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
NVE
AVINOR
Jernbaneverket
STATSBYGG
TRONDHEIM KOMMUNE

Research & education

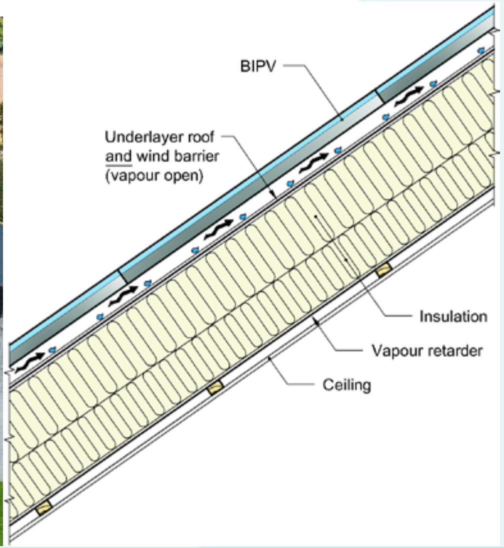
SINTEF
BI
NTNU
Meteorologisk institutt
NGI

Large ventilated wooden roofs-why lacking guidelines

Increased percipitation

Increased interest in large, low slope wooden roofs

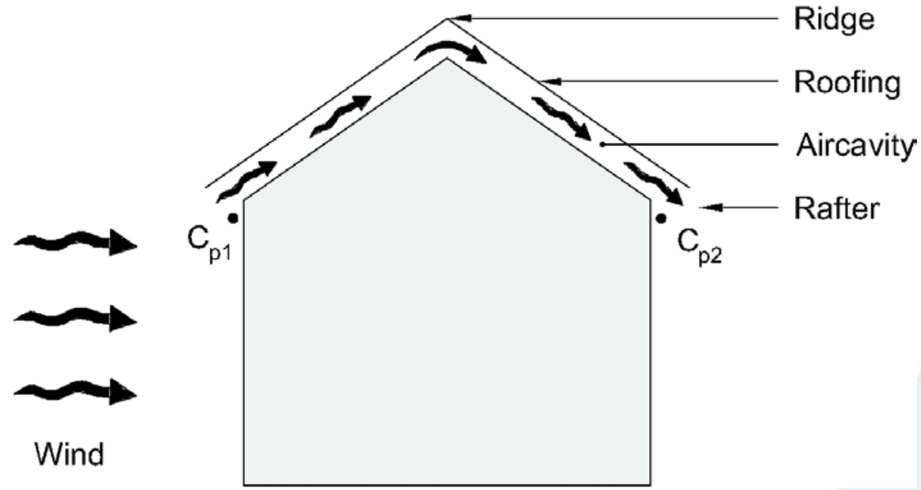
Increased insulation thickness



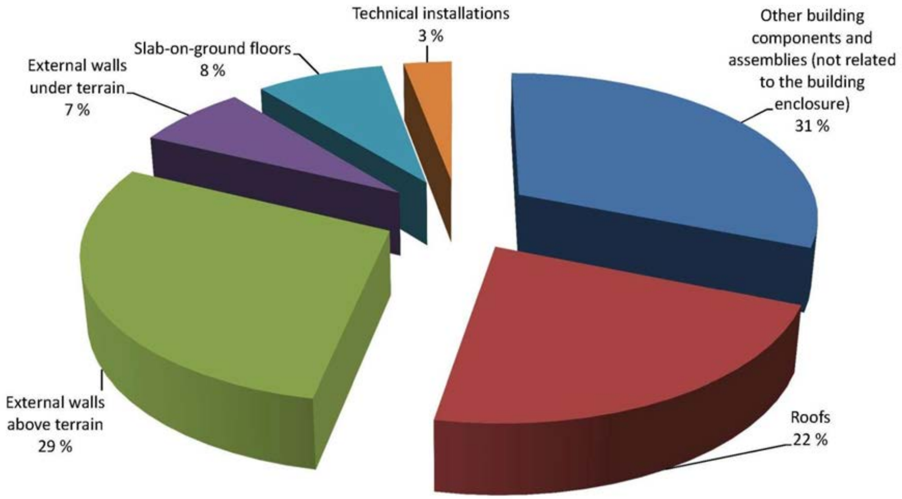
Climate adaption of wooden roofs

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 wood roofs.



