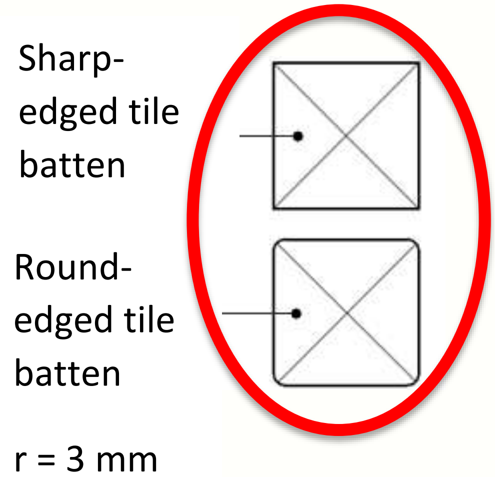
Air flow inside the air cavity in a roof

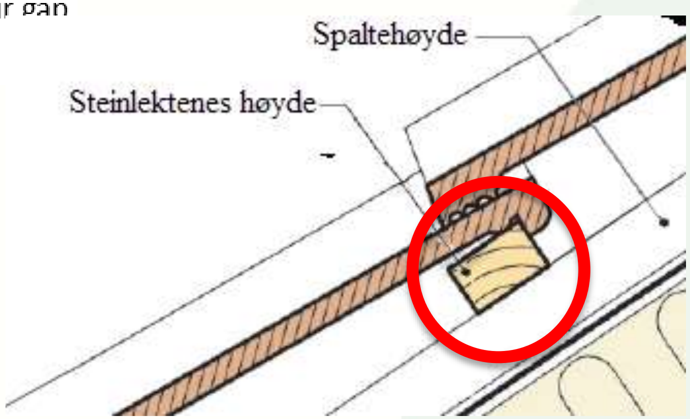
Laboratory investigation to investigate pressure losses






1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Local loss coefficient [-]
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.4
Dynamic pressure (Pa)
36 mm sharp. + 23 mm air gap
36 mm rounded + 23 mm air gap
Danvak 23 mm air gap
36 mm sharp + 48 mm air gap
36 mm rounded + 48 mm air gap
Danvak 48 mm air gap

