Why building physics did not solve moisture problems (yet)

It's your fault

VDF: Vapour Diffusion Fetish

Instagram

Prof. Nathan Van Den Bossche

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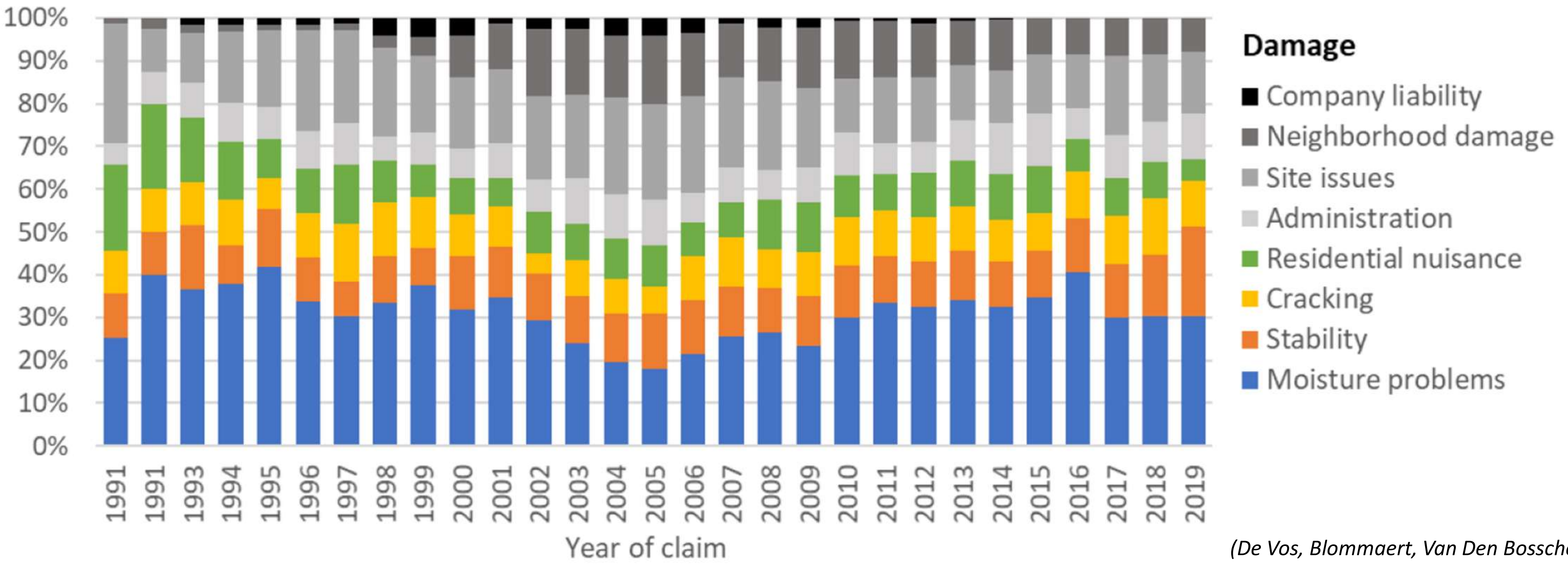
Pathologies

- ❑ Insurance company
  - New construction
  - 10 year liability
  - 26.392 insurance cases
- ❑ Only technical problems:
  - 49% moisture problems
  - 19% mechanical problems
  - 17% cracking
  - 16% residential nuisance (HVAC, fire, glass…)
- ❑ Moisture problems:
  - Internal leakage (tubes, sinks)
  - Rainwater infiltration (roof, wall)
  - Rising damp
  - Condensation



(De Vos, Blommaert, Van Den Bossche, 2020)

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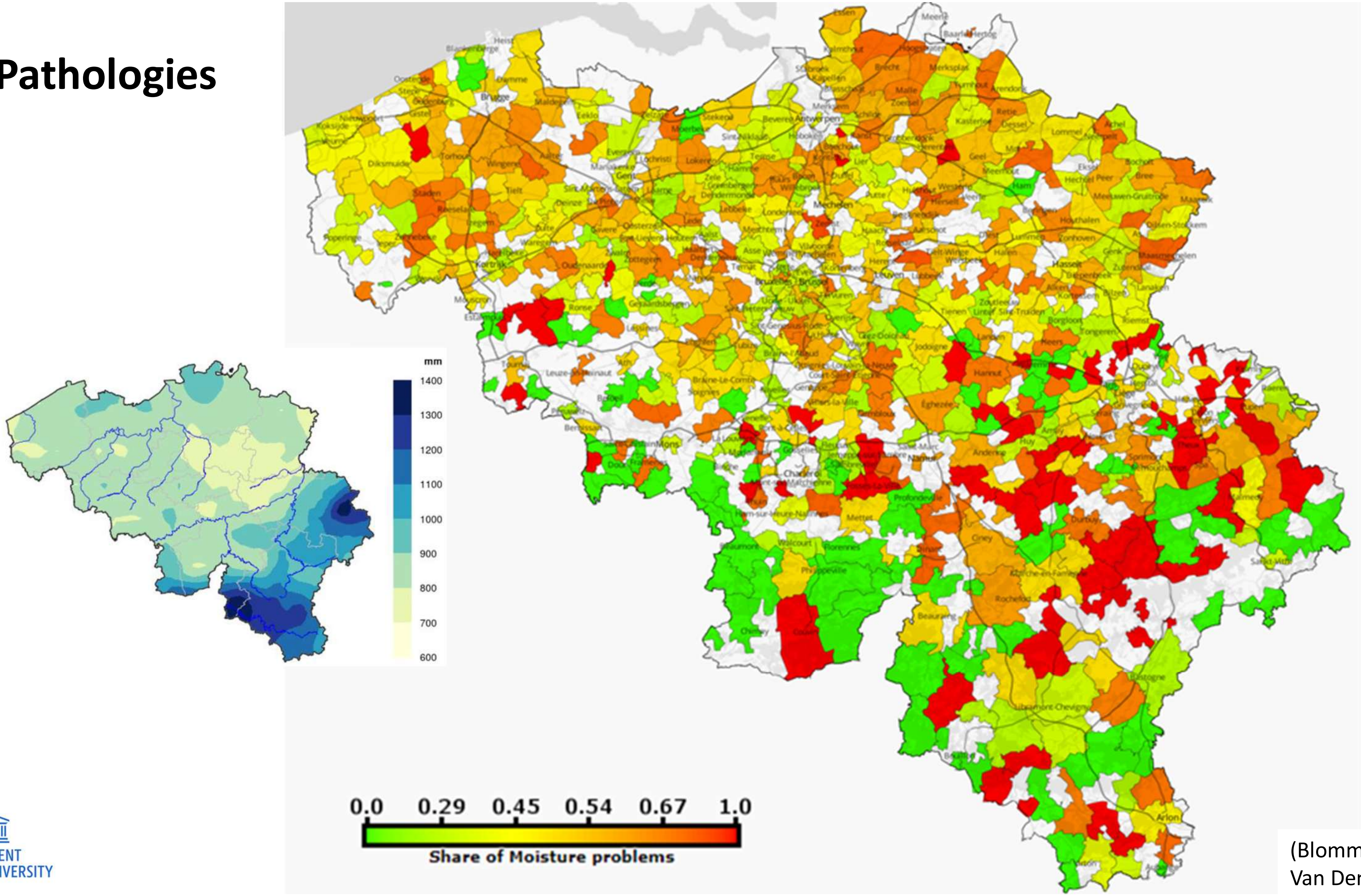
Pathologies



(Blommaert, Daniotti, Van Den Bossche 2022)

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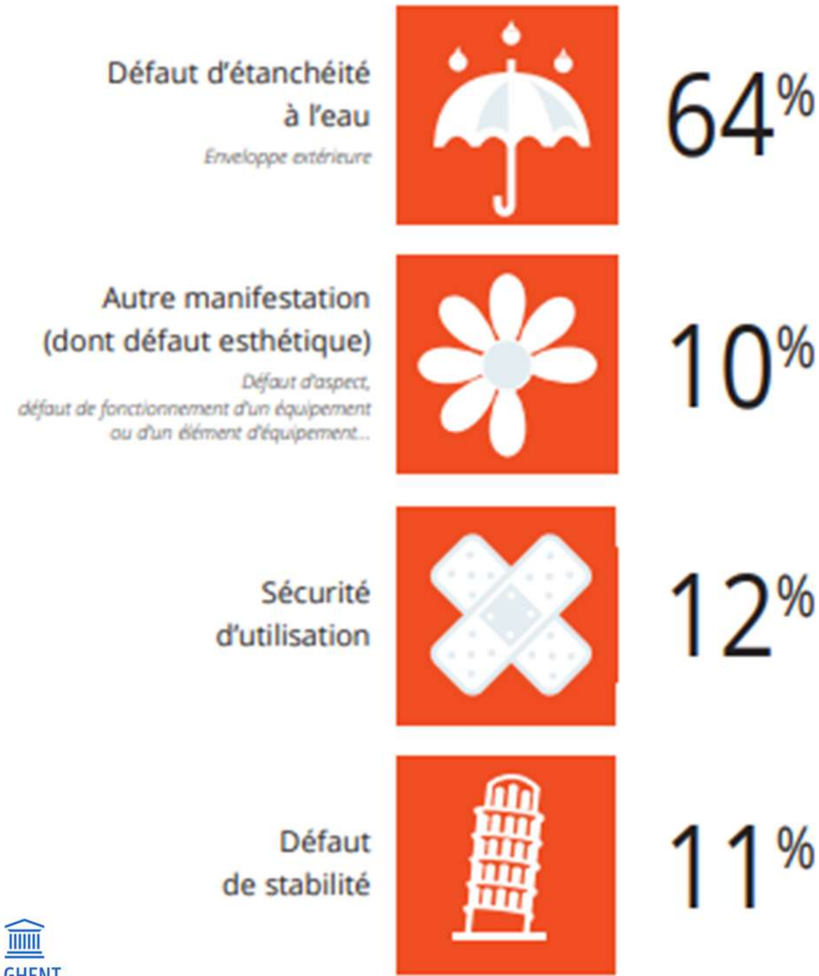
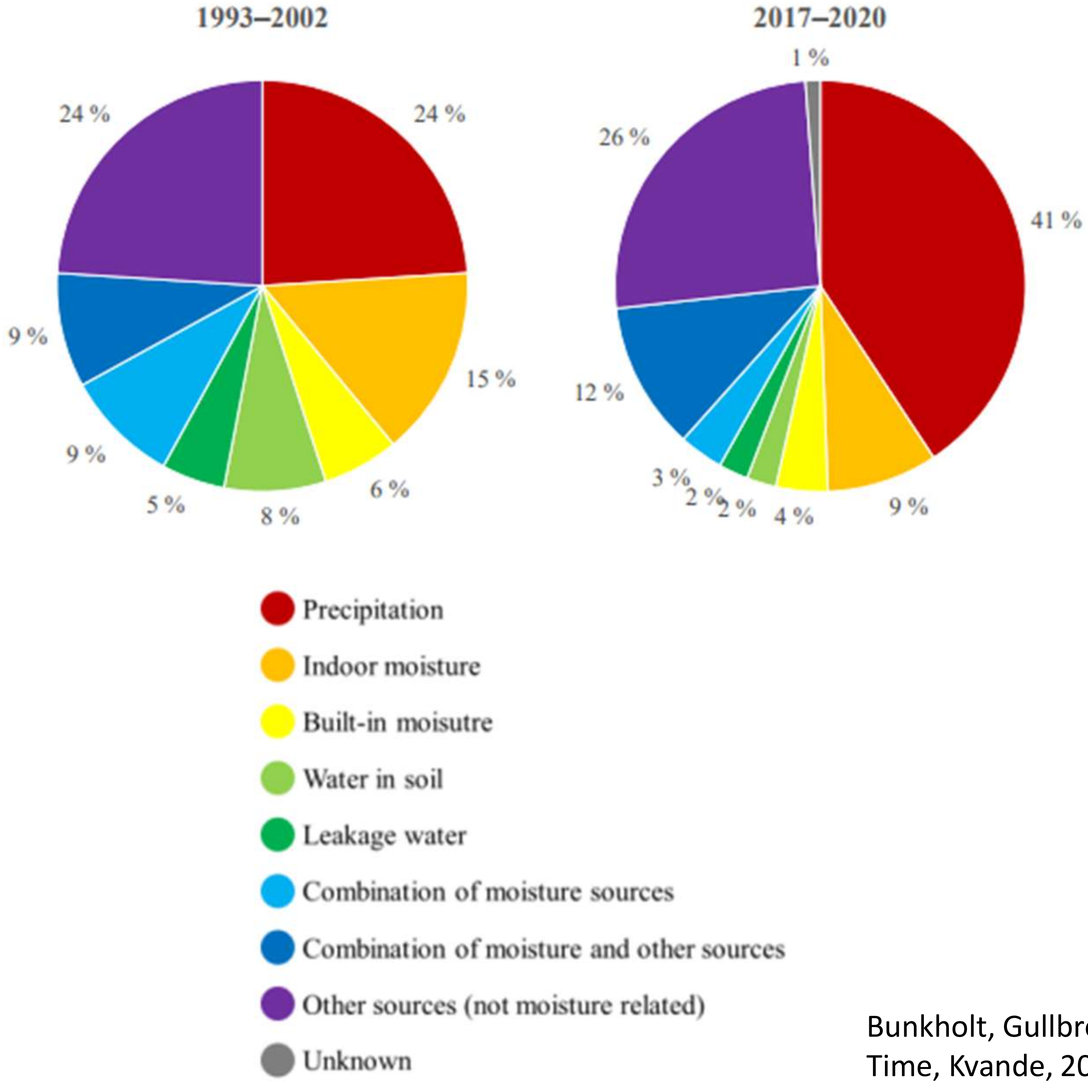
Pathologies France



AQC, 2022

Pathologies Norway

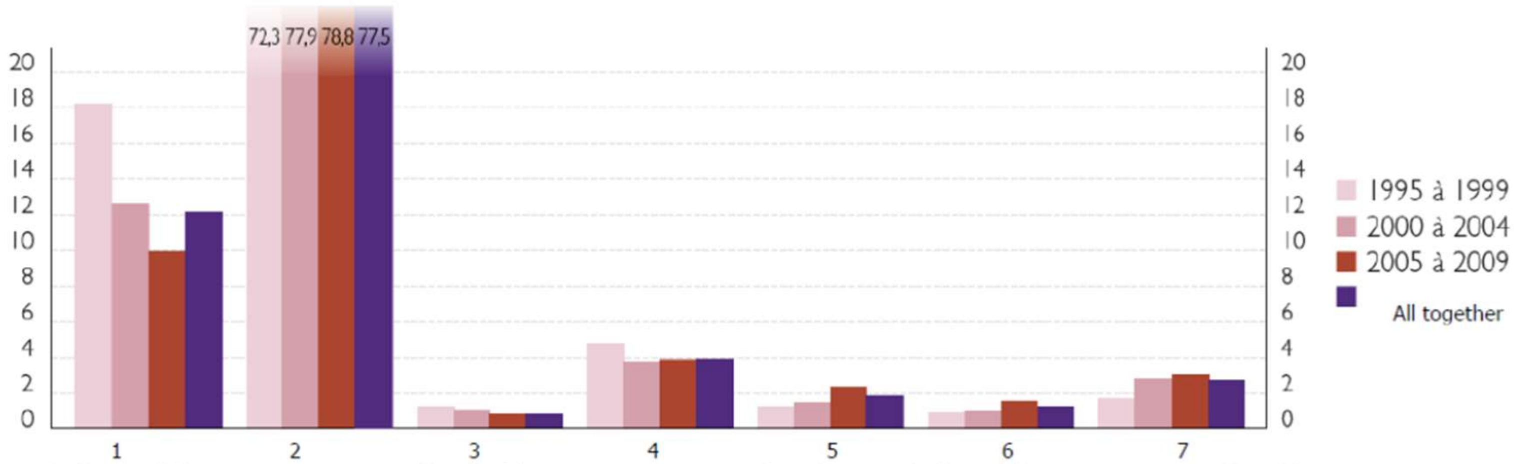


Bunkholt, Gullbrekken, Time, Kvande, 2021

Who is responsible?

country	design	execution	material	use	unknown
Finland	50	30	10	10	
France	30	60	10		
Germany (former Fed.Rep.Germ.)	50	25	25		
Germany (former Germ.Dem.Rep.)	40	40	20		
Great Britain	40	50	10		
Netherlands	40	35	10	10	5
Norway	45	40	15		
USA	50	25	15	10	
average	43	38	14		
Czechoslovakia	5	70	25		
Hungary	20	38	42		
Poland	15	63	22		
average	13	57	30		