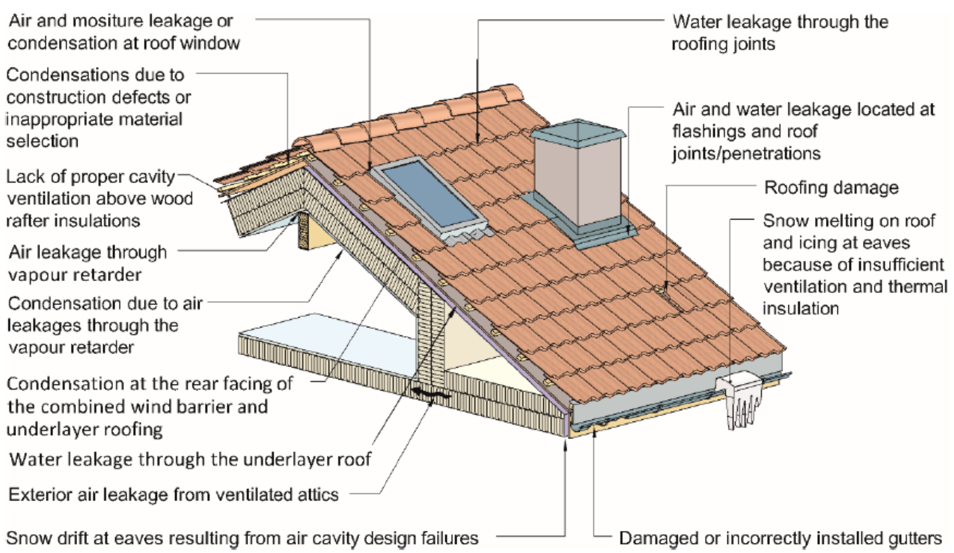
Building defects



A large part located to roofs

SINTEF Building defects archive consisting over 2000 report

Overview of typical defects and causes



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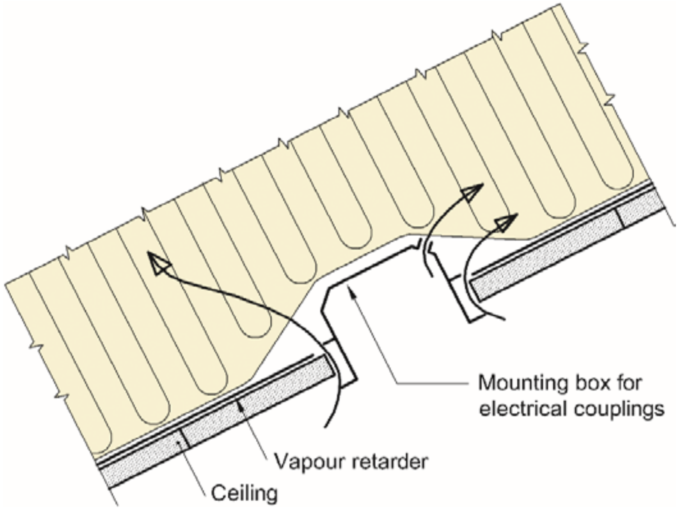
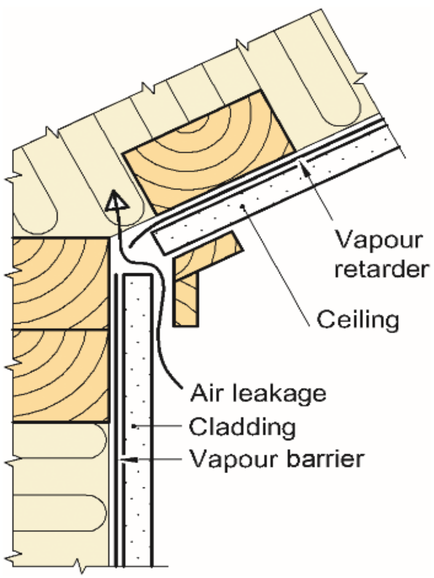

