Moisture report

Business Academy Aarhus

Architectural Technology and Construction Management

13bk2ena, group no 2

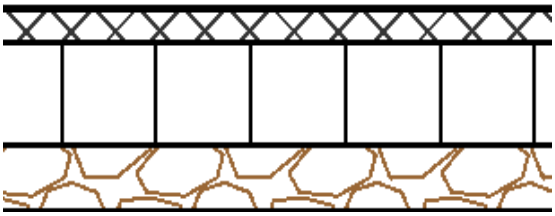
Aleksandra Kowalczyk, Joanna Jankowska,
Christian Bisgaard Nielsen, Marius Raducan
Signed by: Aleksandra Kowalczyk, Joanna Jankowska

10/28/2014

Content

Ground supported floor

Description of the construction:



100 mm of reinforced concrete

300 mm of hard insulation

200 mm of leca nuts

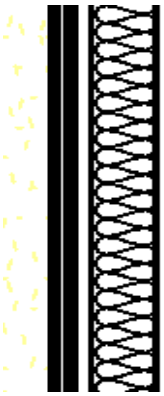
We did not do moisture analysis for ground supported floor, because there is no differences in temperature. Instead of that, we are making our own analysis ground supported floor.

Conclusion:

Ground supported floor is the connection between house and the soil and it is resting directly on the ground. Ground supported floor must be insulated against ingress of moisture. To avoid moisture in a building we are putting leca nuts, which works as capillary breaking layer and insulating. That means is not allowed to get moisture from the soil inside the building. For better protection we have 30 mm of perimeter insulation (placed between foundation and floor). We also have moisture barrier, which is damp proof membrane, which overlapping connection between wall, foundation and ground supported floor.

Wall

Moist assessment of the cavity wall:



20 mm External wooden cladding

38 mm wooden battens/ventilation cavity

Wind breaking layer

178 mm Stud construction/180 mm Insulation

38 mm wooden battens/Insulation

12 mm OSB Plate/ dpm

12 mm Gypsum board

Total thickness of the wall

300 mm

Moisture calculation

Add layer | Remove layer | Move down layer | Analyse

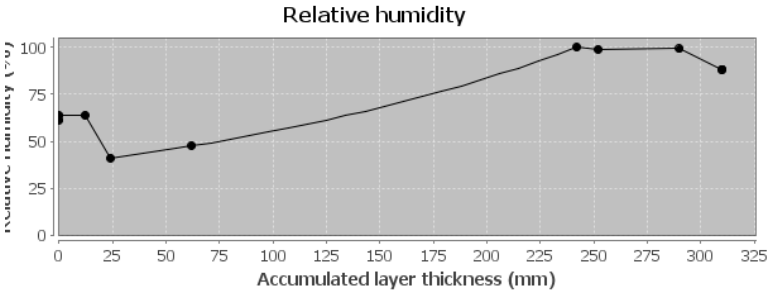
Material Layer	Thickness s (mm)	Thermal conductivity λ (W / (m · °C))	Thermal resistance R (m² · °C / W)	Permeability d (kg / (m · s · GPa))	Vapour resistance Z (GPa · m² · s / kg)
Internal surface			0.25		
Gypsum board	12	0.17	0.071	0.031	0.387
OSB Plate/damp proof membrane	12	0.16	0.075	8E-4	15
Insulation/batten	38	0.036	1.056	0.125	0.304
Insulation/stud construction	180	0.036	5	0.125	1.44
Wind breaking layer	10	0.16	0.0625	0.008	1.25
Ventilation cavity	38	1.110	0.034	0.19	0.20
Wooden cladding	20	0.61	0.033	0.003	6.667
External surface			0.04		