CIB W086, 1993



AQC, 2010

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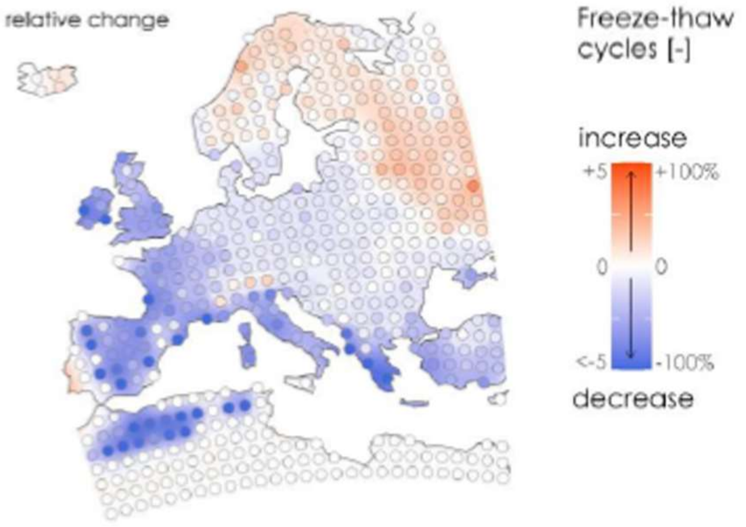
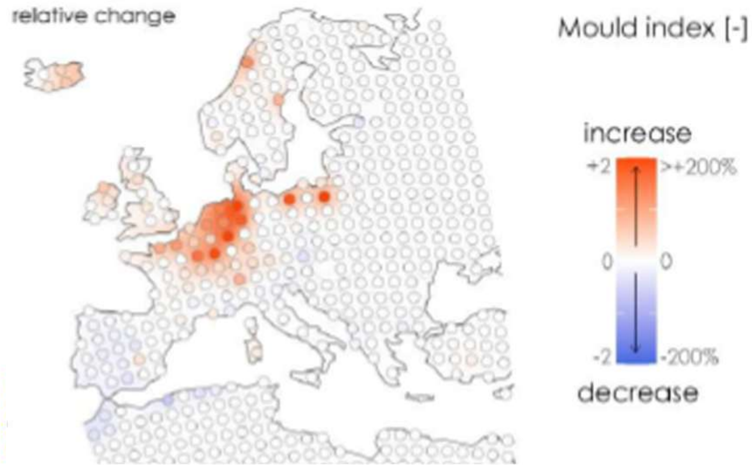
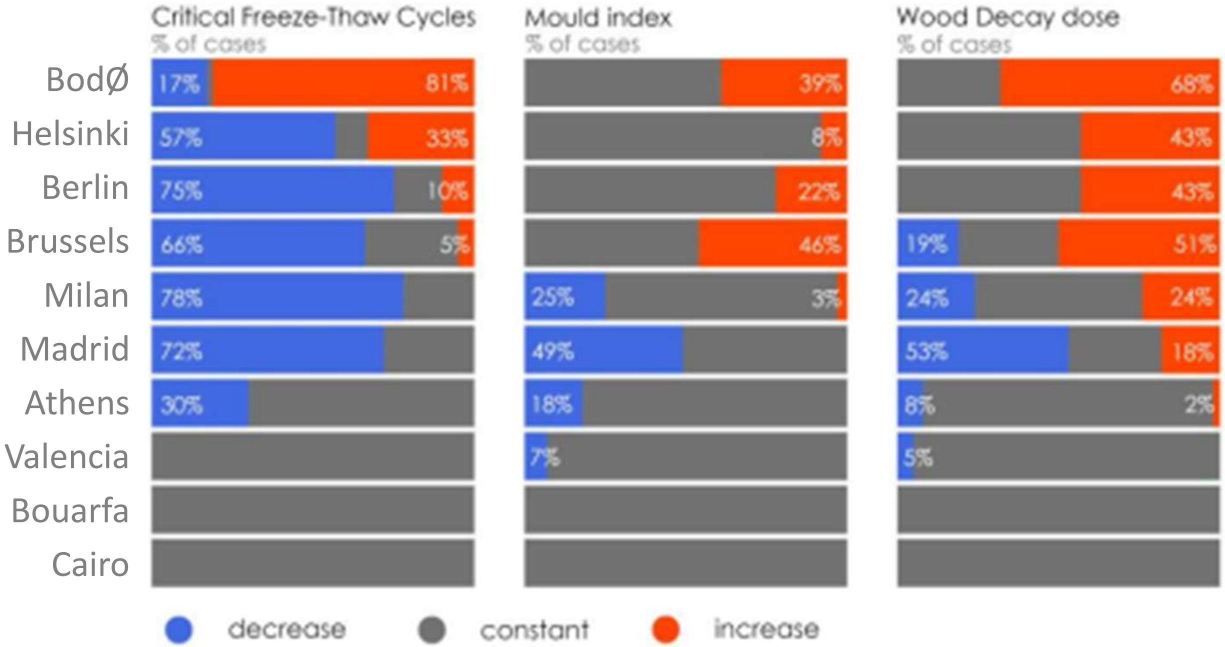
Projections for the future



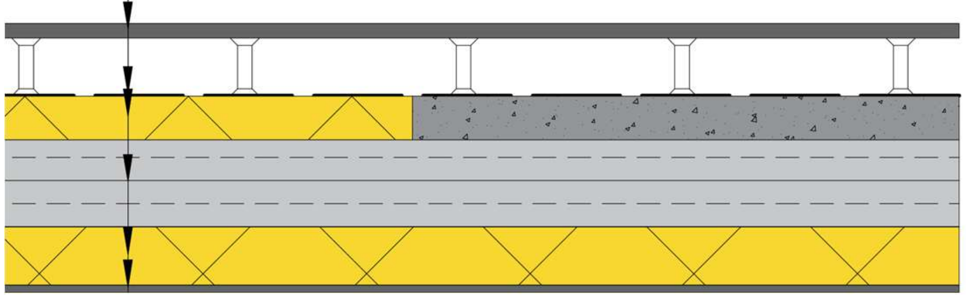




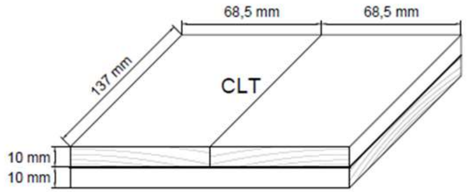
(Vandemeulebroucke, Van Den Bossche, 2022)

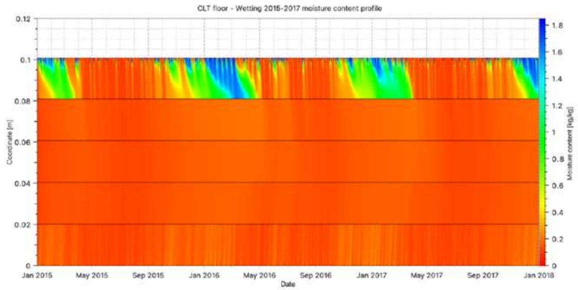
Case-study

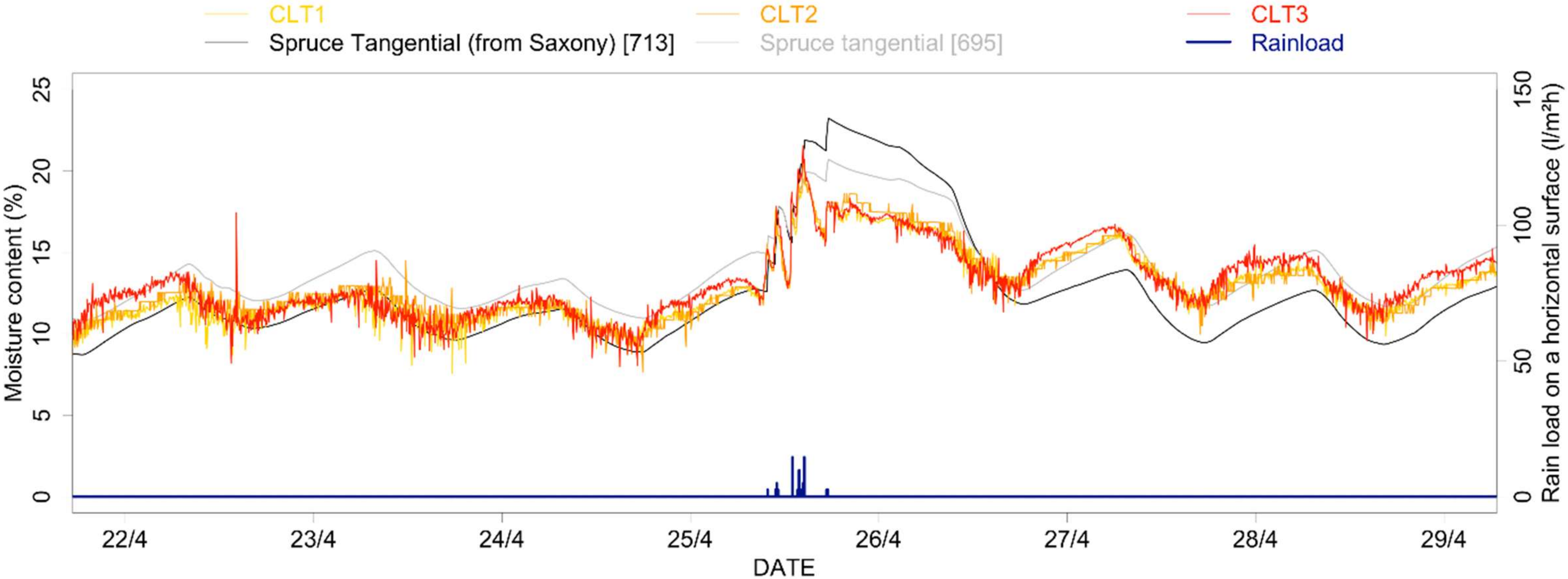
- 20mm tiles
- 80mm tiles supports
- FPO waterproofing layer
- 60mm EPS insulation
- 120mm CLT
- 80mm EPS insulation
- 10mm silicone-based render



Case-study







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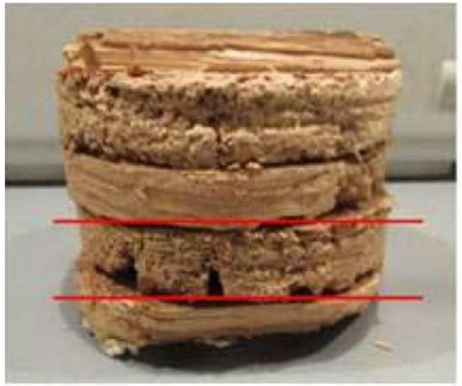
(Habtie, Van Den Bossche, 2023)

Case-study

Case-study



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Why building physics did not solve moisture problems (yet)

It's your fault

Prof. Nathan Van Den Bossche

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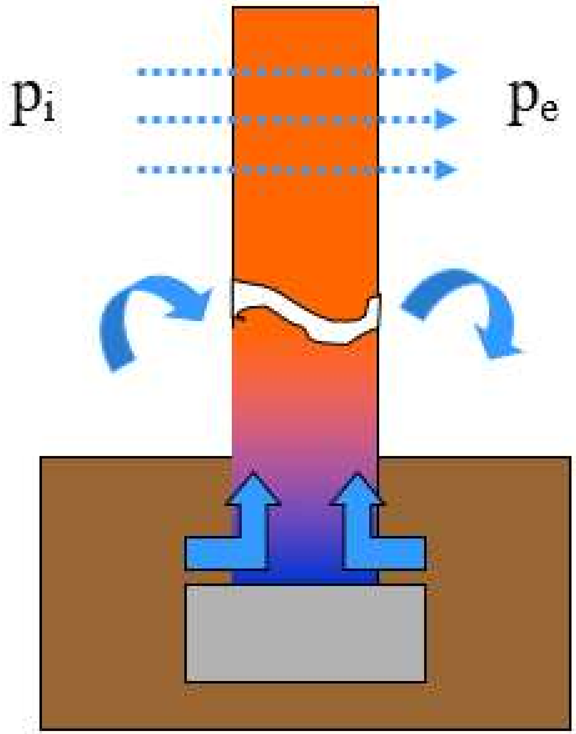
Moisture transport

- Different transport modes
  - Vapour diffusion
  - Vapour transport by convection
  - Capillary water transport
  - Water transport ~Hydraulics



How long does it take to transport 1kg of moisture?

Moisture transport

- Different transport modes
  - **Vapour diffusion**

$$g = \frac{p_i - p_e}{Z_{tot}} = \frac{p_i - p_e}{\sum \mu d / \delta_a}$$

Impact surface transfer coefficients is negligible
δ_a = 2.10^{-10} [kg/msPa = s]

- Example:
  - Concrete d = 10cm, μ = 100
  - Annual vapour pressure difference = 400 Pa [1 Pa = 1 kg/(m.s²)]
  - Z = 5 10^{10} m/s
  - g_v = 80 10^{-10} kg/m²/s = 0.25 kg/m²/year (31.536.000 s/year)

=> 4 years

Moisture transport

- Different transport modes
  - **Vapour transport by convection**

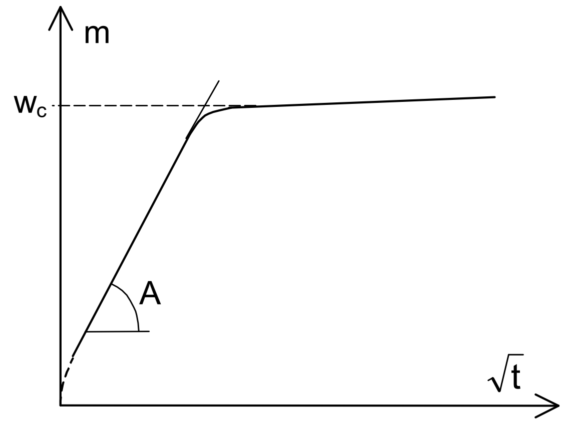
- Example:
  - Indoor 20°C, 50% RH (8,64g/m³)
  - Outdoor 0°C, 90% RH (4,23g/m³)
  - Bedroom of 40m³, ACH 0,5
    - g_v = 20m³/h * (8,64-4,23)g/m³ = 88,2g/h

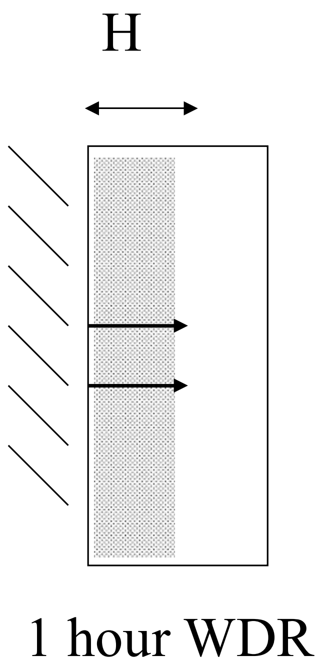
=> 11,3 hours

temp. [°C]	p_s [Pa]	c_{max} [g/m³]
35	5627	39,56
34	5323	37,54
33	5033	35,62
32	4757	33,77
31	4496	32,02
30	4245	30,34
29	4007	28,73
28	3782	27,21
27	3567	25,75
26	3363	24,36
25	3169	23,05
24	2985	21,78
23	2811	20,55
22	2645	19,43
21	2488	18,35
20	2340	17,28
19	2198	16,30
18	2065	15,37
17	1938	14,47
16	1818	13,65
15	1706	12,85
14	1599	12,07
13	1498	11,35
12	1403	10,65
11	1313	10,01
10	1229	9,40

Moisture transport

- Different transport modes
  - **Capillary water transport**





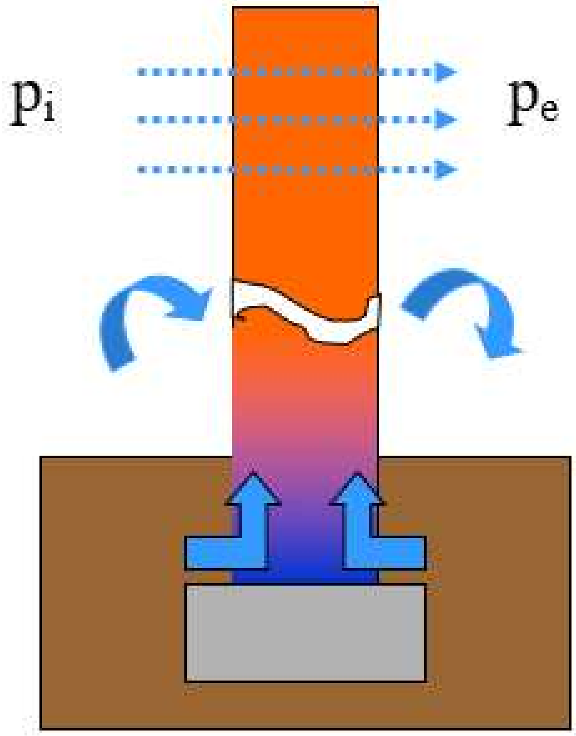
Penetration depth H moisture front?

- Brick (large pores):
  - $A = 0.50\ kg/m^2/s^{½}$
  - $w_c = 300\ kg/m^3$
- $H = 0.10\ m$
- $m = 30\ kg/m^2$

=> 4 seconds

Moisture transport

- Different transport modes
  - Vapour diffusion **=> 4 years**
  - Vapour transport by convection **=> 11,3 hours**
  - Capillary water transport **=> 4 seconds**
  - Water transport ~Hydraulics **=> 1 second**



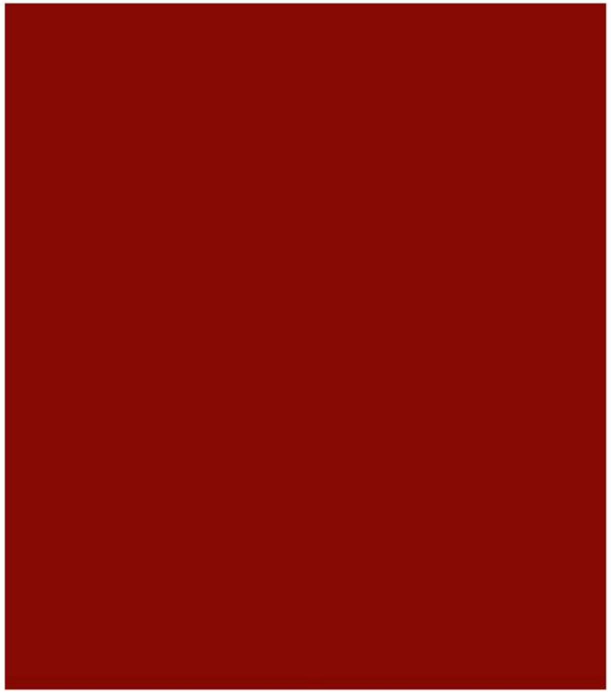
How long does it take to transport 1kg of moisture?