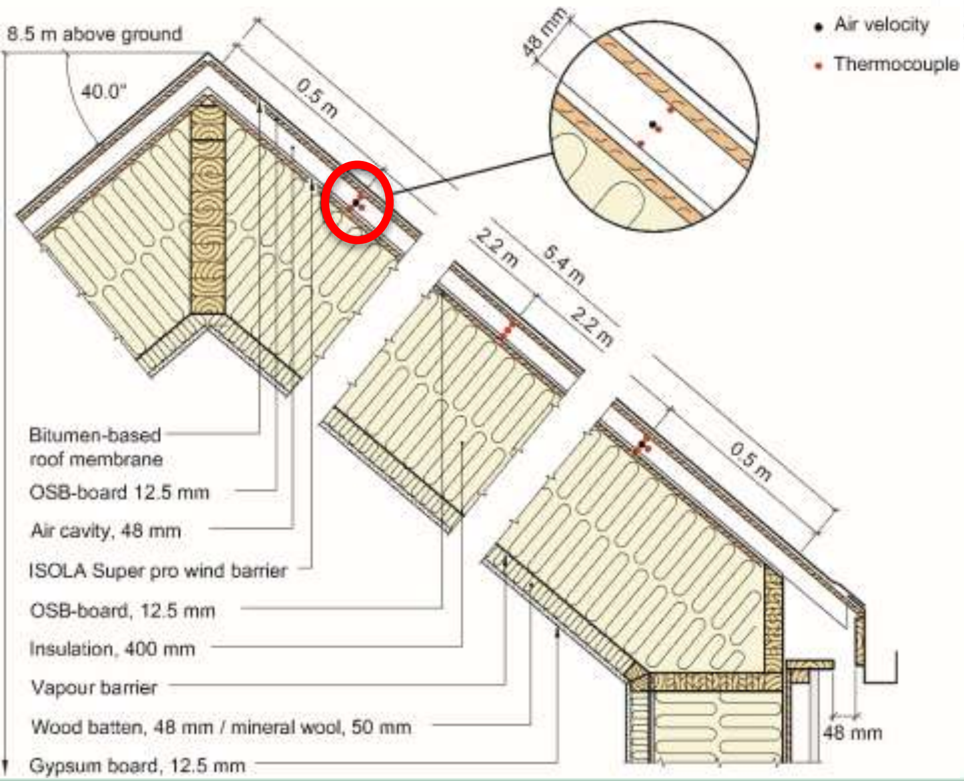

Sharp-
edged tile
batten
Round-
edged tile
batten
r = 3 mm

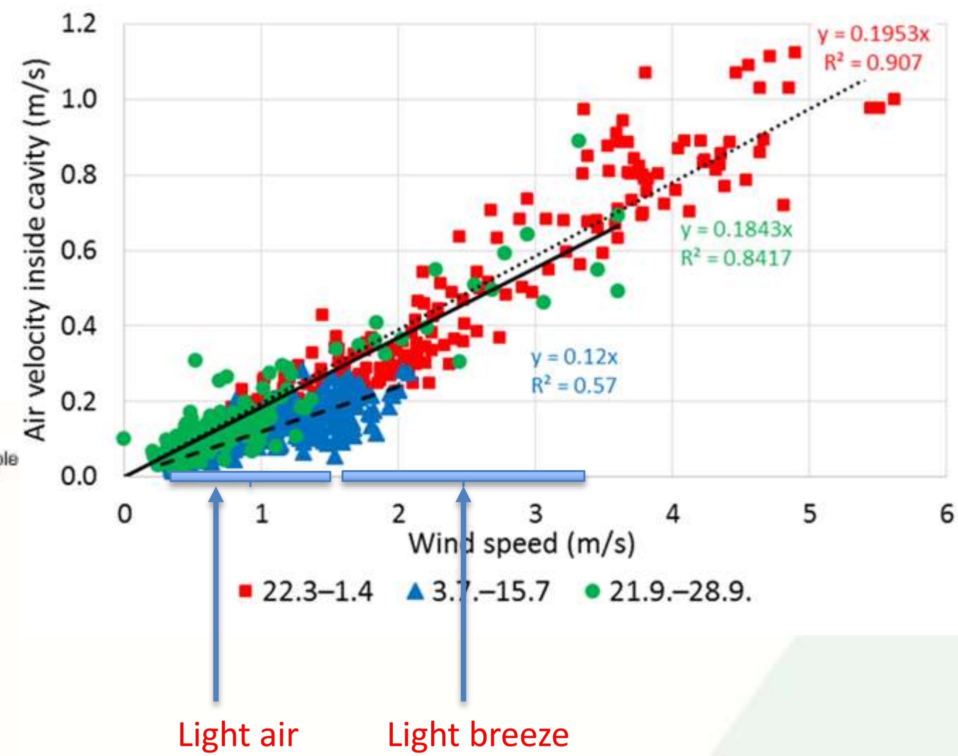

Spaltehøyde
Steinlektenes høyde

Field experiments - performance of roofs

ZEB Test Cell Laboratory located at NTNU campus

Field experiments





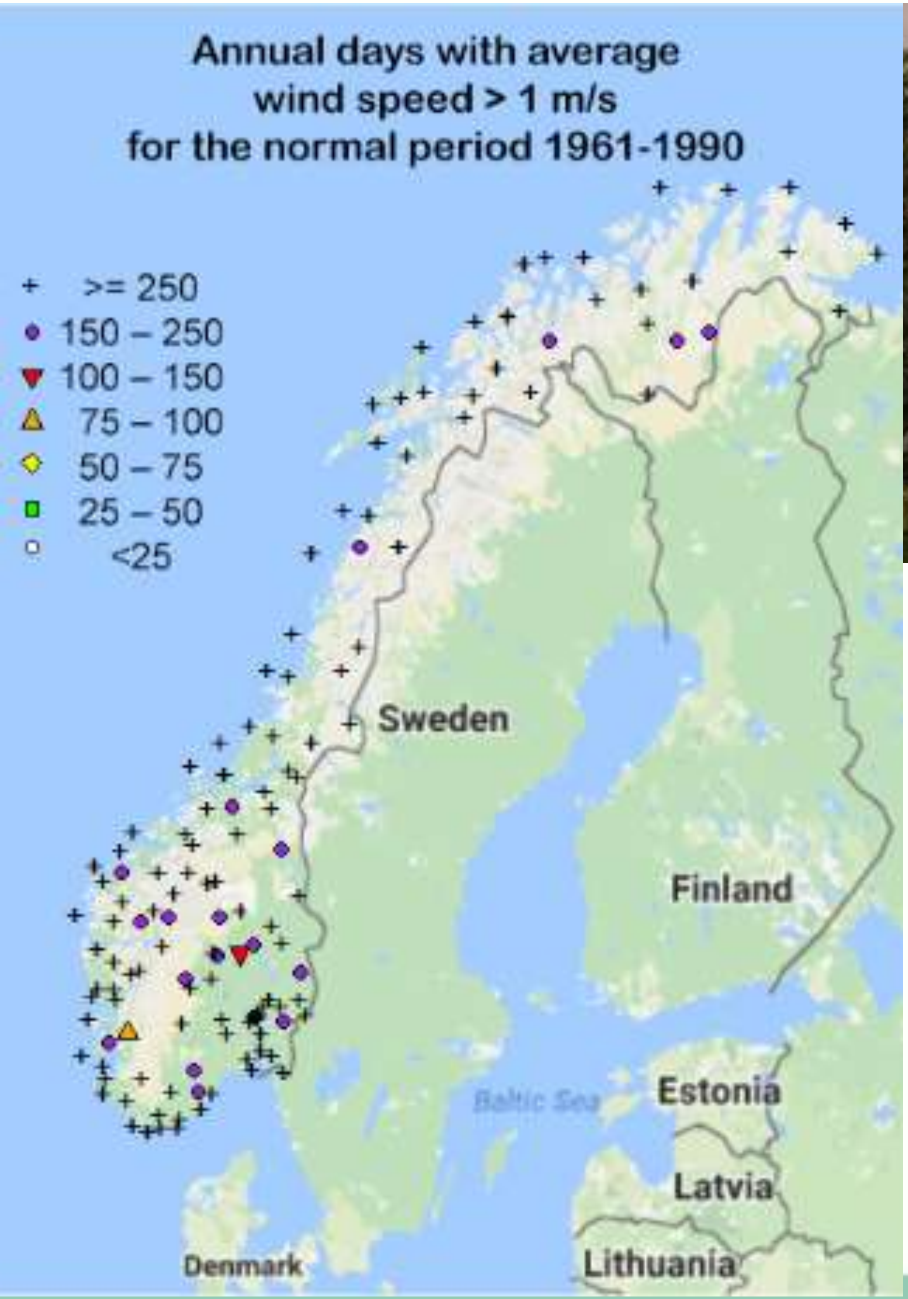


Illustration from Norgeshus

Practical example:

Roof length	11 m
Wind speed	1 m/s
Air velocity inside cavity	0.2 m/s
Air change rate	60 h^{-1}

New guidelines for risk reduction of wooden roofs

Convection barrier when insulation thickness exceed 200 mm, also in roofs.

Rounded tile battens can be used to lower friction inside air cavity.

Roof length of 30 m requires a 225 mm opening through the air gap system.

Thank you for the attention

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