Mounting box for
electrical couplings
Vapour retarder
Ceiling


Vapour
retarder
Ceiling
Air leakage
Cladding
Vapour barrier

Research methods

Laboratory investigations

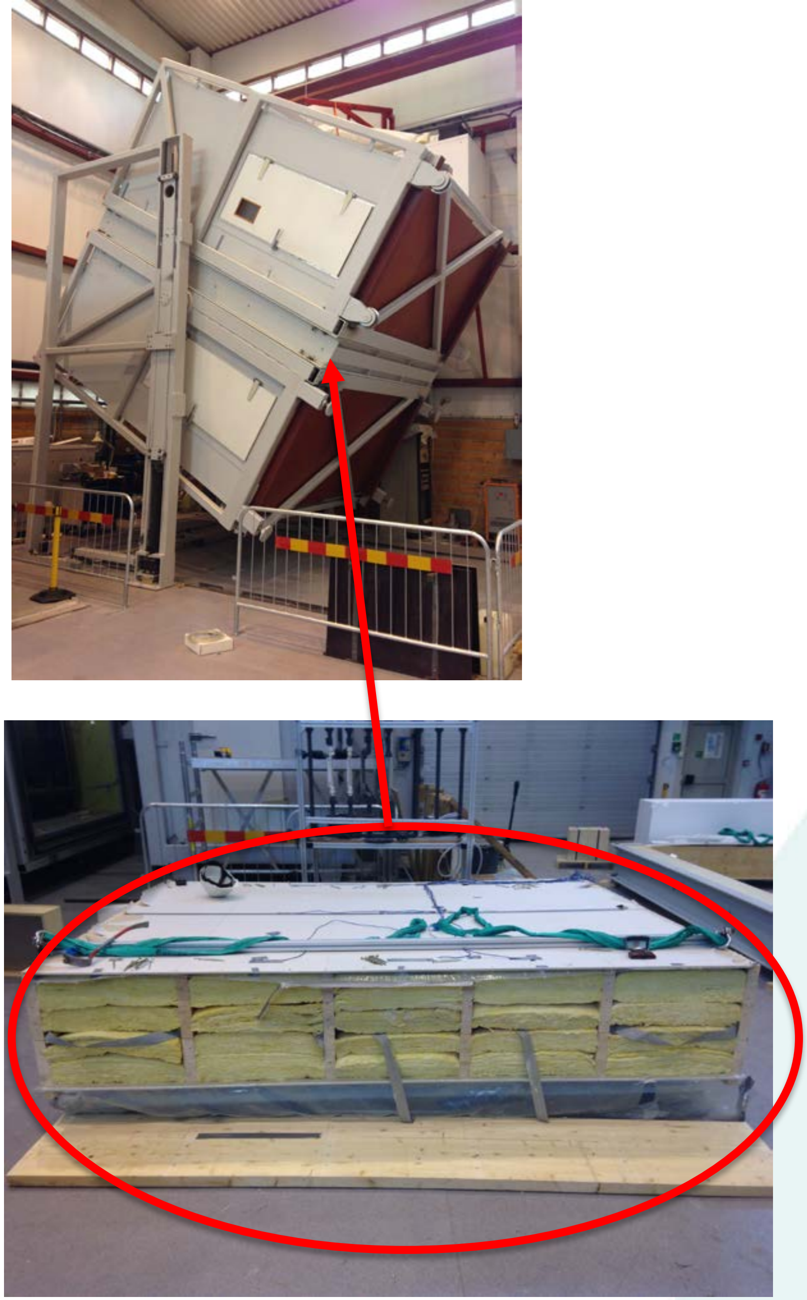
Field experiments

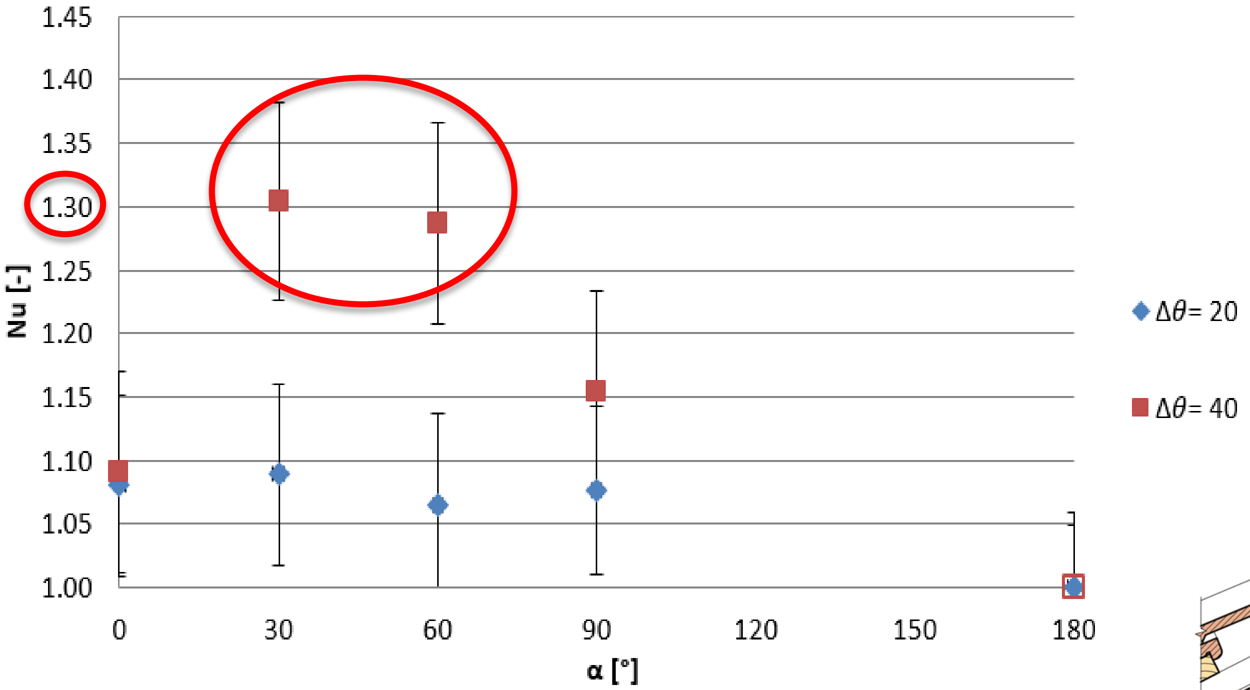
Calculations

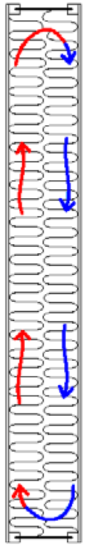
Heat transfer: Highly insulated wooden roofs