Vapour Diffusion Fetish

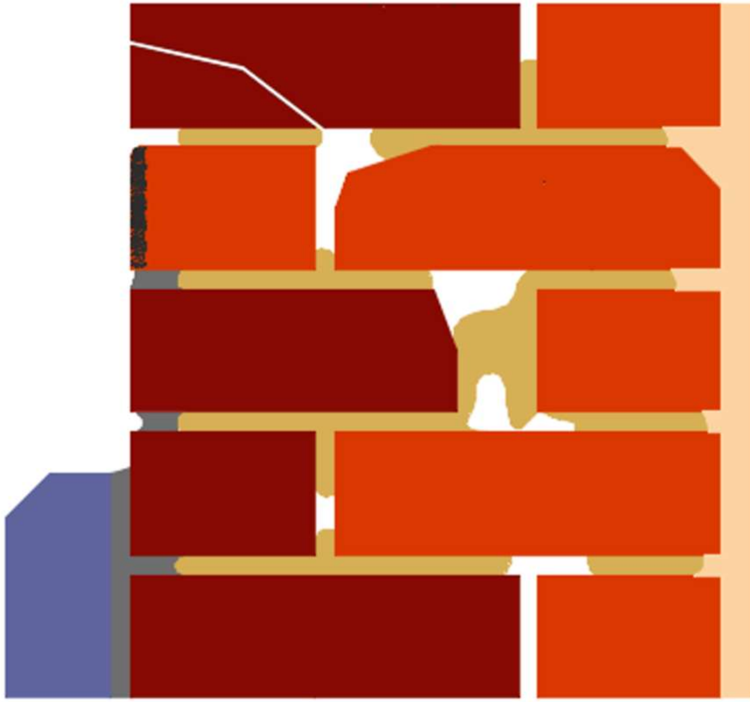
- WDR loads
- Splashing
- Runoff
- Infiltration
- Deficiencies
- Air leakage
- 2D
- 3D
- Materials
- Hysteresis
- Indoor climate
- Outdoor climate
- Salt
- Degradation

DELPHIN Simulationsprogramm für den gekoppelten Wärme-, Luft-, Feuchte-, Schadstoff- und Salztransport

WUFI®



Reality



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Vapour Diffusion Fetish

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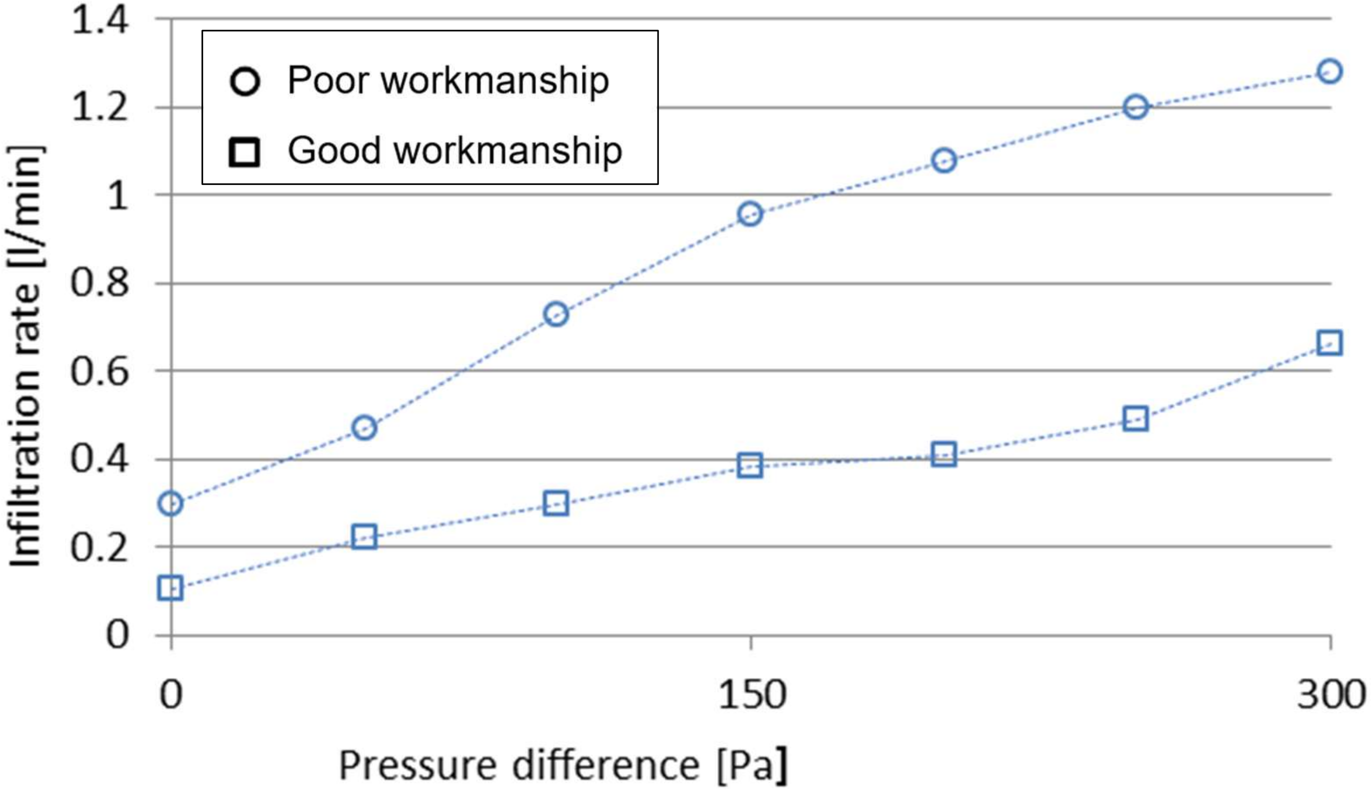

(Van Goethem, Van Den Bossche, 2015)

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Vapour Diffusion Fetish

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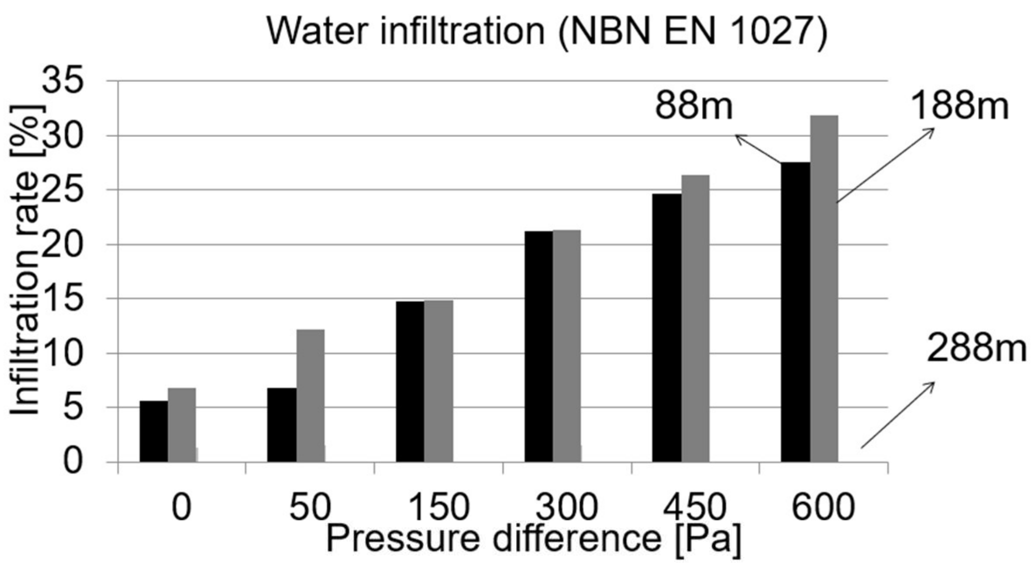

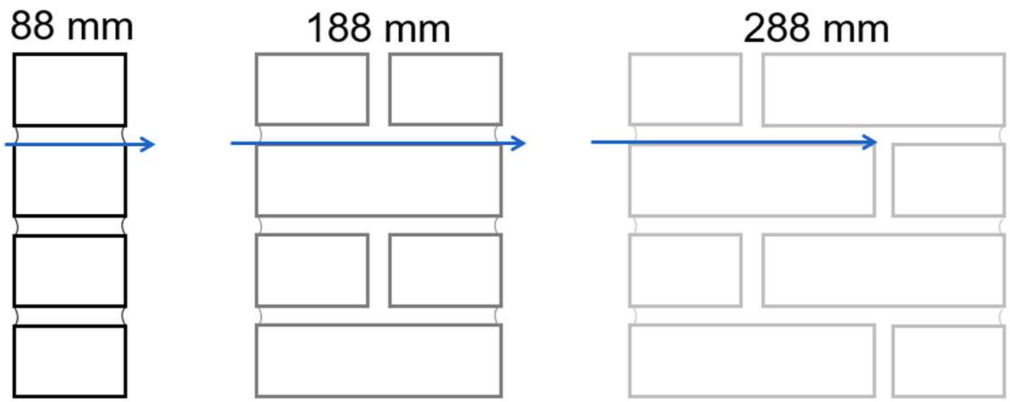

(Calle, Van Den Bossche, 2020)

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Vapour Diffusion Fetish

- WDR loads
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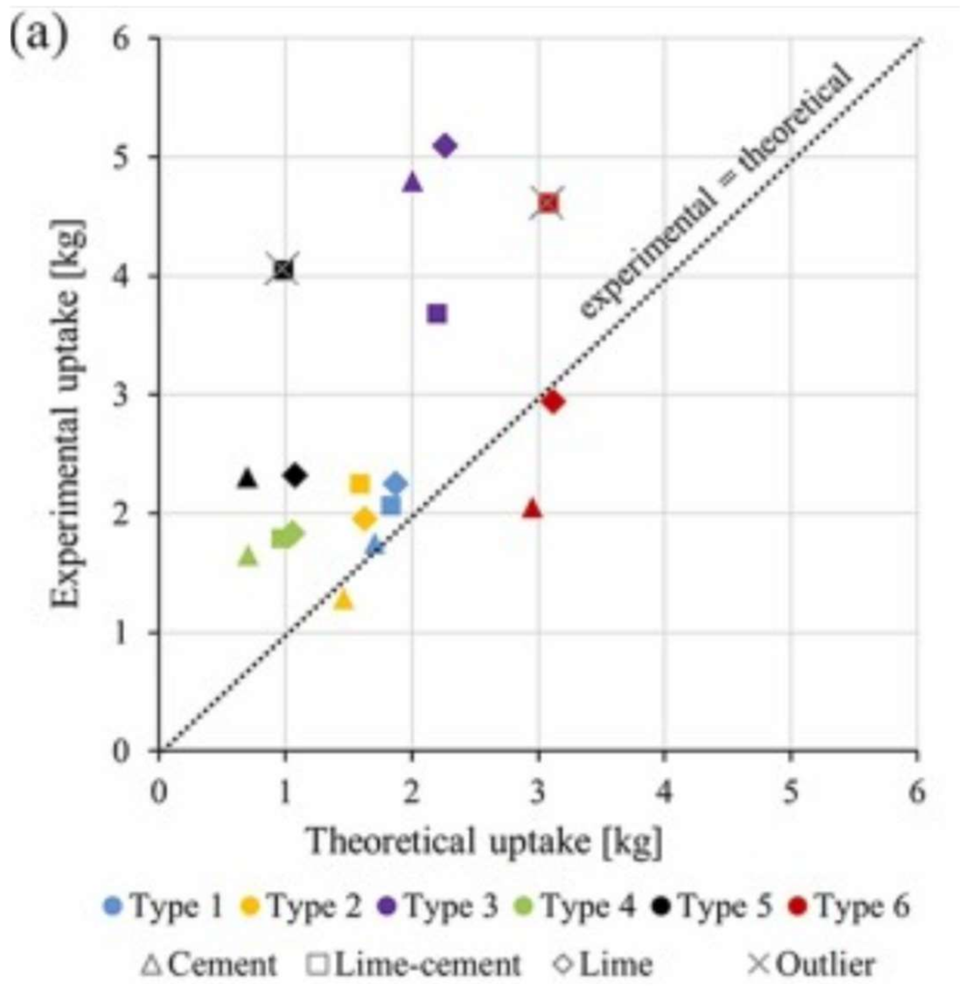

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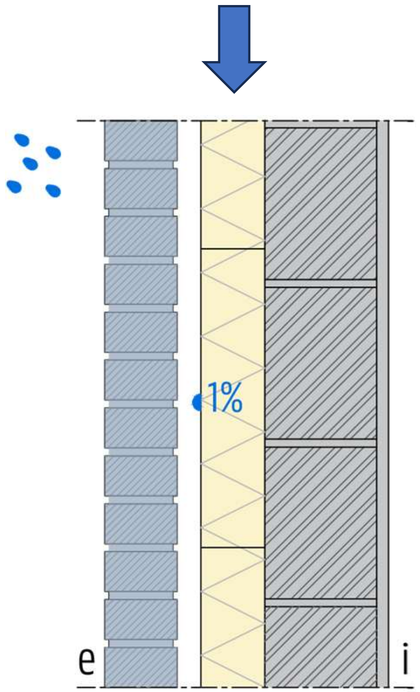
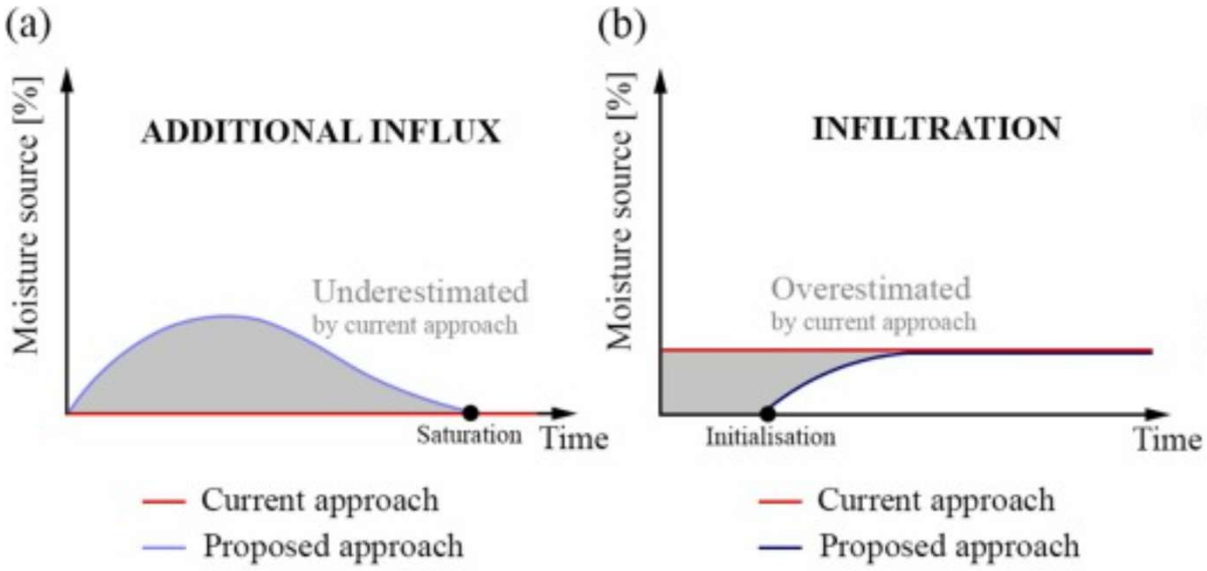
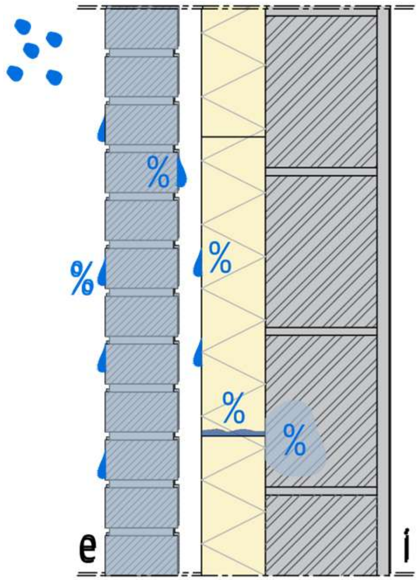
(Van den Bossche, Van Den Bossche, 2025)





(Van den Bossche, Van Den Bossche, 2025)



Quantified watertightness performance

ASHRAE Standard 160 – 1%

- → Independent of cladding or cavity width
- → North American context
- → Stochastic nature of water infiltration requires numerous experiments

How can we quantitatively predict the watertightness of various wall assemblies?

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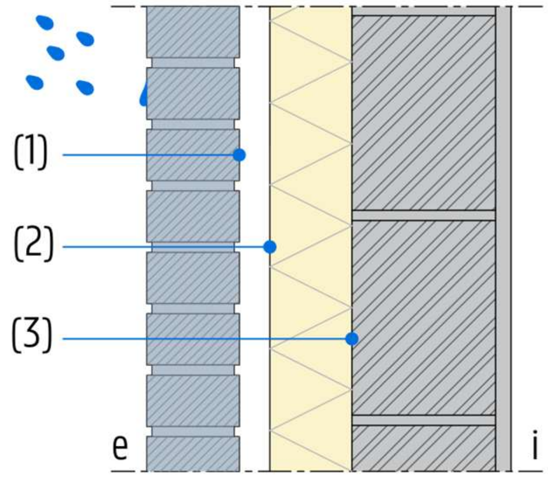
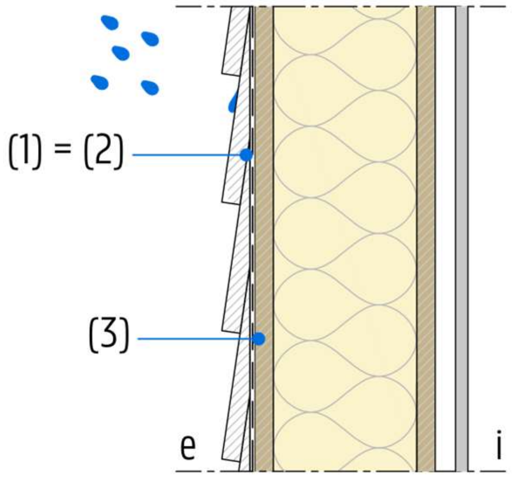
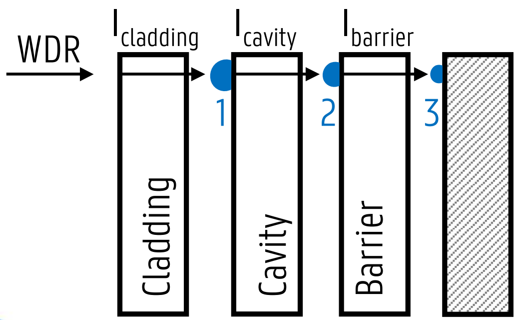
Infiltration percentages as input for hygrothermal simulations

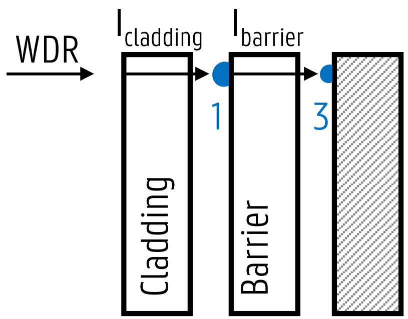


Drained wall assemblies



Undrained wall assemblies





We need to know 4 things

- **% through cladding**
- % crossing cavity
- Drainage & retention
- % crossing WRB