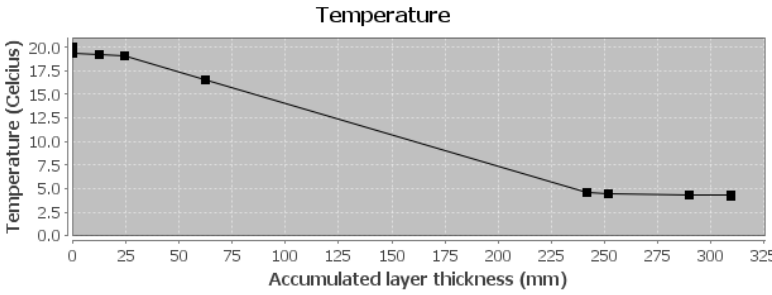
Month	External temperature te (°C)	External relative humidity φe (%)	Internal temperature ti (°C)	Internal relative humidity φi (%)	Humidity Class
January	-0.4	91.0	20.0	61.1	3
February	-0.5	90.0	20.0	60.7	3
March	1.8	86.0	20.0	60.3	3
April	5.5	77.0	20.0	57.4	3
May	10.7	73.0	20.0	57.9	3
June	14.0	75.0	20.0	62.7	3
July	15.1	76.0	20.0	65.1	3
August	15.1	76.0	20.0	65.1	3
September	12.0	82.0	20.0	64.4	3
October	8.5	86.0	20.0	62.7	3
November	4.2	89.0	20.0	61.5	3
December	1.2	91.0	20.0	61.8	3

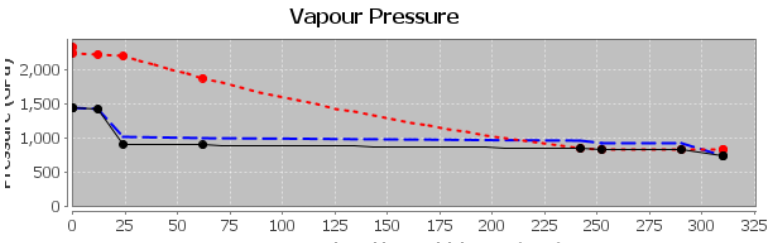
Input data

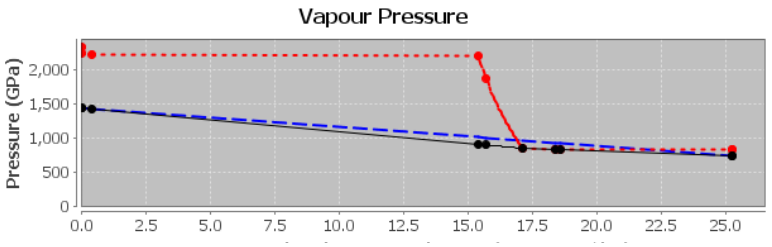
Result

Material Layer	Accumulated thickness s-sum (mm)	Accumulated vapour resistance Z-sum (GPa · m² · s / kg)	Temperature t (°C)	Simulated vapour pressure P0 (GPa)	Vapour Pressure P (GPa)	Satuated vapour pressure P-sat (GPa)	Relative humidity φ (%)	Water accumulations Δc (g / m²)	Sum of water accumulations c (g / m²)
OSB Plate / Insulation/batten	24	15.39	19.1	1009	908	2204	41	0	0
Insulation/bat... / Insulation/stu...	62	15.69	16.5	1000	898	1881	48	0	0
Insulation/stu... / Wind breaking...	242	17.13	4.6	960	848	848	100	53	53
Wind breaking... / Ventilation ca...	252	18.38	4.5	925	830	839	99	0	0
Ventilation ca... / Wooden cladding	290	18.58	4.4	920	828	834	99	0	0
External surface	310	25.25	4.3	734	734	830	88	0	0
External	310	25.25	4.2	734	734	824	89	0	0









Export analysis to csv (danish settings) | Export analysis to csv (english settings) | Export analysis to pdf