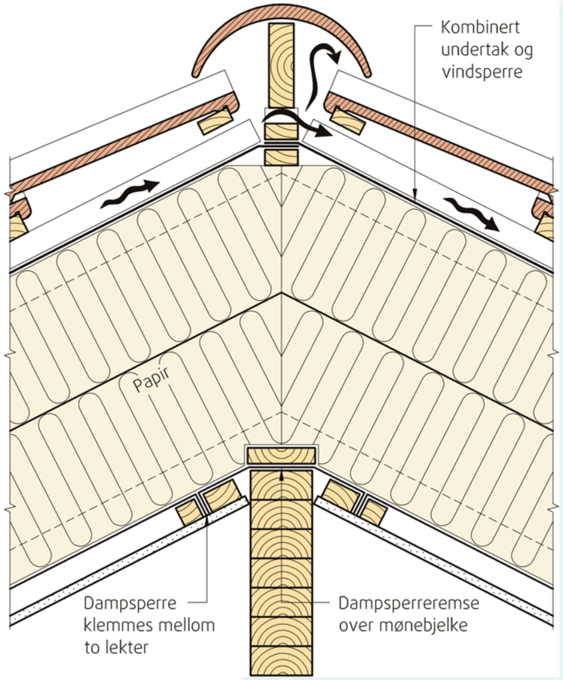
- Thick wood frame structures

- Angle of inclination









Heat transfer affected by:

Temperature difference across structure

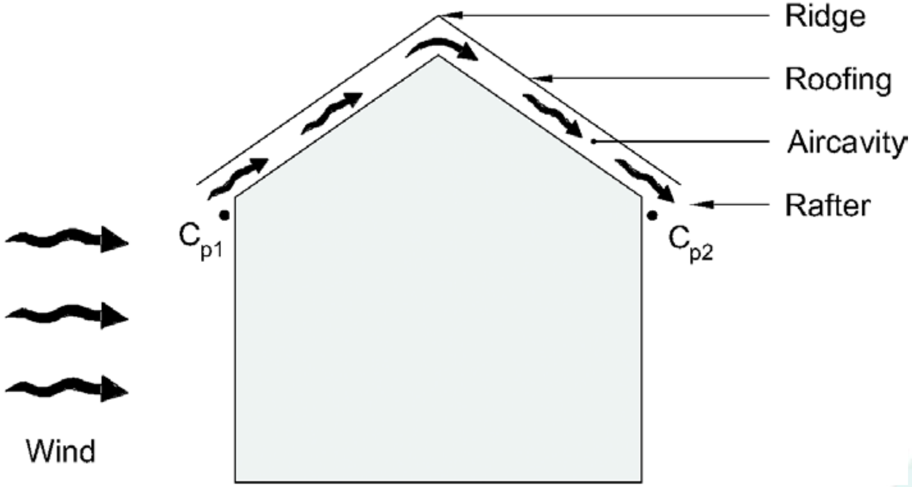
Angle of inclination

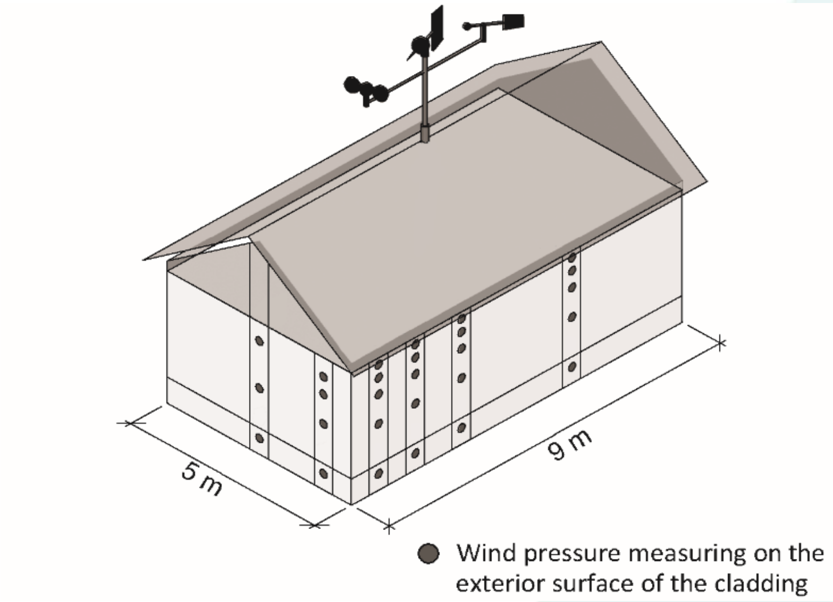
Roof ventilation

The ventilation of the cavity is given by:

Driving forces: wind and temperature differences (natural convection)

Pressure losses

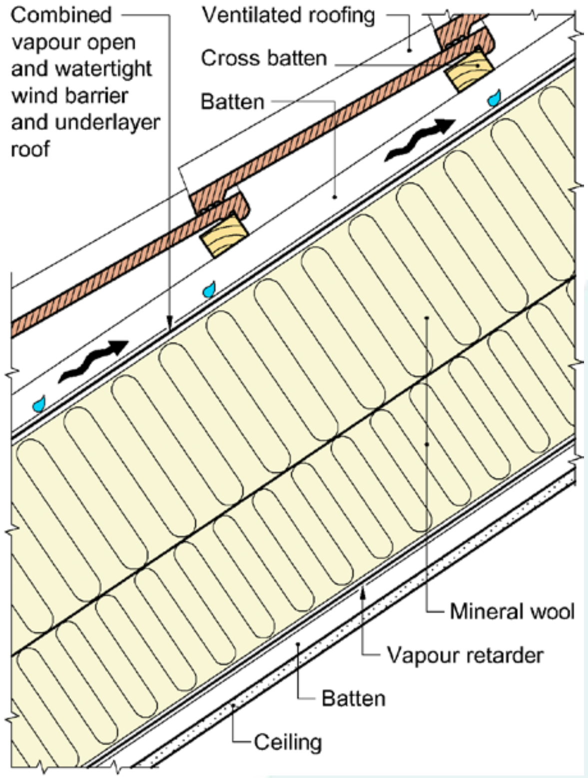




Why ventilate roofs?