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Review of rainwater infiltration rates in wall assemblies

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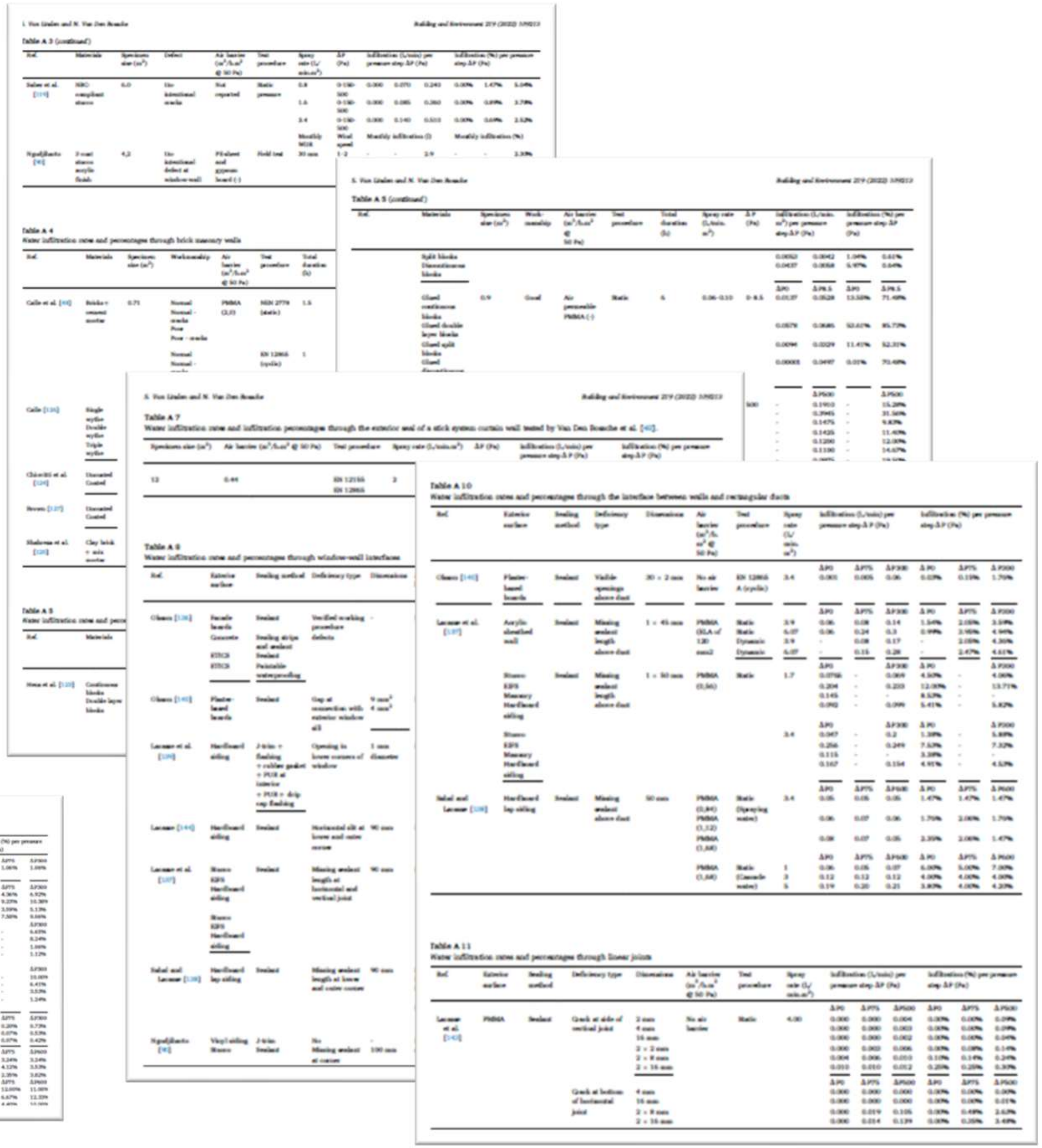
Ghent University, Faculty of Engineering and Architecture, Building Physics Research Group, Belgium

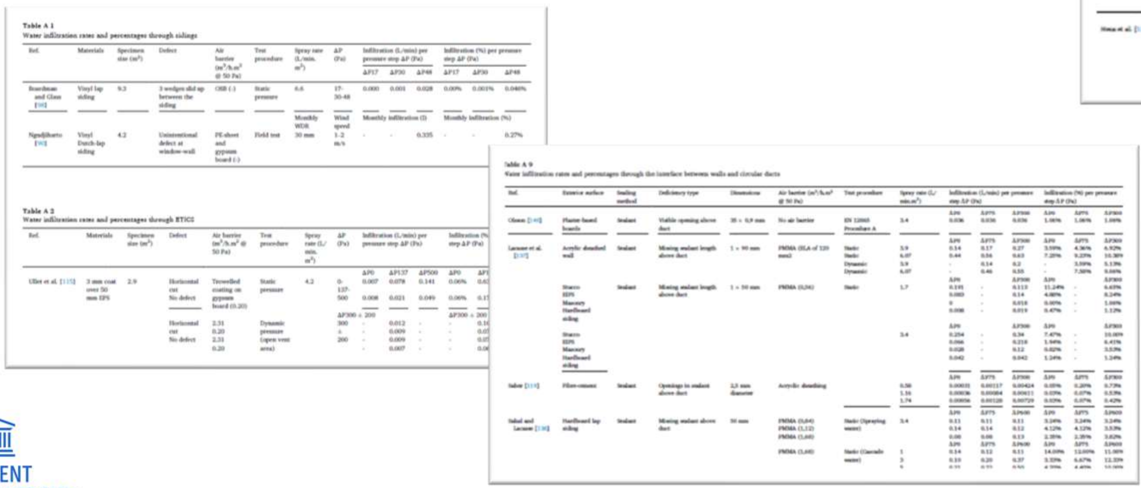
ARTICLE INFO

Keywords:
Rainwater infiltration
Hygrothermal simulation
Watertightness test method
Water entry function

ABSTRACT

Detailed knowledge on expected infiltration percentages through various exterior cladding surfaces is of importance when conducting hygrothermal simulations to evaluate the long-term performance of wall assemblies. Due to the stochastic nature of rainwater infiltration through wall assemblies, it is not possible to precisely predict the amount of rainwater that will infiltrate. However, laboratory and field tests may provide insight into the range of infiltration rates that can be expected for a given cladding and insight into the impact of deficiencies and the parameters affecting infiltration. Therefore, quantitative studies concerning infiltration rates, which were mostly laboratory studies, were reviewed. Based on the reviewed studies, the driving forces for infiltration were determined and the impact of the applied test method, pressure difference and water deposition rate on the infiltration rates was analyzed. A methodology to obtain information on infiltration percentages without performing additional laboratory tests was proposed and a categorization of cladding materials was developed.





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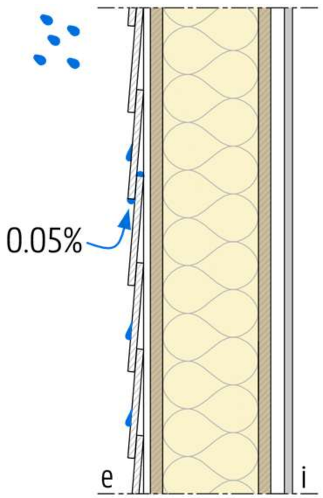
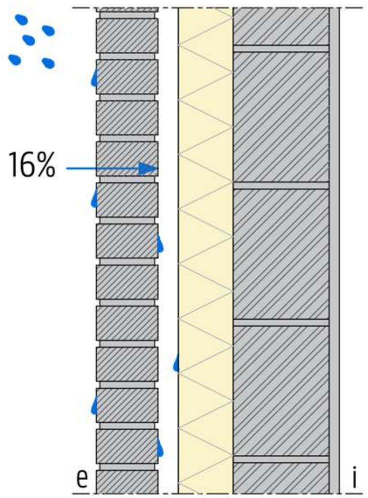
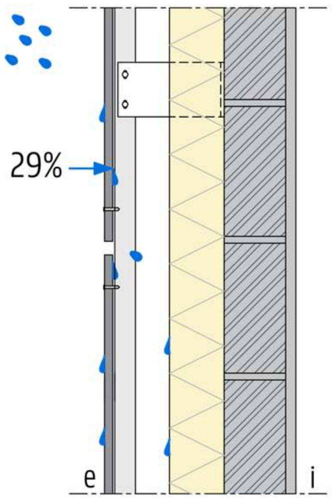
Infiltration percentages depend on cladding type and vary linearly with pressure



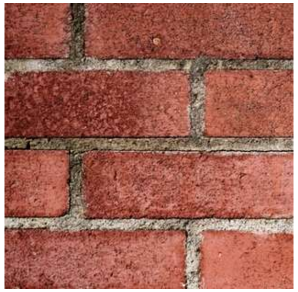




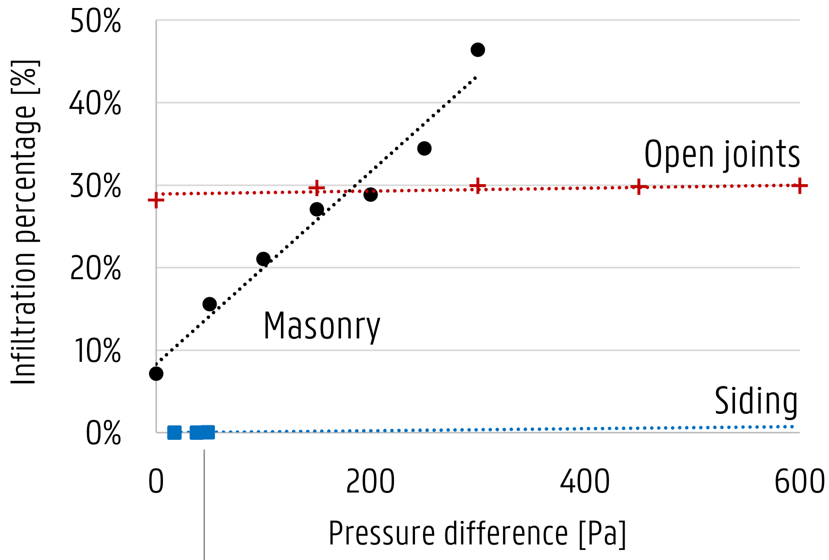
Siding

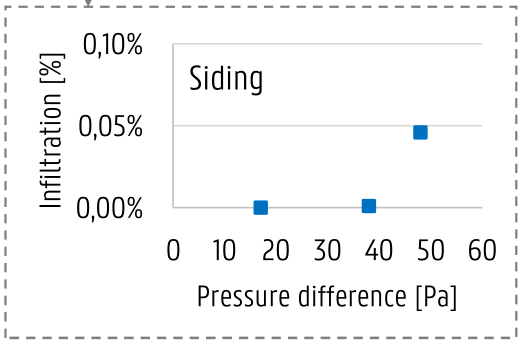
Masonry

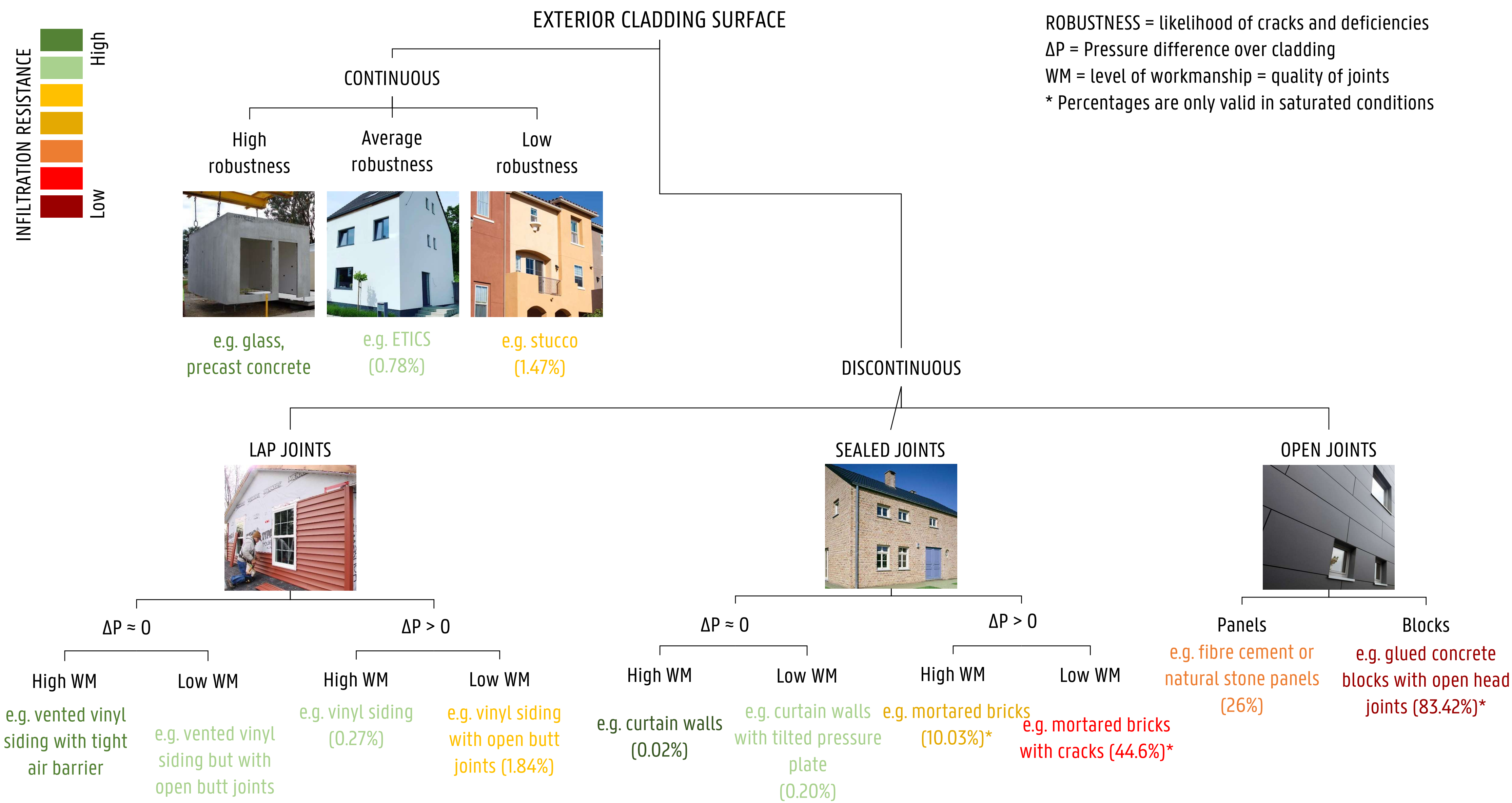
Panels with open joints



(50 Pa)

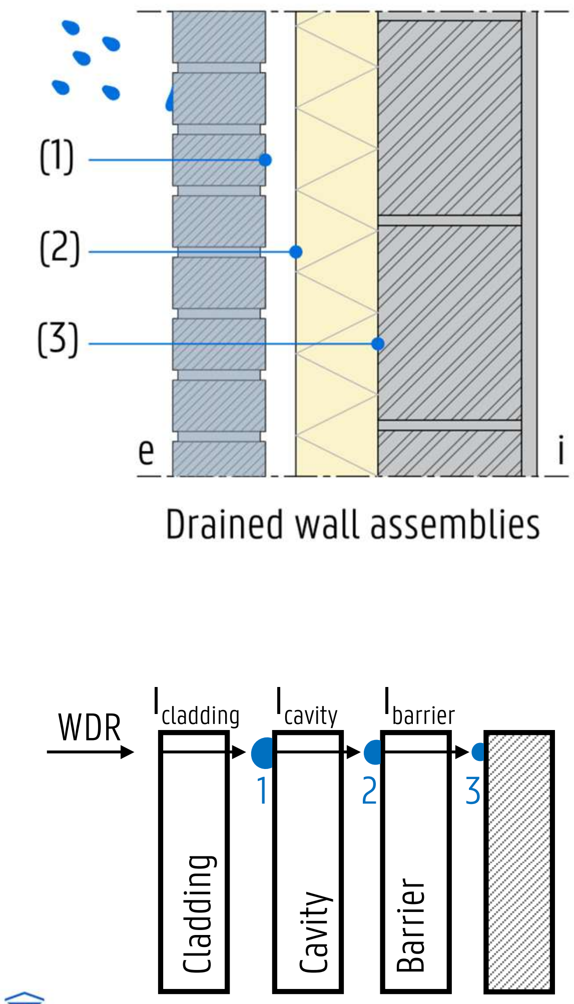


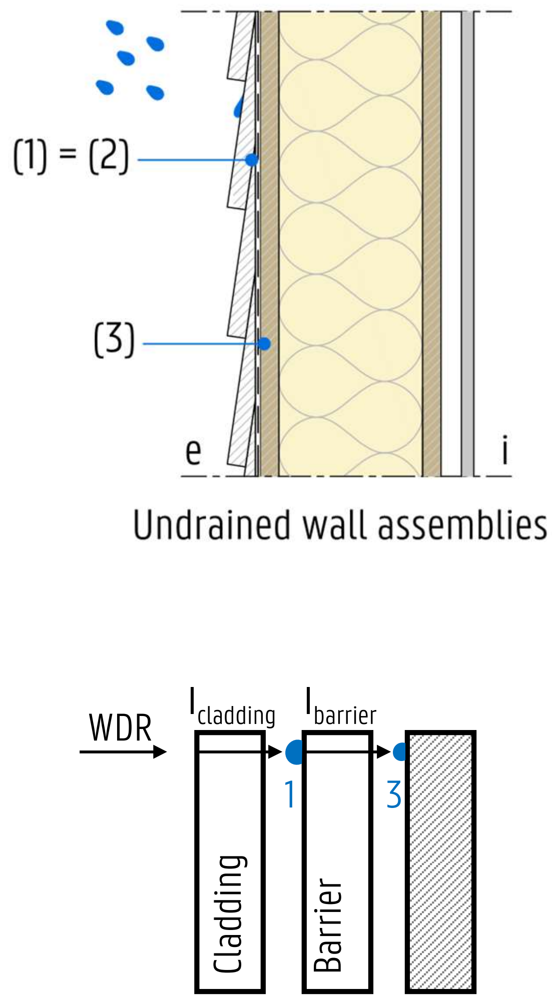




EXTERIOR CLADDING SURFACE
ROBUSTNESS = likelihood of cracks and deficiencies
ΔP = Pressure difference over cladding
WM = level of workmanship = quality of joints
* Percentages are only valid in saturated conditions
INFILTRATION RESISTANCE
High
Low
CONTINUOUS
High robustness
Average robustness
Low robustness
e.g. glass, precast concrete
e.g. ETICS (0.78%)
e.g. stucco (1.47%)
DISCONTINUOUS
LAP JOINTS
SEALED JOINTS
OPEN JOINTS
ΔP ≈ 0
ΔP > 0
High WM
Low WM
e.g. vented vinyl siding with tight air barrier
e.g. vented vinyl siding but with open butt joints
High WM
Low WM
e.g. vinyl siding (0.27%)
e.g. vinyl siding with open butt joints (1.84%)
ΔP ≈ 0
ΔP > 0
High WM
Low WM
e.g. curtain walls (0.02%)
e.g. curtain walls with tilted pressure plate (0.20%)
High WM
Low WM
e.g. mortared bricks (10.03%)*
e.g. mortared bricks with cracks (44.6%)*
Panels
Blocks
e.g. fibre cement or natural stone panels (26%)
e.g. glued concrete blocks with open head joints (83.42%)*