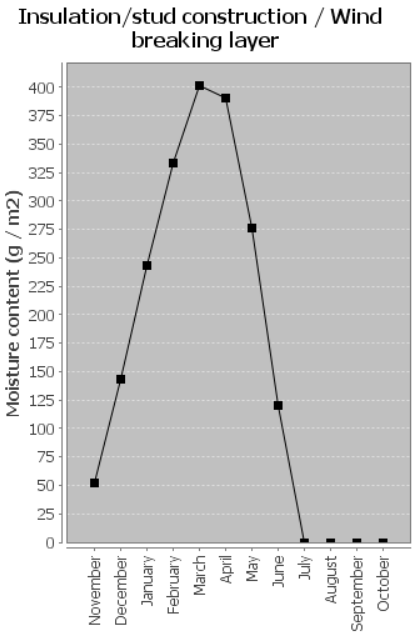
Analysis overview

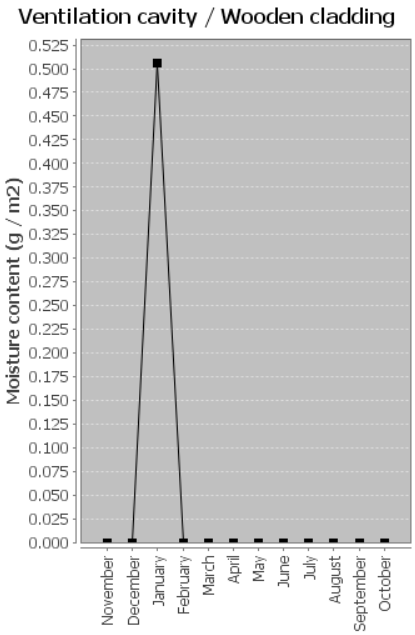
- Dew points in 9 months
- 2 dew points in the building envelope divided into 7 material layers
- No months with mould growth risk on internal surface ($\varphi_{is} < \varphi_{design}$)

φ_{design} = 80% acording to DS/EN ISO 13788

φ_{design} = 75% acording to SBi guidelines 216 to the Danish Building Regulations

	Internal surface Relative humidity φ_{is} (%)	Water accumulations Δc (g / m²)	Sum of water accumulations c (g / m²)
November	64	53	53
December	65	90	143
January	64	101	244
February	64	89	333
March	63	68	401
April	59	-11	390
May	59	-114	276
June	64	-155	121
July	66	-121	0
August	66	0	0
September	66	0	0
October	64	0	0





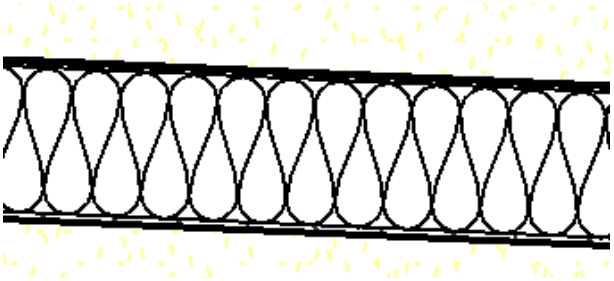
Conclusion

We have a dew points in 9 months . It shows that we have lack of heat in the construction but we do not have risk of having mold in the building. The biggest risk of moisture we have in March (it is 400 g/m_2) because of biggest differences in temperatures. We have to use a damp-proof membrane against OSB plate because construction must be tight. That is why we put 15 Z (GPa*m_2*s/kg) in "Vapour resistance" for OSB Plate. Our diagram ends up in 0 (July, August, September, October) which means that we do not have any risk of condensation in the construction.

Our wall is protected by wind breaking layer to stops moisture from outside: snow, rain, wind and is protected by damp proof membrane to brings up moisture from inside the building.