The basic principles for roofing ventilation is to transport:

- moisture from the roof and thus prevent the growth of mold and other moisture damage
- heat and thus prevent unwanted melting snow and icing at the eaves and gutters

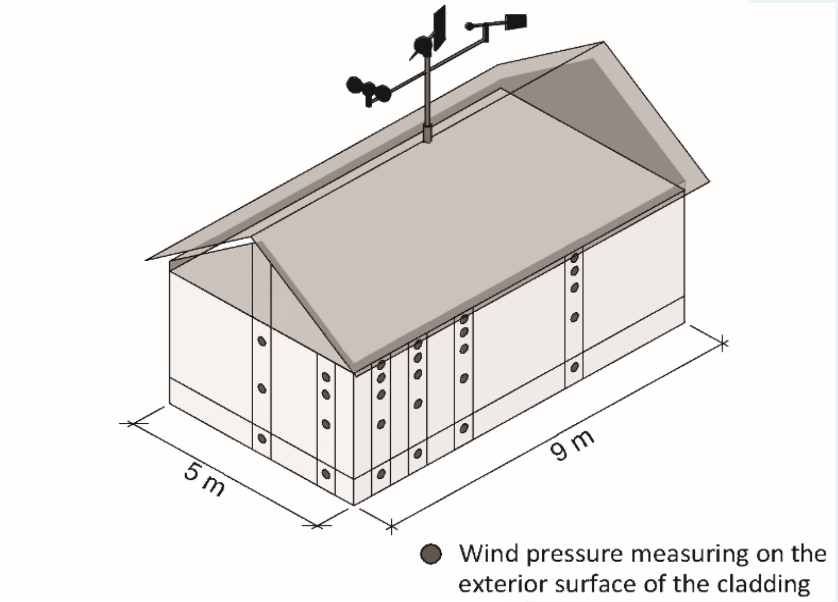


Driving forces wind

Measurements performed by Sivert Uvsløkk in 1985!

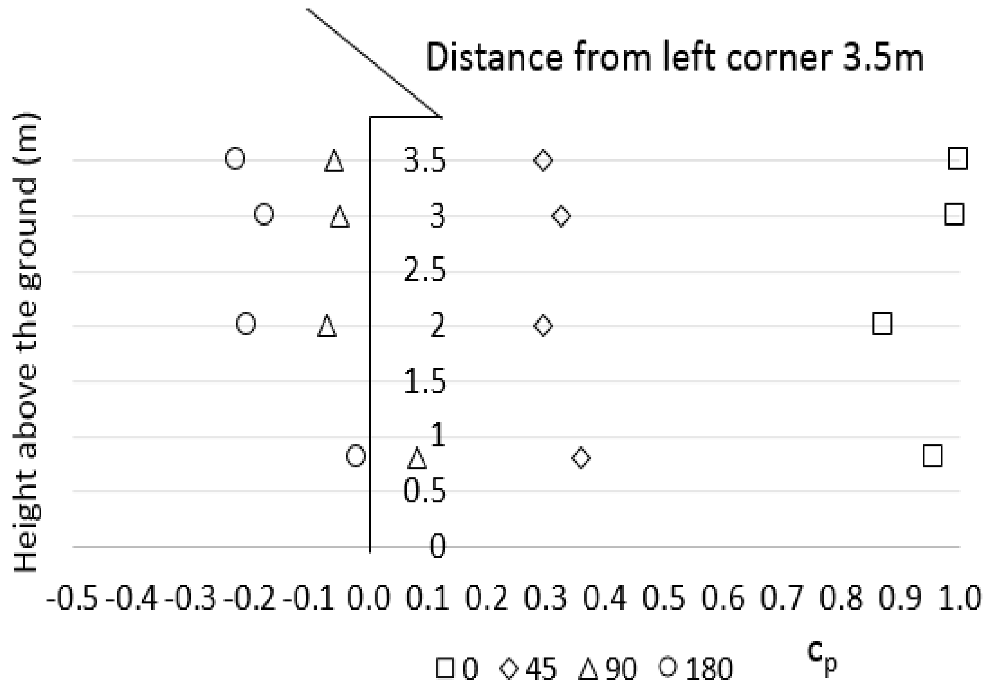
Wind pressure measurements performed on a rotating test house situated at Tyholt