Infiltration percentages with QPA-method as input for hygrothermal simulations





We need to know 4 things

- % through cladding
- **% crossing cavity**
- **Drainage & retention**
- % crossing WRB

BUILDING PHYSICS

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SAGE

Research Paper

Drainage of infiltrated rainwater in wall assemblies: Test method, experimental quantification, and recommendations

Stéphanie Van Linden[1], Michael Lacasse[2] and Nathan Van Den Bossche[1]

Abstract

Drainage reduces the amount of water able to infiltrate toward the interior of wall assemblies. However, a portion of the infiltrated water remains in the assembly after drainage has occurred. The degree to which this retained portion of water affects the durability of the wall assembly can be evaluated by means of hygrothermal simulations. However, the number of studies reporting information on the retention percentage that can be applied as input for hygrothermal simulations and on the drainage performance of wall assemblies is, in general, quite limited. Therefore, an experimental study was developed, to assess governing test methods to evaluate drainage characteristics and to quantify retention of water in wall test specimens having various cavity widths and incorporating different drainage materials. It was concluded that apart from the absolute amount of retained water, the lateral spreading of water in the cavity and the overall wetted area, should also be considered, thereby resulting in reporting the retained amount relative to the wetted area. The latter values provide more detailed information on the behavior of water in the cavity. Additionally, it was concluded that a clear cavity of 1 mm can drain water more efficiently than a cavity of 10 mm. As well, the surface texture of drainage materials affected the spreading and retention of water within the

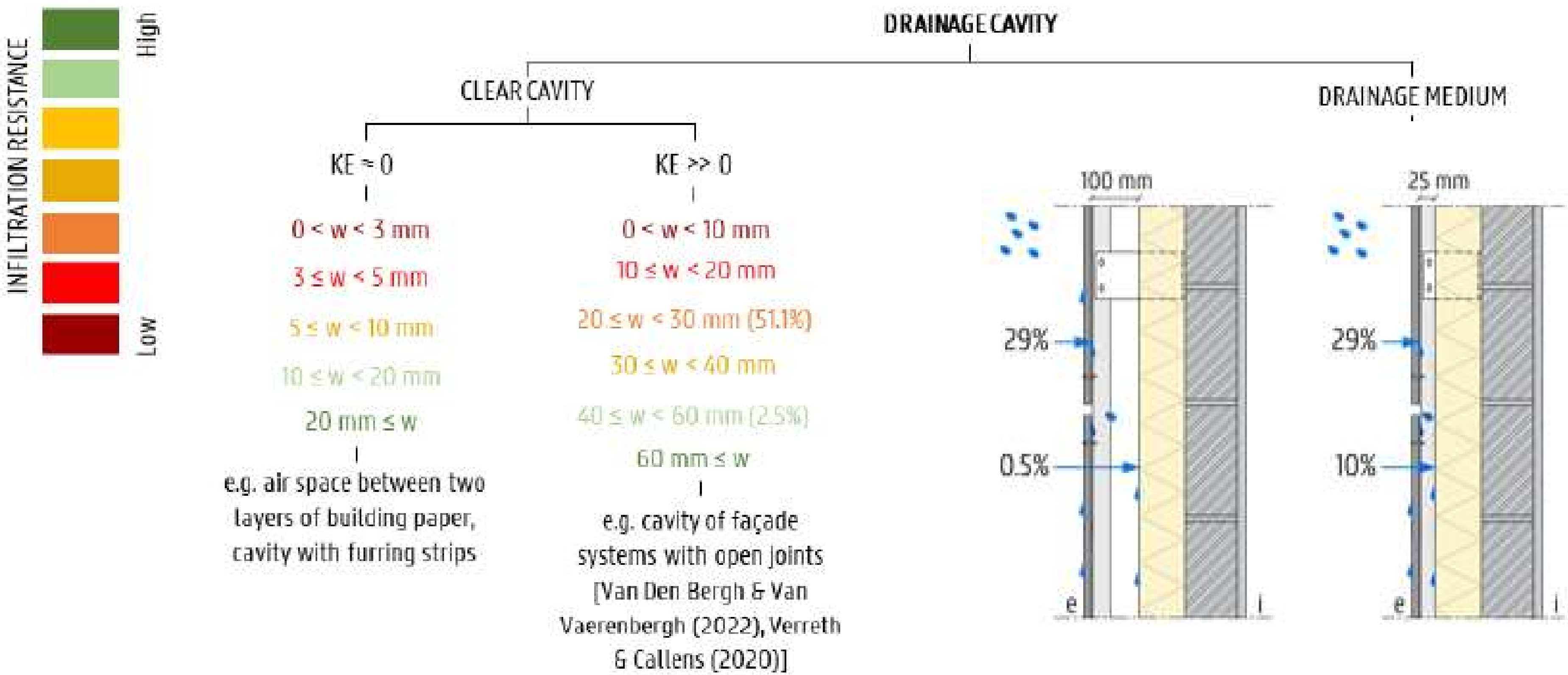
[1]Ghent University, Faculty of Engineering and Architecture, Building Physics Research Group, Gent, Belgium
[2]National Research Council of Canada, Construction Research Centre, Ottawa, ON, Canada

Ref.	Sheathing	Drainage plane	Cavity	Width (mm)	Cladding	DE [%]	V_{ret} [g]	V_{ret} [g/m²]	$V_{ret,sec}$ [g/m²]
[167]	OSB	#30 BP	-	-	XPS	0.0%	*8030.0*	*2697.5*	
	OSB	#15 BP - DEHW	-	-	XPS	1.7%	*7893.5*	*2651.7*	
	OSB	#15 BP	PF	6.35	XPS	97.0%	*240.9*	*80.9*	
	OSB	#15 BP	FF	6.35	XPS	75.4%	*1975.4*	*663.6*	
	OSB	#15 BP	PF	19	XPS	90.9%	*730.7*	*245.5*	
	OSB	HW	-	-	XPS	9.0%	*7304.6*	*2453.9*	
	OSB	HW	PF	6.35	XPS	94.5%	*441.7*	*148.4*	
	OSB	HW	FF	6.35	XPS	77.5%	*1806.8*	*606.9*	
	OSB	HW	DM	NR	XPS	94.1%	*473.8*	*159.2*	
	OSB	DEHW	-	-	XPS	71.0%	*2330.3*	*782.8*	
	OSB	DEHW	PF	6.35	XP				
	OSB	DEHW	FF	6.35	X				
	OSB	DB	-	NR	X				
[165]	-	PE sheet	-	-					
	-	Acrylic sheet	clear cavity	1	PM				
	-	Acrylic sheet	-	-					
	Gypsum	Gypsum	adhesive	> 1	E				
	Gypsum	Trowel	adhesive	1.5	E				
	Gypsum	Trowel	grooves	6.35	E				
	Gypsum	Trowel	adhesive	3	E				
	Gypsum	Trowel	adhesive	2	E				
	Plywood	HW	grooves	NR	E				
	Gypsum	#15 BP (2 layers)	-	-	Stu				
	Gypsum	#15 BP (2 layers)	PF	19	Stu				
	OSB	dimpled DM	dimpled DM	3	Vi				
	OSB	#15 BP	-	-	Vi				
	NR	HW	-	-	Vi				

	NR	#15 BP	-	-	Vinyl	*74.2%*	*536.6*	151.0	181.0
	NR	HW	wrinkled HW	NR	FC sheet	*62.5%*	*562.9*	219.9	373.3
	NR	HW	-	-	FC	*84.0%*	*239.8*	93.7	130.0
	NR	#15 BP	-	-	FC	*83.9%*	*241.9*	94.5	140.0
	NR	HW	-	-	Cedar	*66.3%*	*505.6*	197.5	331.5
	NR	HW	-	-	Cedar	*85.4%*	*218.9*	85.5	116.5
[168]	OSB	LAB	adhesive ribbons	2-3	EPS	*99.1%*	74.0	*24.9*	
	OSB	HW	-	-	Vinyl	*97.1%*	230.0	*77.3*	
	OSB	#15 BP	-	-	Vinyl	*95.5%*	364.0	*122.3*	
	OSB	HW	-	-	Hardboard	*98.5%*	123.5	*41.5*	
	OSB	HW	channelled nylon DM	6.7	Hardboard	*97.1%*	231.0	*77.6*	
	OSB	HW	nylon DM	6.9	Hardboard	*96.5%*	284.0	*95.4*	
	OSB	HW	-	-	Wood	*94.7%*	426.0	*143.1*	
	OSB	HW	dimpled DM	6.3	Wood	*96.8%*	260.0	*87.3*	
	OSB	HW	PF	19	Wood	*94.2%*	467.0	*156.9*	
	OSB	HW	-	-	FC	*95.8%*	340.0	*114.2*	
	OSB	#15 BP	-	-	FC	*97.5%*	197.0	*66.2*	
[170]	OSB	HW	-	-	EPS	*98.8%*	12.0	*32.2*	*32.2*
	OSB	HW	-	-	EPS'	*97.2%*			
	OSB	HW	DM	NR	EPS	*98.8%*			
	OSB	HW	DM	NR	EPS'	*96.4%*			
	OSB	BP	DM	NR	EPS	*99.0%*			
	OSB	BP	DM	NR	EPS'	*95.8%*			
	OSB	BP (2 layers)	-	-	EPS	*98.8%*			
	OSB	BP (2 layers)	-	-	EPS'	*95.6%*			
	Gypsum	LAB	notch adhesives	9.5	EPS	*98.7%*			
	Gypsum	LAB	notch adhesives	9.5	EPS'	*99.0%*			
[175]	-	HW	nylon DM	NR	FC (A)	*50.6%*			
	-	HW	nylon DM	NR	FC (NA)	94.5%			
	-	HW	nylon DM with filter fabric	NR	FC (A)	46.0%			
	-	HW	NR	20	EIFS	96.8%			
	-	HW	-	-	FC (A)	27.2%			
	-	HW	NR	20	FC (A)	66.8%			
	-	HW	channelled DM	11	FC (A)	54.8%			
	-	HW	channelled DM	11	FC (NA)	94.2%			
	-	HW	channelled DM	6	FC (A)	38.8%			
	-	DEHW	-	-	FC (A)	40.7%			

Ref.	Sheathing	Drainage plane	Cavity	Width [mm]	Cladding	Tfw [s]	Rate [l/h.m]	tss [s]
167]	OSB	#30 BP	-	-	XPS	No drainage		
	OSB	#15 BP - DEHW	-	-	XPS	No drainage		
	OSB	#15 BP	PF	6.35	XPS	23.0		
	OSB	#15 BP	PF	19	XPS	13.0		
	OSB	HW	-	-	XPS	1646.7		
	OSB	HW	PF	6.35	XPS	13.7		
	OSB	HW	DM	NR	XPS	22		
	OSB	DEHW	-	-	XPS	184.8		
	OSB	DEHW	PF	6.35	XPS	10		
	OSB	DB	-	NR	XPS	16		
167]	OSB	HW	-	-	XPS	120 s		
	OSB	DEHW	-	-	XPS	5 s		
	OSB	HW	F	NR	XPS	Immediate		
	OSB	DEHW	F	NR	XPS	Immediate		
172]	OSB	#15 BP	-	-	PIR	120	8.69	600
	OSB	#15 BP	-	-	EPS	75	19.87	3600
	OSB	#15 BP	F	0.8	EPS	5	309.24	300
	OSB	#15 BP	-	-	Cement board	10	531.55	180
	OSB	#15 BP	DM	3.2	Cement board - EPS	7	1235.72	300
	OSB	#15 BP	Grooves	NR	EPS	5	2568.32	180
173]	OSB	BP (2 layers)	-	-	stucco		26.72	
	OSB	BP - higher perm HW	-	-	stucco		40.08	
	OSB	BP - DEHW	-	-	stucco		40.08	
	open frame	BP	-	-	stucco		53.44	
	OSB	BP (2 layers)	-	-	one-coat stucco		53.44	
	OSB	BP (2 layers)	Channels	NR	stucco		80.16	
	OSB	BP (2 layers)	-	-	cracked stucco		347.37	
	OSB	BP (2 layers)	DM	NR	EIFS		347.37	

Effect of cavity with on drainage and rain water transfer



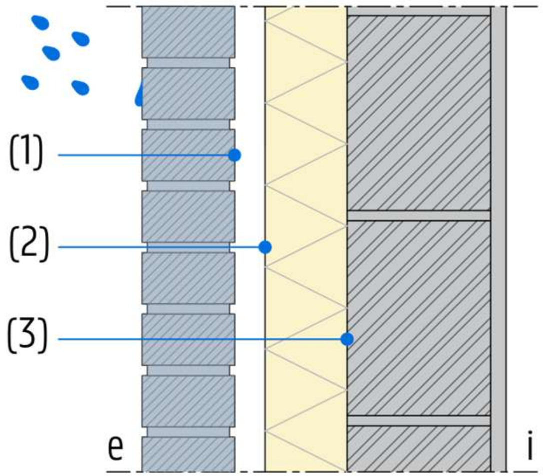
KE = Kinetic Energy

KE ≈ 0 water enters cavity through cracks or small deficiencies after breaching of meniscus

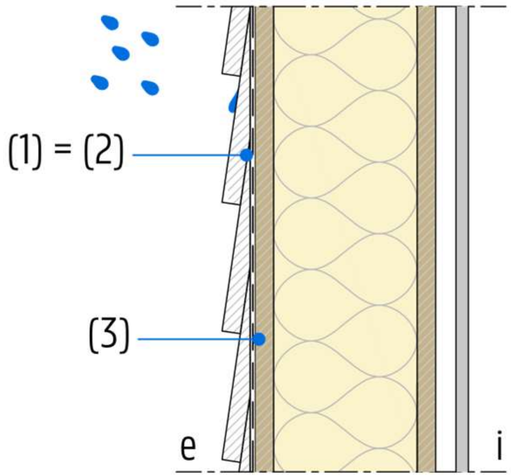
KE >> 0 water enters cavity through large openings in an unobstructed manner

w = cavity width

Infiltration percentages with QPA-method as input for hygrothermal simulations



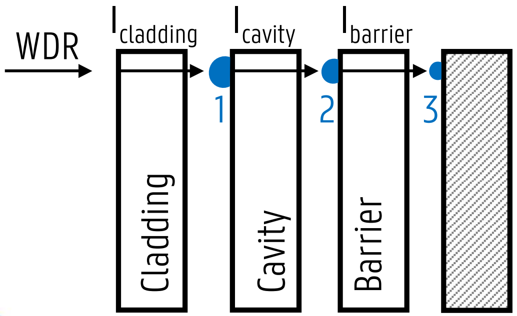
Drained wall assemblies

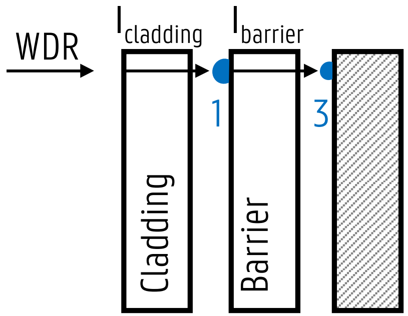


Undrained wall assemblies

We need to know 4 things

- % through cladding
- % crossing cavity
- Drainage & retention
- **% crossing WRB**