Roof

Description of the construction



Bitumen felt layer

12 mm chipboard

465 mm battens with insulation

Hygrodiode membrane

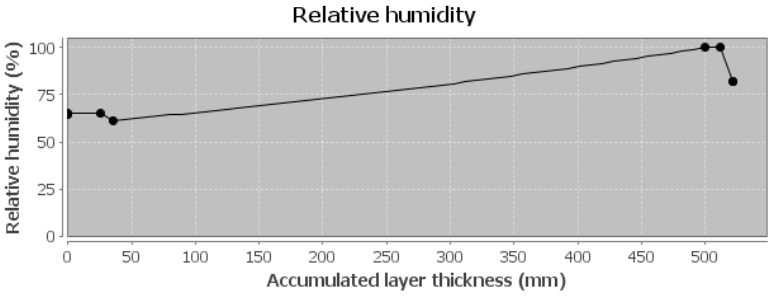
25 mm troltex board

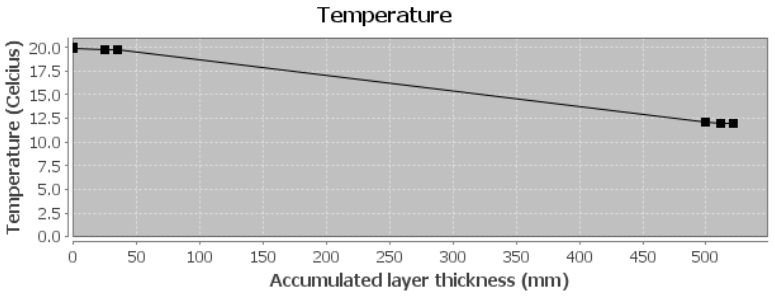
Add layer | Remove layer | Move down layer | Analyse

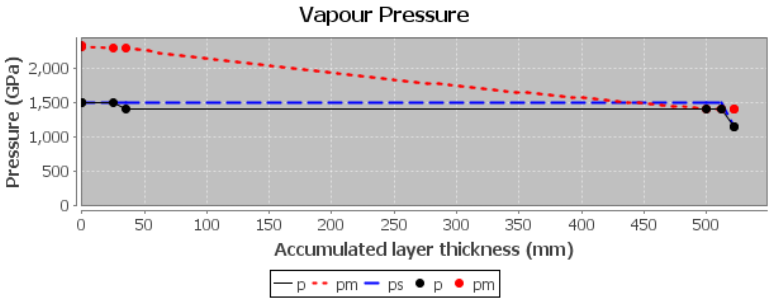
Material Layer	Thickness s (mm)	Thermal conductivity λ (W / (m · °C))	Thermal resistance R (m² · °C / W)	Permeability d (kg / (m · s · GPa))	Vapour resistance Z (GPa · m² · s / kg)
Internal surface			0.25		
Troltex board	25	0.16	0.15625	0.004	6.25
Hygrodiode membrane	10	0.17	0.059	1E-4	100
Battens with insulation	465	0.036	12.917	0.125	3.72
Chipboard	12	0.16	0.075	0.004	3
Bitumen felt layer	10	0.6	0.017	2.5E-6	4000
External surface			0.04		

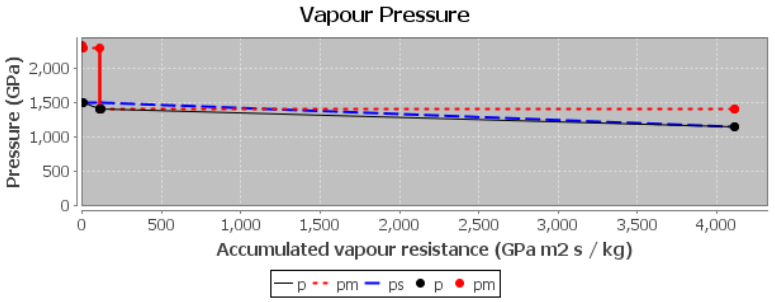
Month	External temperature te (°C)	External relative humidity φe (%)	Internal temperature ti (°C)	Internal relative humidity φi (%)	Humidity Class
January	-0.4	91.0	20.0	61.1	3
February	-0.5	90.0	20.0	60.7	3
March	1.8	86.0	20.0	60.3	3
April	5.5	77.0	20.0	57.4	3
May	10.7	73.0	20.0	57.9	3
June	14.0	75.0	20.0	62.7	3
July	15.1	76.0	20.0	65.1	3
August	15.1	76.0	20.0	65.1	3
September	12.0	82.0	20.0	64.4	3
October	8.5	86.0	20.0	62.7	3
November	4.2	89.0	20.0	61.5	3
December	1.2	91.0	20.0	61.8	3