Picture by Sivert Uvsløkk, SINTEF



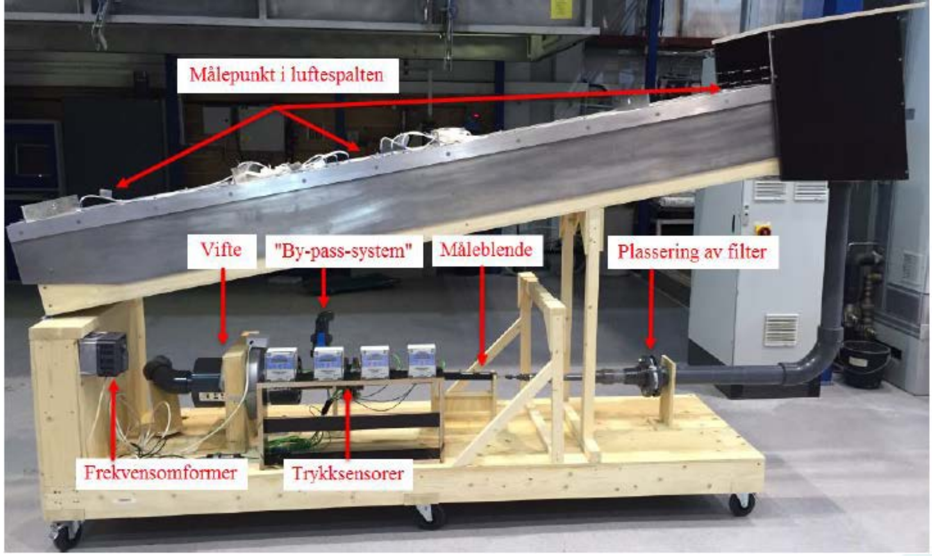
New analysis of "old" data

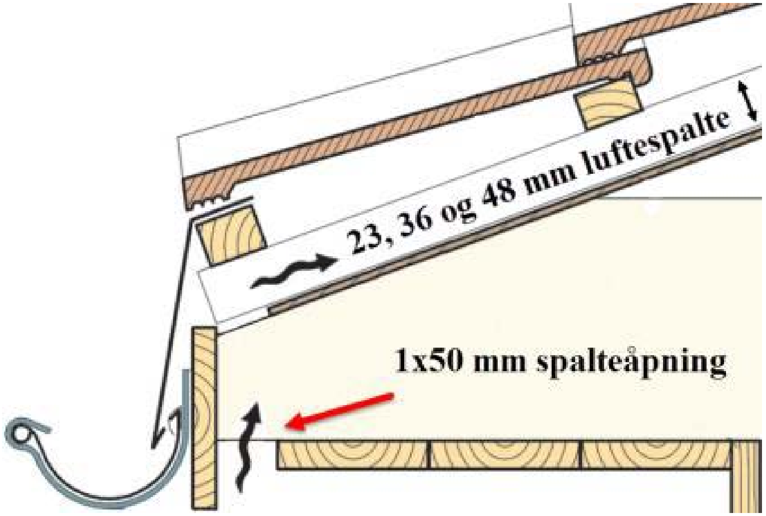
Increased knowledge about wind driven ventilation