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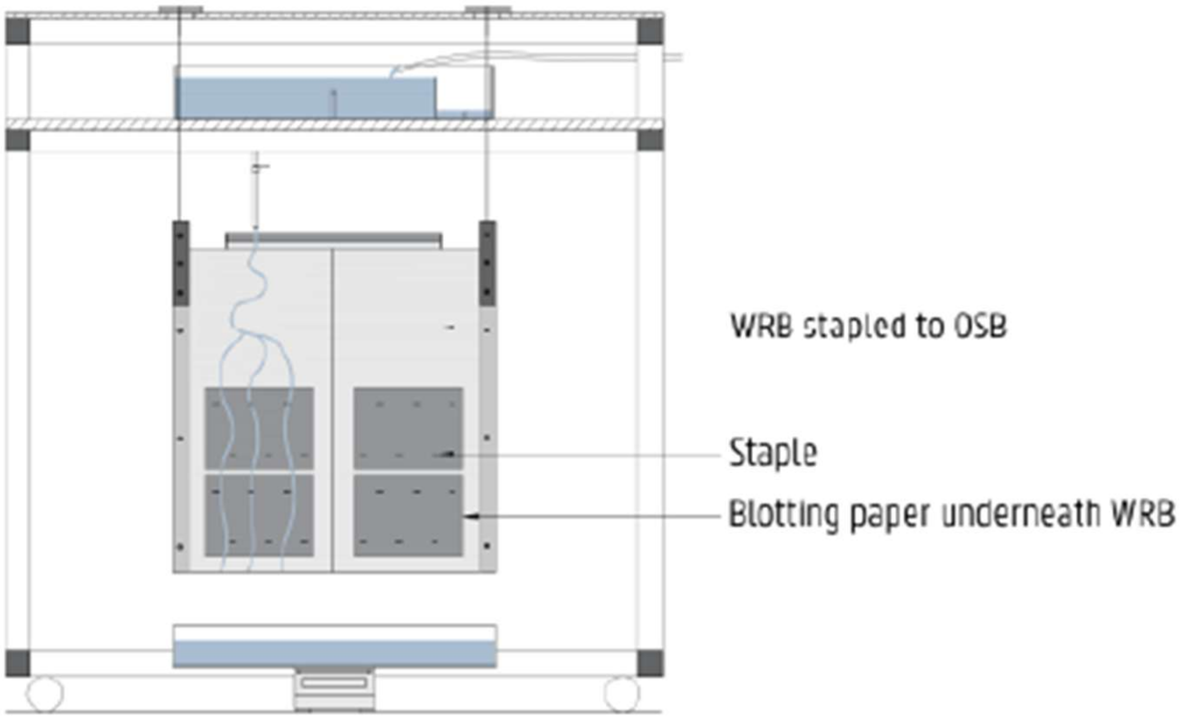
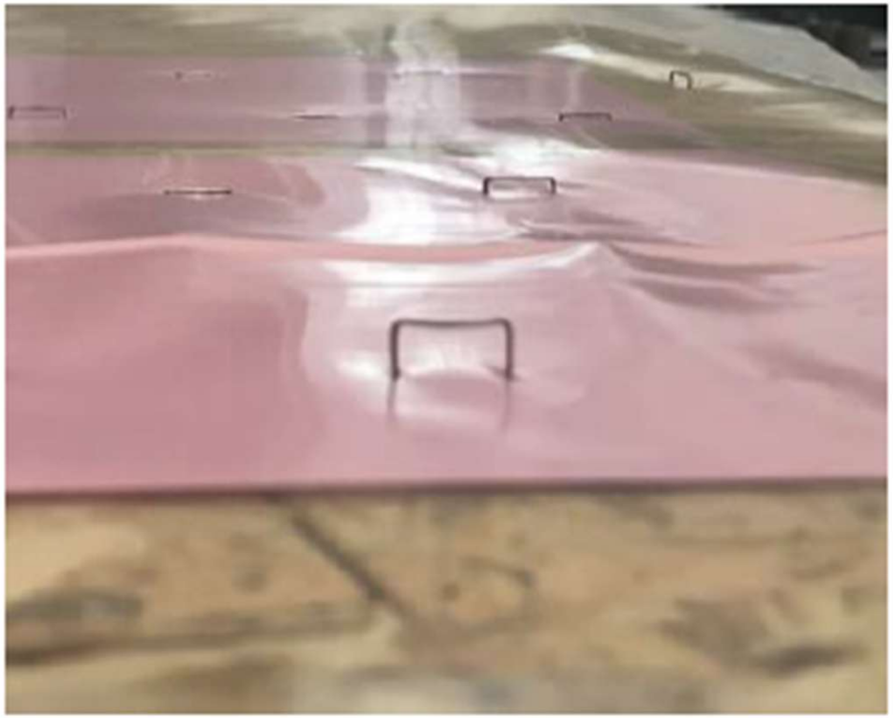
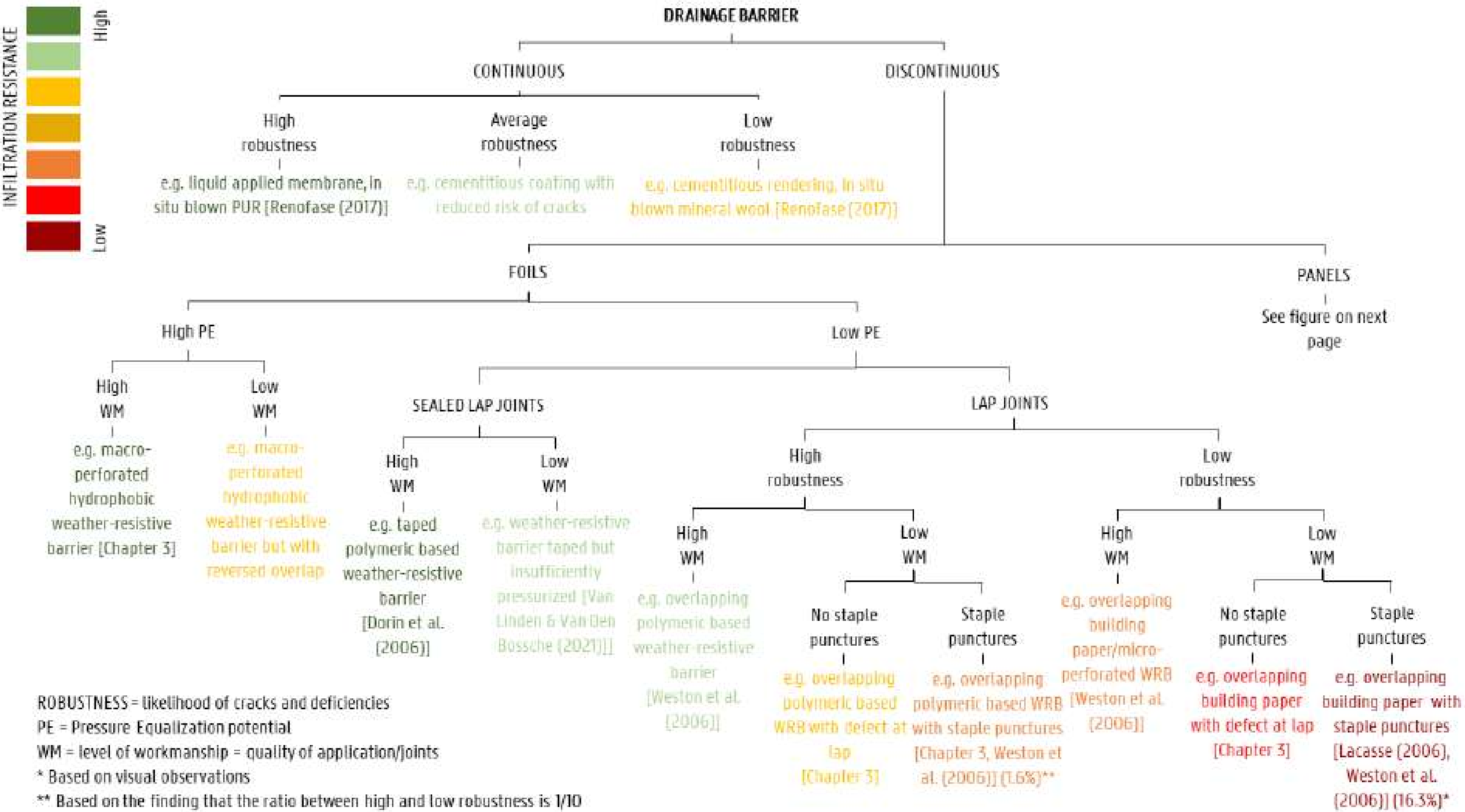
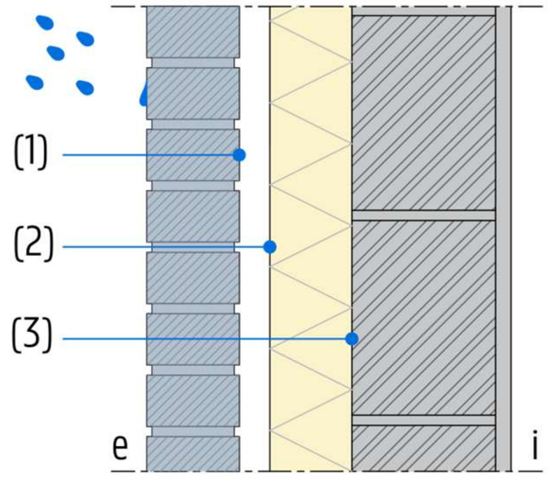

WRB stapled to OSB
Staple
Blotting paper underneath WRB

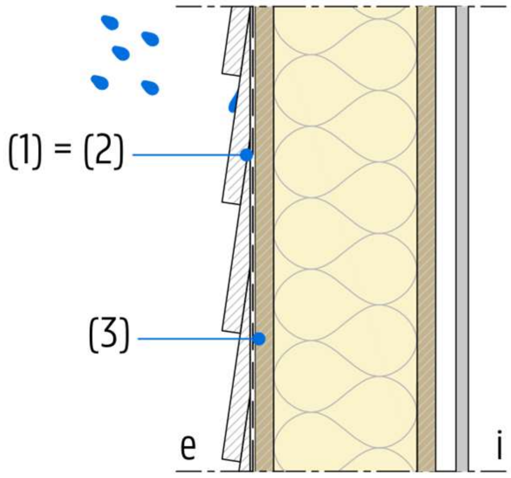



INFILTRATION RESISTANCE
High
Low
DRAINAGE BARRIER
CONTINUOUS
DISCONTINUOUS
High robustness
e.g. liquid applied membrane, in situ blown PUR [Renofase (2017)]
Average robustness
e.g. cementitious coating with reduced risk of cracks
Low robustness
e.g. cementitious rendering, in situ blown mineral wool [Renofase (2017)]
FOILS
PANELS
See figure on next page
High PE
Low PE
High WM
e.g. macro-perforated hydrophobic weather-resistive barrier [Chapter 3]
Low WM
e.g. macro-perforated hydrophobic weather-resistive barrier but with reversed overlap
SEALED LAP JOINTS
High WM
e.g. taped polymeric based weather-resistive barrier [Dorin et al. (2006)]
Low WM
e.g. weather-resistive barrier taped but insufficiently pressurized [Van Linden & Van Den Bossche (2021)]
LAP JOINTS
High robustness
High WM
e.g. overlapping polymeric based weather-resistive barrier [Weston et al. (2006)]
Low WM
No staple punctures
e.g. overlapping polymeric based WRB with defect at lap [Chapter 3]
Staple punctures
e.g. overlapping polymeric based WRB with staple punctures [Chapter 3, Weston et al. (2006)] (1.6%)**
Low robustness
High WM
e.g. overlapping building paper/micro-perforated WRB [Weston et al. (2006)]
Low WM
No staple punctures
e.g. overlapping building paper with defect at lap [Chapter 3]
Staple punctures
e.g. overlapping building paper with staple punctures [Lacasse (2006), Weston et al. (2006)] (16.3%)*
ROBUSTNESS = likelihood of cracks and deficiencies
PE = Pressure Equalization potential
WM = level of workmanship = quality of application/joints
* Based on visual observations
** Based on the finding that the ratio between high and low robustness is 1/10

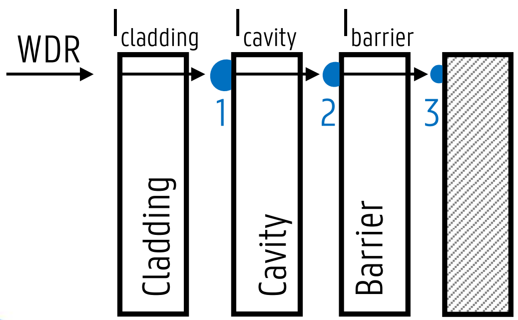
Infiltration percentages with QPA-method as input for hygrothermal simulations

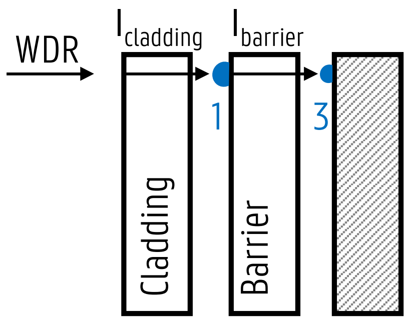


Drained wall assemblies



Undrained wall assemblies





$I_{CLADDING}$	I_{CAVITY}	$I_{BARRIER}$
0.02%	0.01%	0.001%
0.8%	2.5%	0.01%
1.8%	5.8%	0.2%
10%	24%	0.5%
26%	48%	1.6%
45%	75%	3.4%
84%	99%	16%

Retention: 200g/m²

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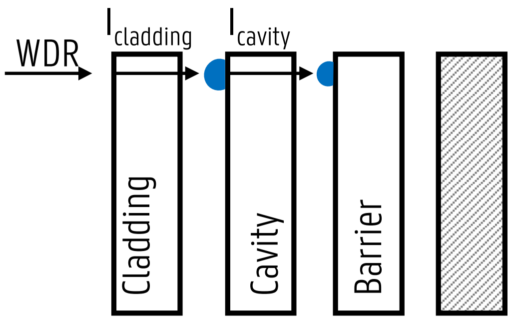
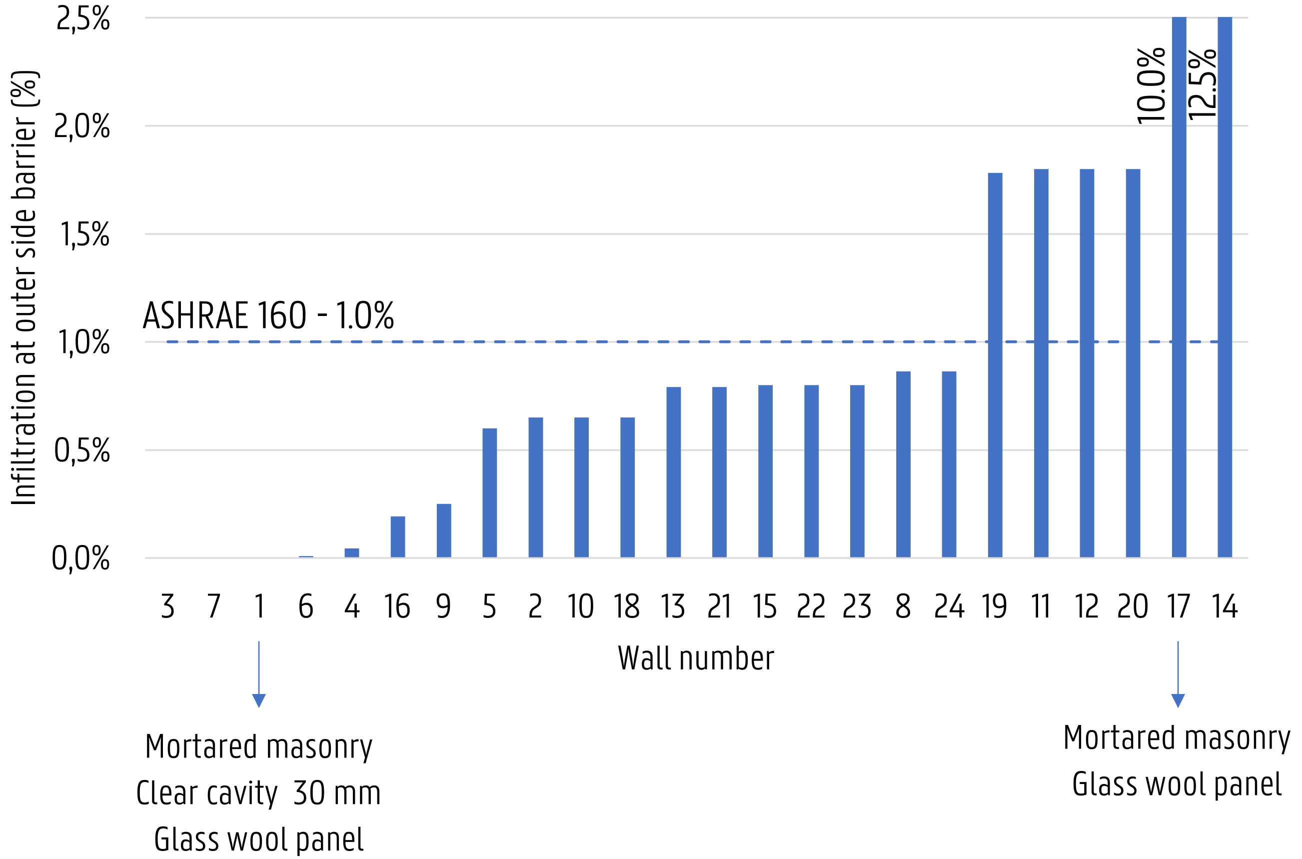
Infiltration percentages with QPA-method as input for hygrothermal simulations

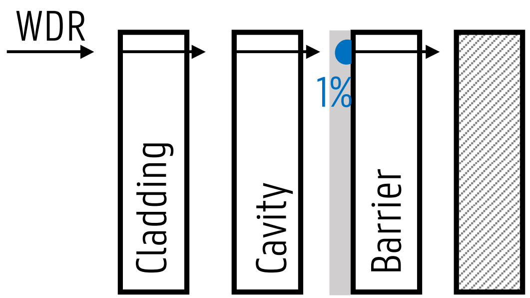


$$MS_{barrier} = WDR*I_{cladding} * I_{cavity}$$



Implementation of rainwater infiltration in hygrothermal simulations

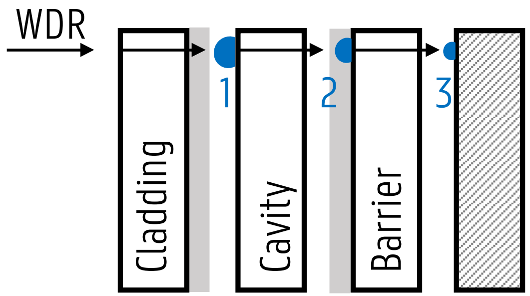
Minimum



1% - according to ASHRAE 160

Retention 200 g/m^2

Advanced

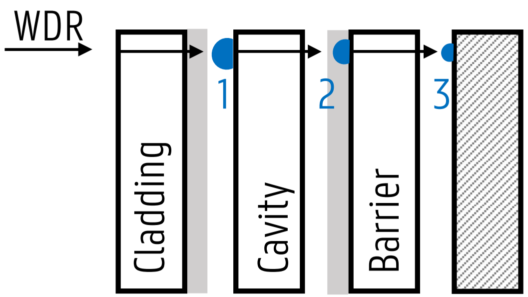


According to QPA-method

Retention 200 g/m^2 or drainage tests

Simulate the exterior surface absorption first

Superior



Based on watertightness tests

Based on drainage tests

Simulate the exterior surface absorption first

Why building physics did not solve moisture problems (yet)

It’s your fault

VDF: Vapour Diffusion Fetish

Prof. Nathan Van Den Bossche

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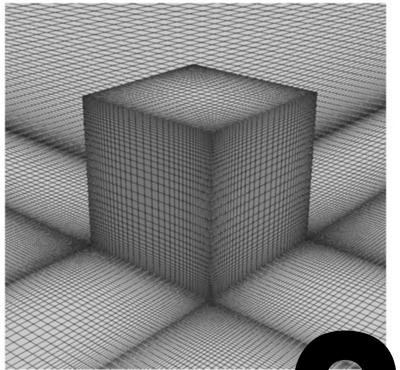
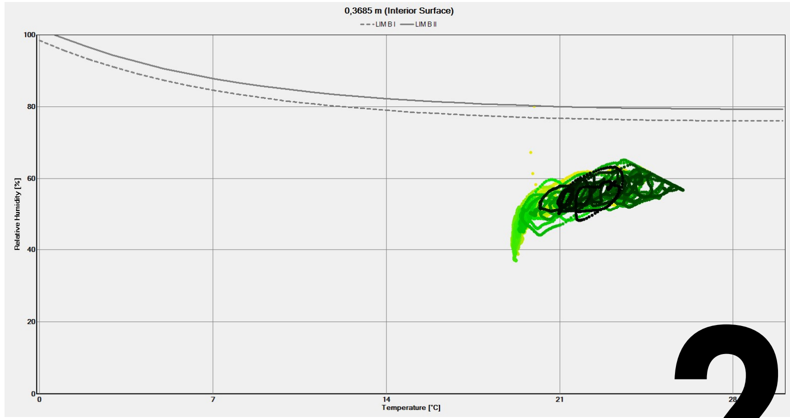
CFD + HAM + DEGRADATION MODEL



?