Material Layer	Accumulated thickness s-sum (mm)	Accumulated vapour resistance Z-sum (GPa · m² · s / kg)	Temperature t (°C)	Simulated vapour pressure P0 (GPa)	Vapour Pressure P (GPa)	Satuated vapour pressure P-sat (GPa)	Relative humidity φ (%)	Water accumulations Δc (g / m²)	Sum of water accumulations c (g / m²)
Internal	0	0.0	20.0	1506	1506	2337	64	0	0
Internal surface	0	0.0	19.9	1506	1506	2316	65	0	0
Troltex board / Hygrodiode membrane	25	6.25	19.8	1505	1500	2302	65	0	0
Hygrodiode mem... / Battens with i...	35	106.25	19.7	1497	1411	2297	61	0	0
Battens with insulation / Chipboard	500	109.97	12.1	1496	1408	1409	100	0	0
Chipboard / Bitumen felt layer	512	112.97	12.0	1496	1405	1405	100	2	2
External surface	522	4112.97	12.0	1149	1149	1404	82	0	0









Export analysis to csv (danish settings) | Export analysis to csv (english settings) | Export analysis to pdf

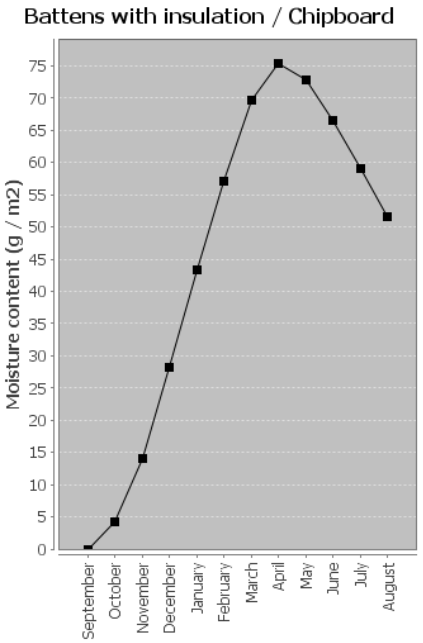
Analysis overview

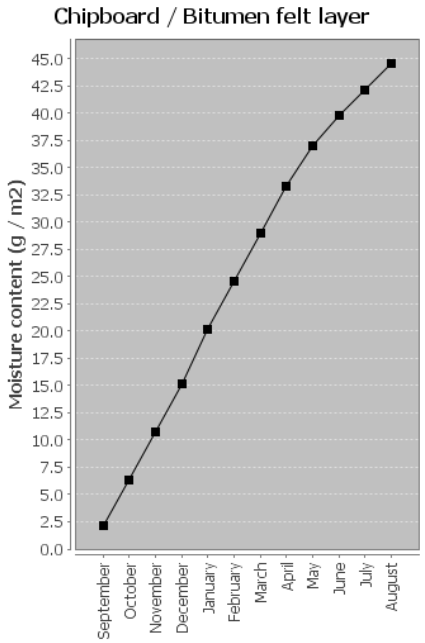
- Dew points in 12 months
- 2 dew points in the building envelope divided into 5 material layers
- No months with mould growth risk on internal surface ($\varphi_{is} < \varphi_{design}$)

φ_{design} = 80% acording to DS/EN ISO 13788

φ_{design} = 75% acording to SBi guidelines 216 to the Danish Building Regulations

	Internal surface Relative humidity φ_{is} (%)	Water accumulations Δc (g / m²)	Sum of water accumulations c (g / m²)
September	65	2	2
October	64	8	11
November	63	14	25
December	63	19	43
January	63	20	64
February	62	18	82
March	62	17	99
April	58	10	109
May	59	1	110
June	63	-4	106
July	65	-5	101
August	65	-5	96





Conclusion

We have a dew point in every month. It shows that we have lack of heat in the construction but we do not have risk of having mold in the building. The biggest risk of moisture is in April (it is 65 g/m_2) because of biggest differences in temperatures. The diagram above shows that we have condensation in the building so diagram does not end up on 0. It happens because of Hygrodiode membrane which program can not read, it is treated as a ventilation cavity. We have to be careful with using this membrane and we have to fulfill some demands:

* Make connection in the whole roof really tight

* Roof facing South

*Fill it up with insulation

The roof stops moisture effect from outside: snow, rain, wind and construction moisture from inside.