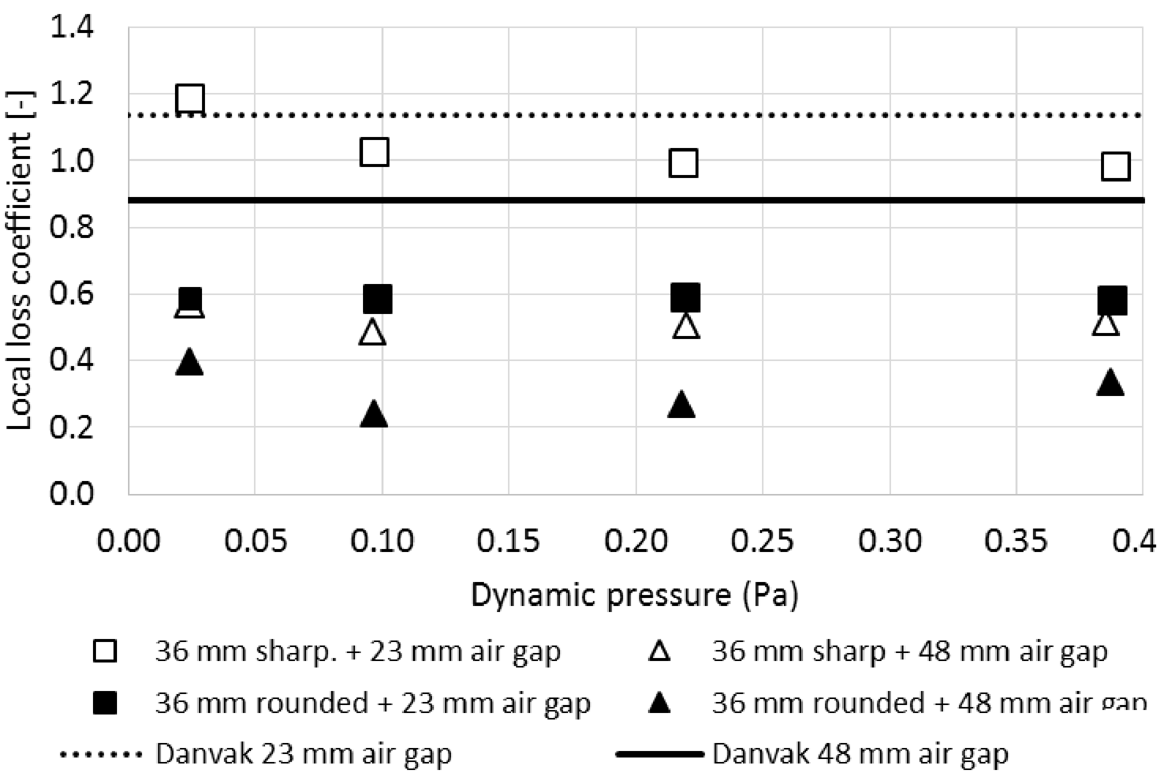


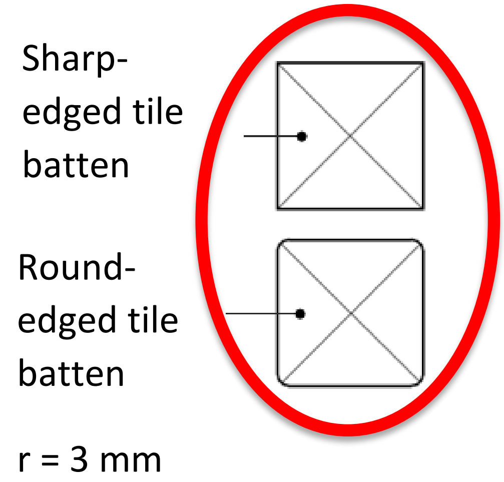
Pressure losses: Air flow inside air cavity

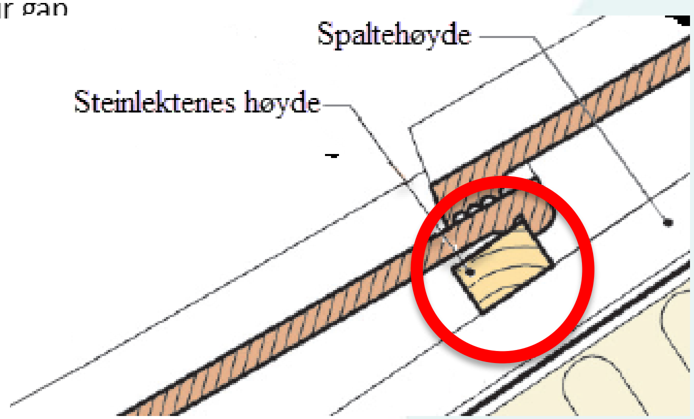
Laboratory investigation






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 sharp + 48 mm air gap
36 mm rounded + 23 mm air gap
36 mm rounded + 48 mm air gap
Danvak 23 mm air gap
Danvak 48 mm air gap