?



?

Validation

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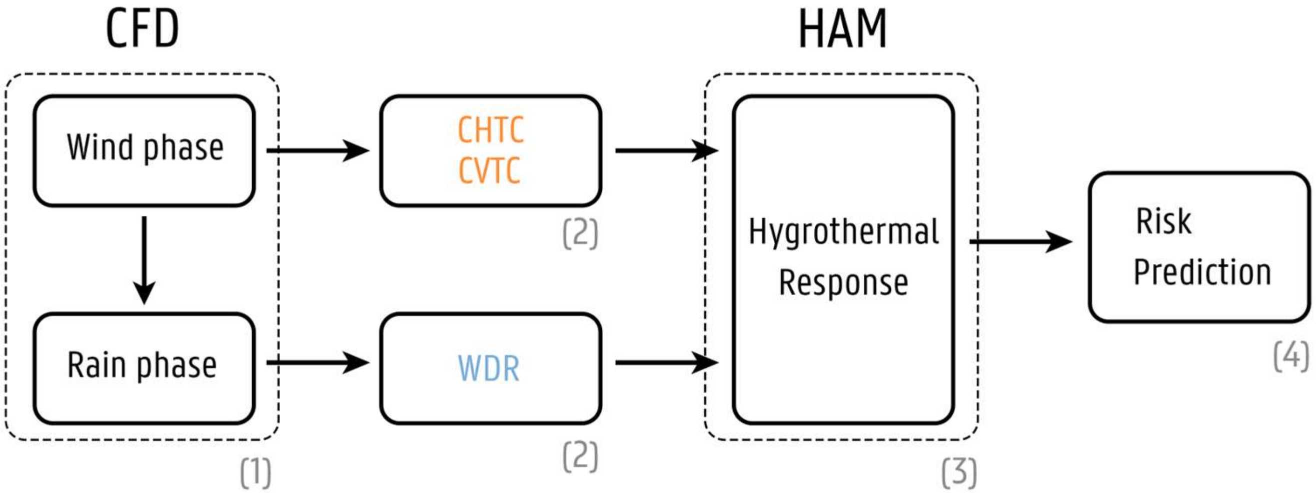
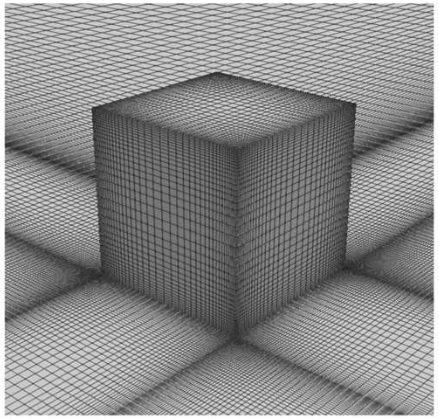
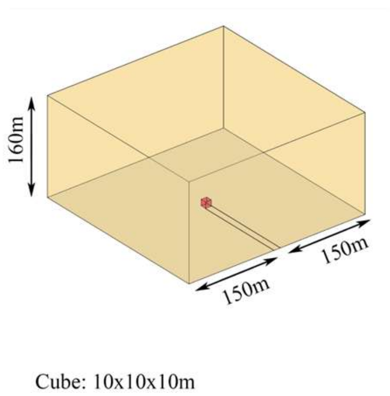
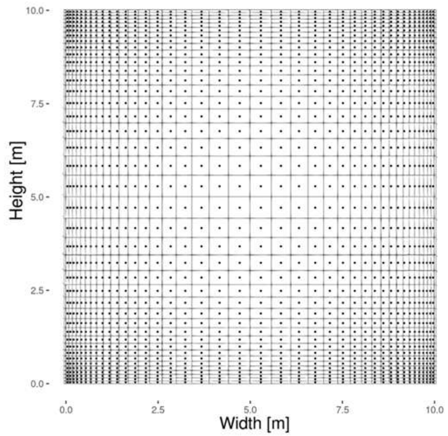
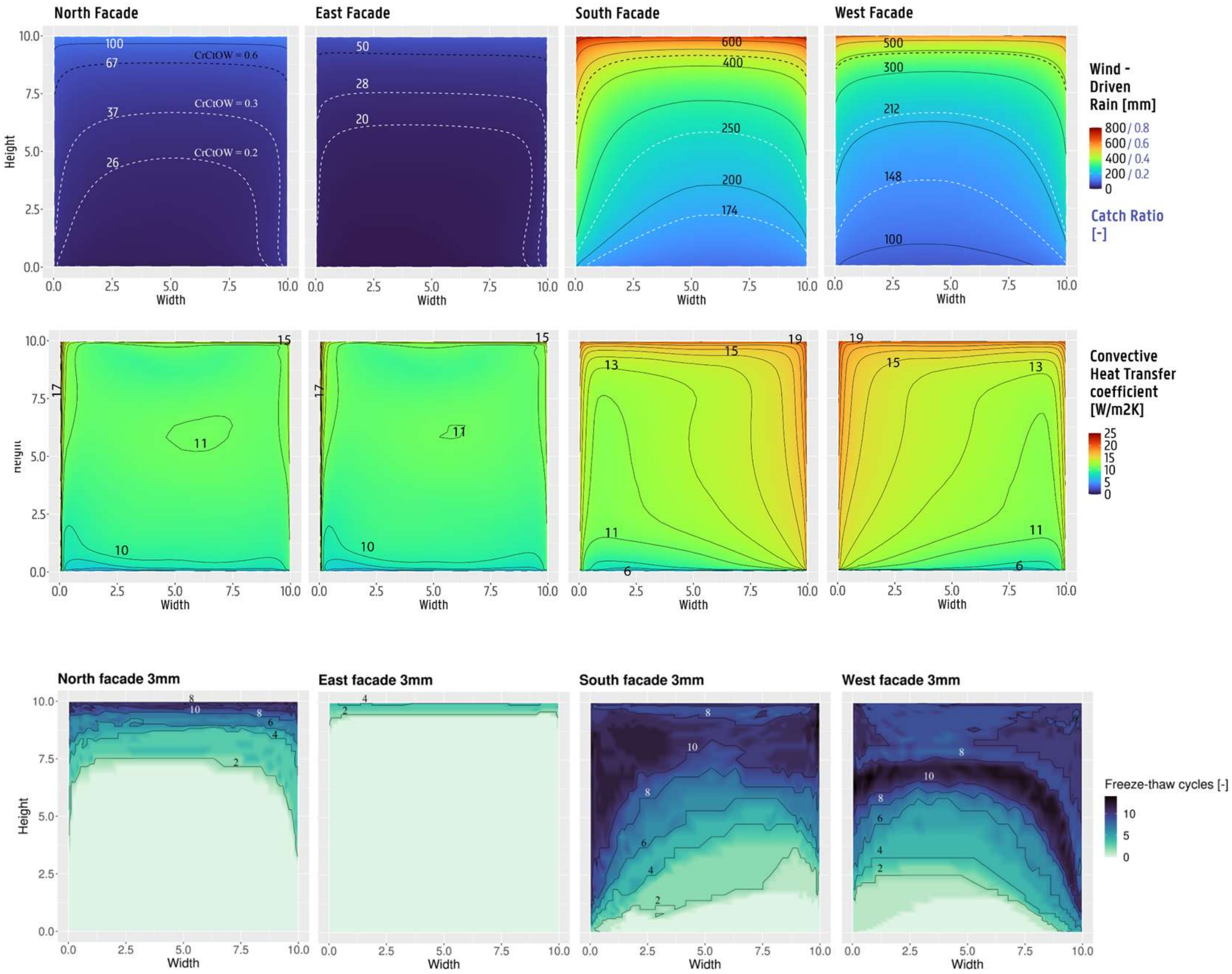








(Vanderschelden, Van Den Bossche, 2025)



(Vanderschelden, Van Den Bossche, 2025)

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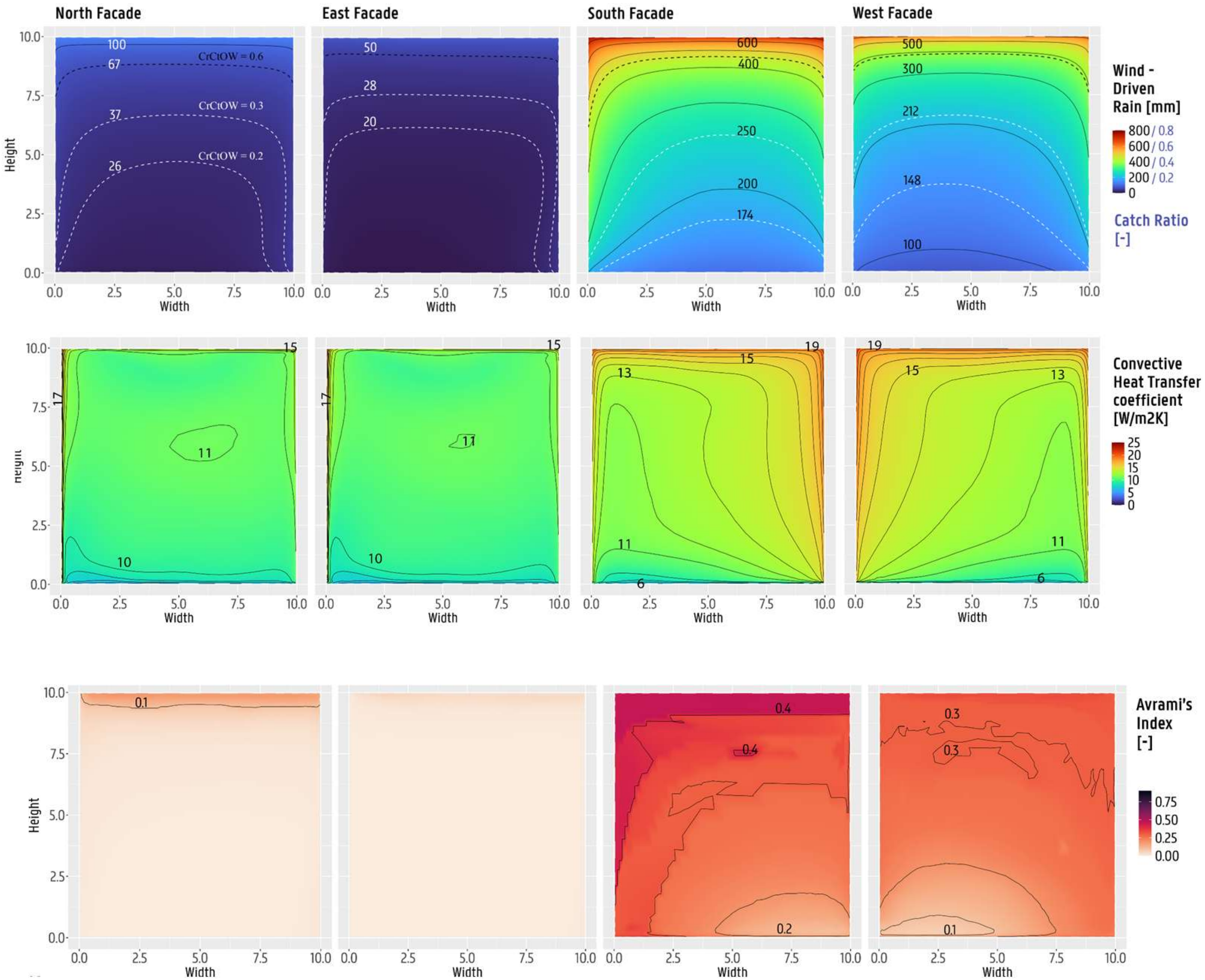

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(Vanderschelden, Van Den Bossche, 2025)

Hyperspectral imaging

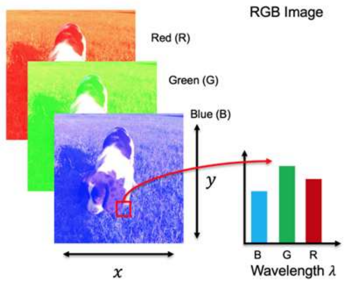
Important for vegetation detection

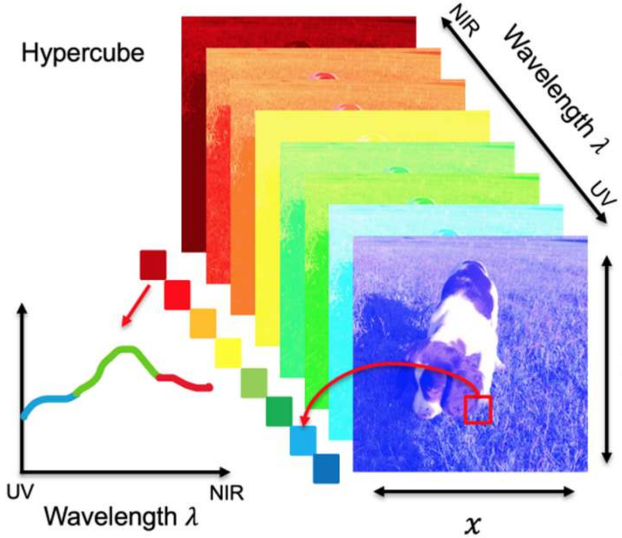
visible, VIS

NIR, near infrared

Our Hyperspectral setup:

- Every pixel: 3 → 31 properties
- VIS and NIR





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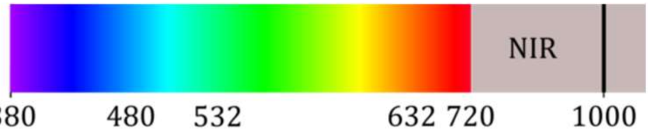
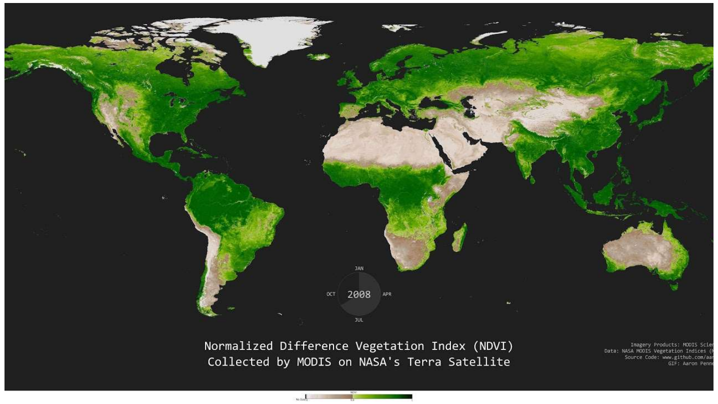
(Soubrier, Van Den Bossche, 2025)

Normalized Difference Vegetation Index (NDVI)