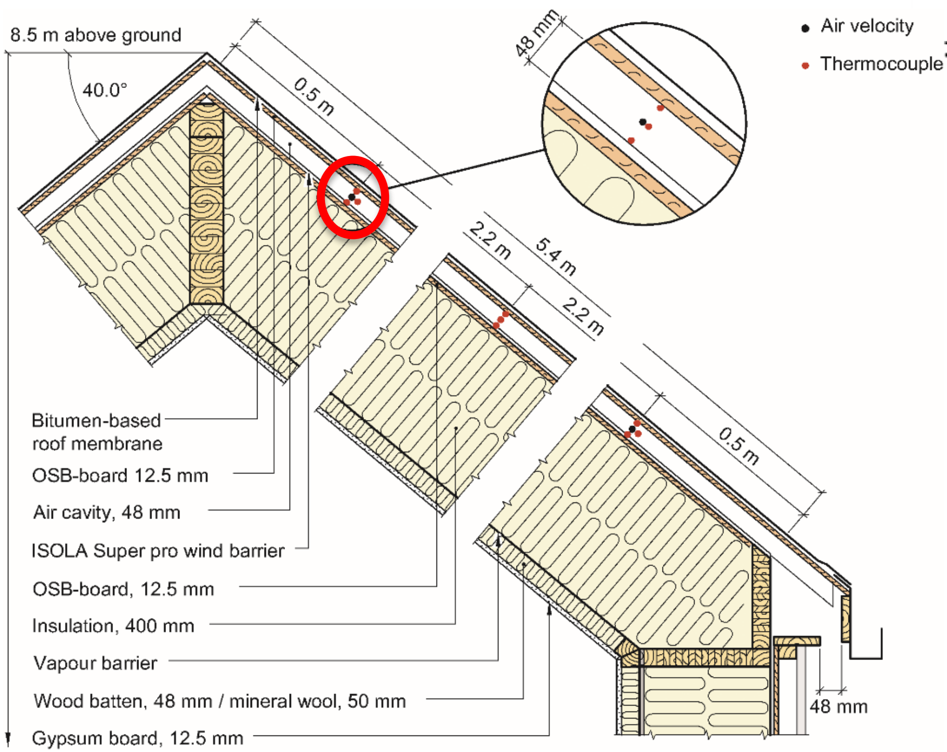

Sharp-
edged tile
batten
Round-
edged tile
batten
r = 3 mm

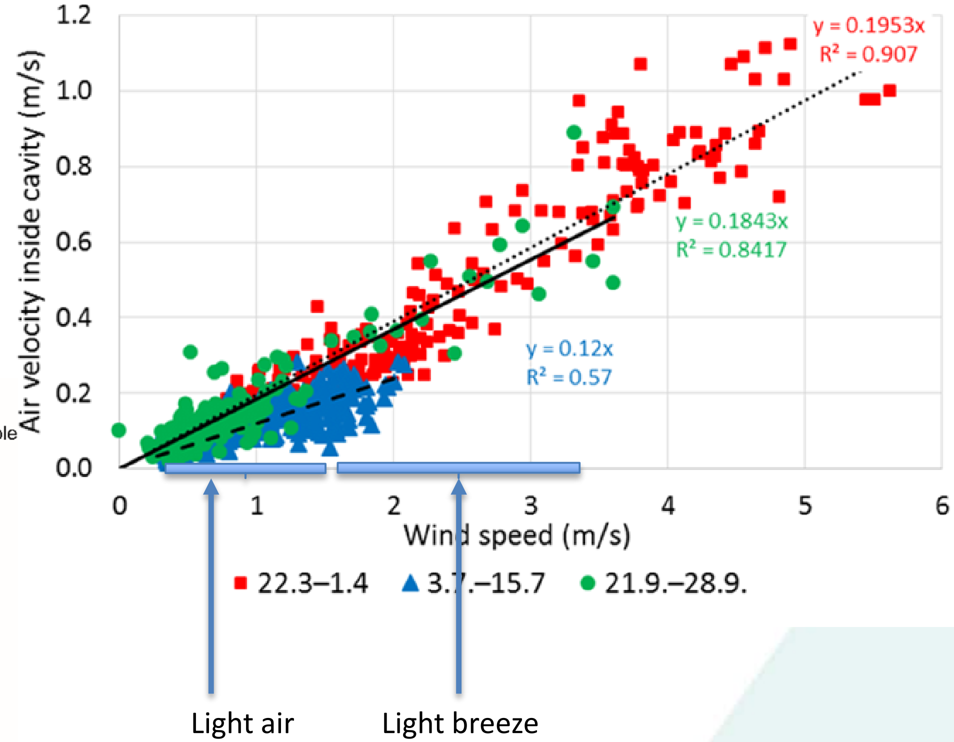

Spaltehøyde
Steinlektenes høyde

Field experiments

ZEB Test Cell Laboratory located at campus

Field experiments





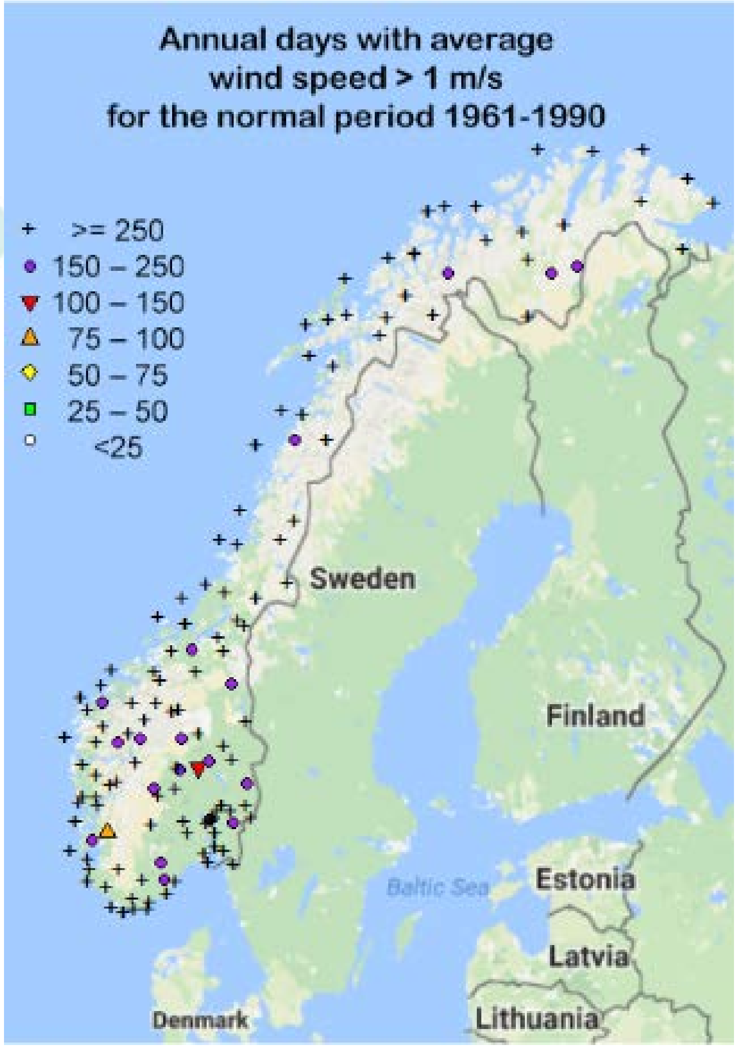


Illustration from Norgeshus

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}

Summary

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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