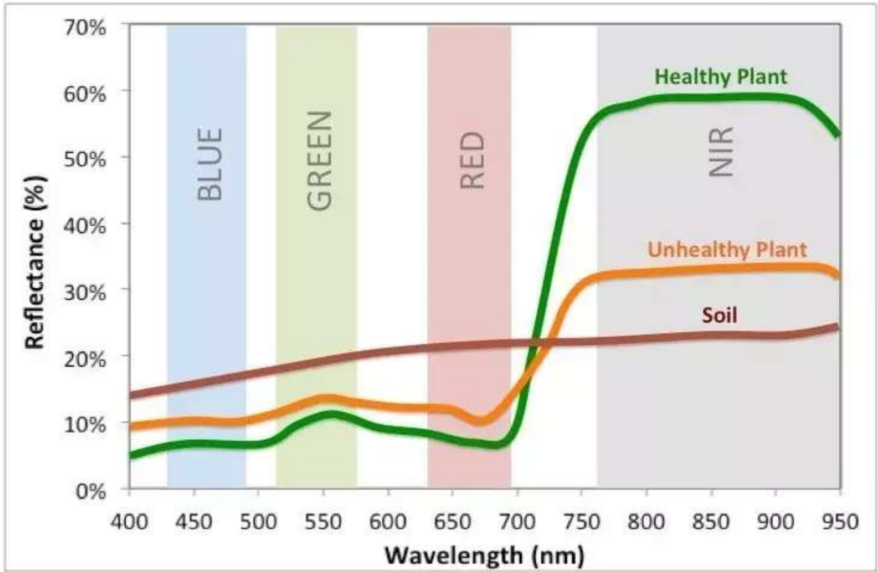
Proxy presence of plants and their healthiness



$$NDVI = \frac{NIR - RED}{NIR + RED}$$

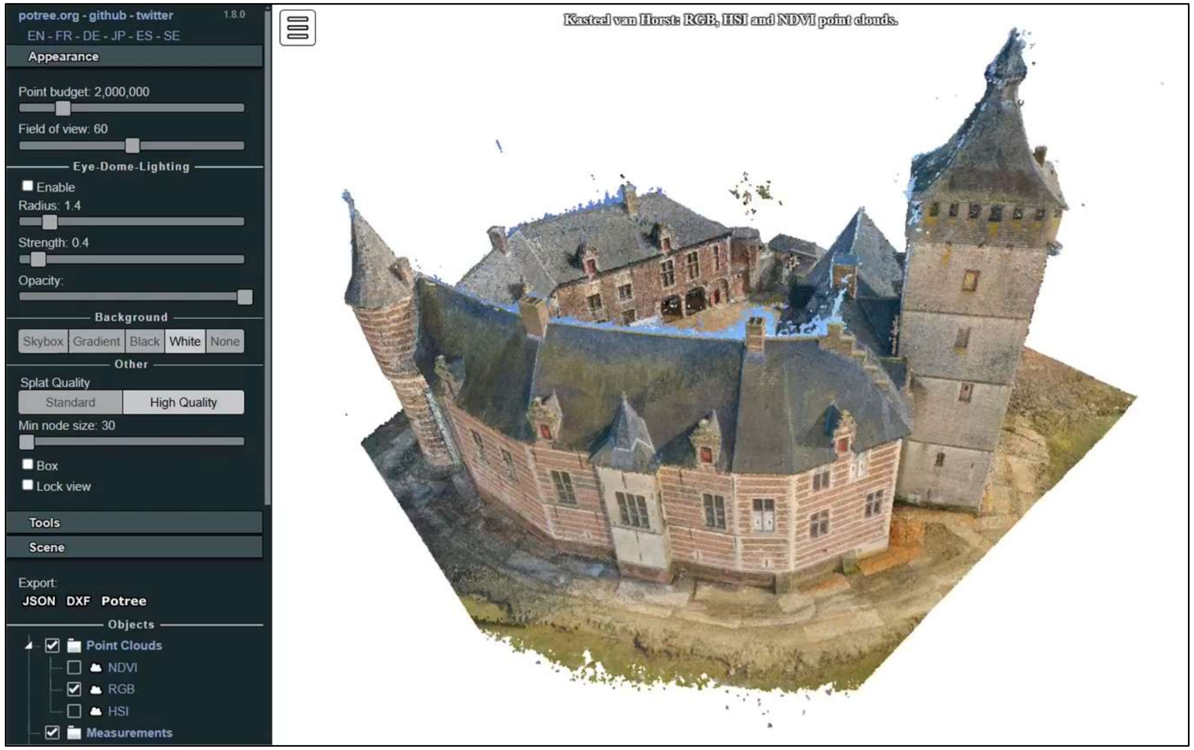


NASA's Terra Satellite



(Soubrier, Van Den Bossche, 2025)

Case study of this research:



↳ can be hosted on Raspberry Pi

- ❑ Combining ***<u>RGB-HSI-UAV</u>***
- ❑ Photogrammetry using consumer-grade software
- ❑ Publicly available
  - ❑ Static websites, long term storage
  - ❑ Opensource technology (Potree)
  - ❑ Accessible for low-specs clients

imec

https://telin.ugent.be/~psoubrie/Horst/

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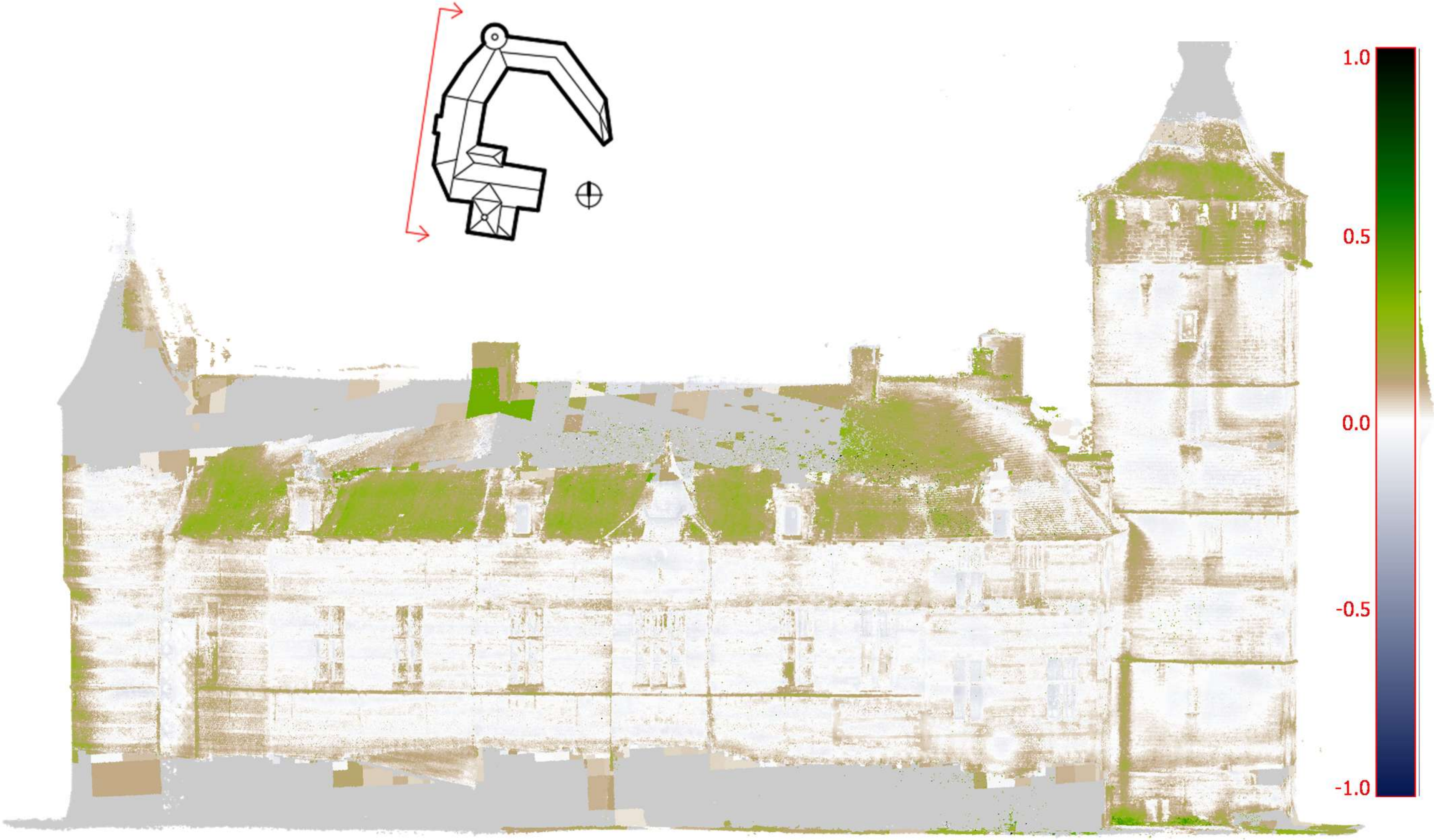
(Soubrier, Van Den Bossche, 2025)



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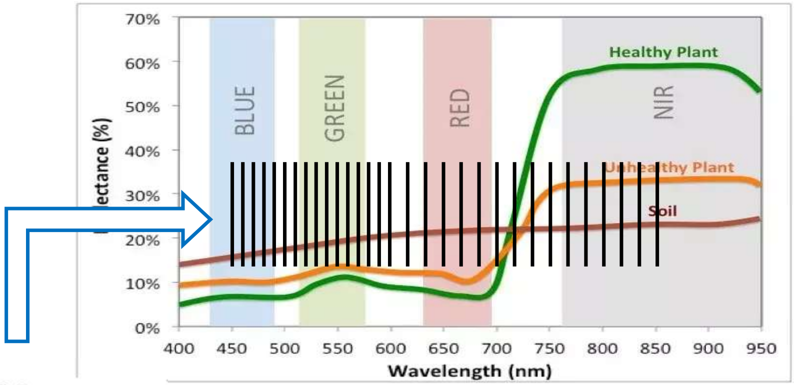
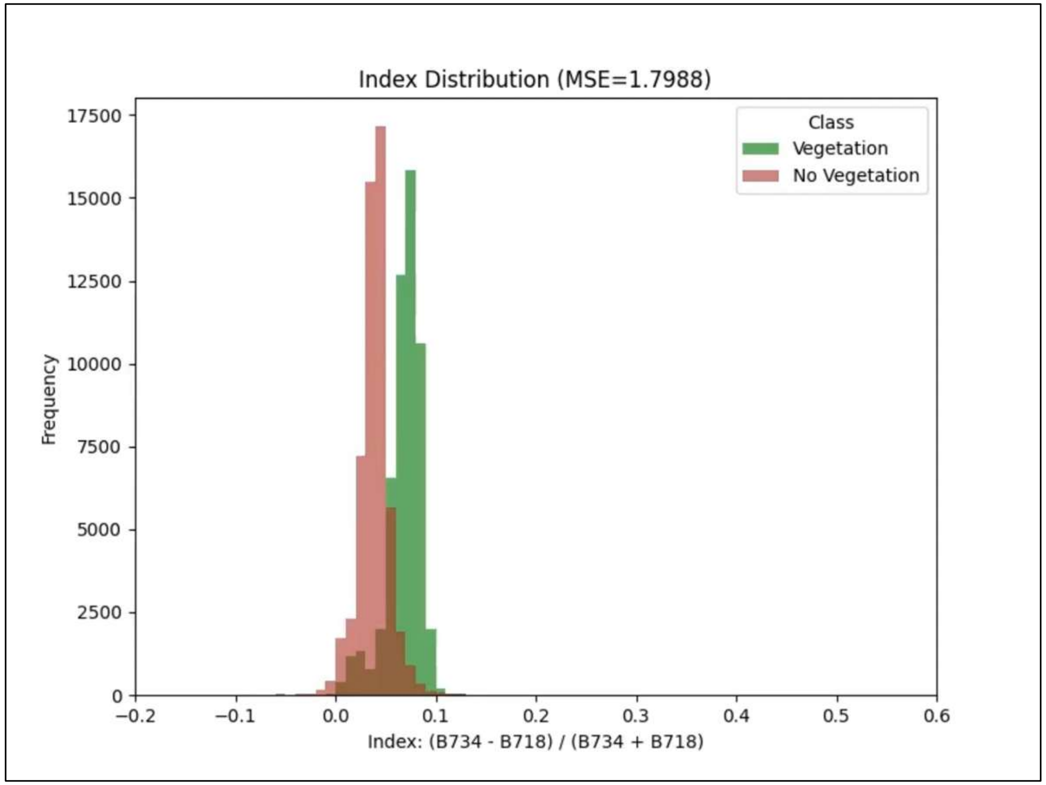
(Soubrier, Van Den Bossche, 2025)

Brute force search: better normalized difference index



- ❑ 31 bands to choose from
- ❑ Minimizing RMSE
  - Veg: 1, non-veg: -1
  - Maximizing separation vegetation from building materials
- ❑ Result: 473nm & 525nm



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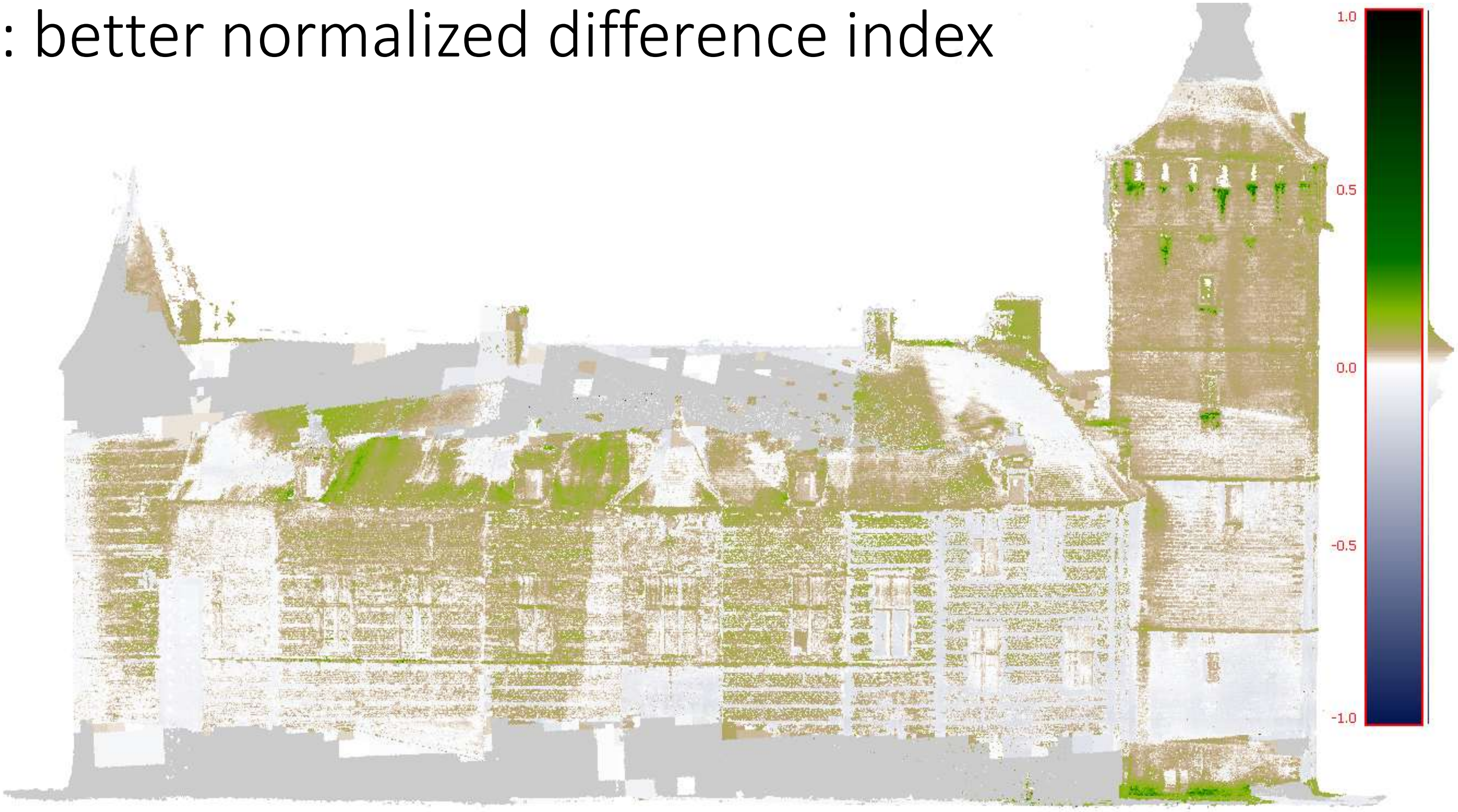
(Soubrier, Van Den Bossche, 2025)

Brute force search: better normalized difference index

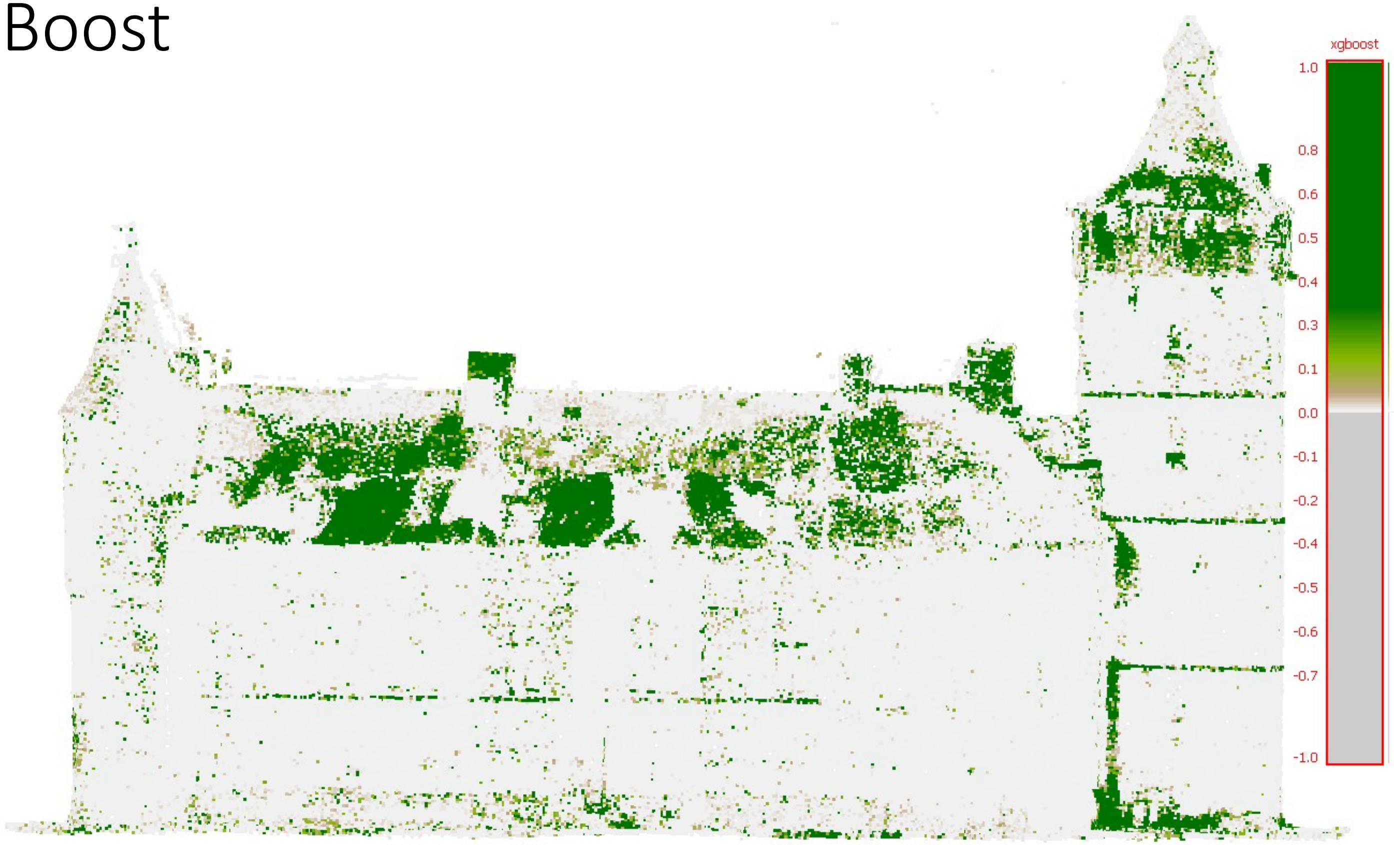
- ❑ No false positive tail
- ❑ Vegetation healthiness tail
- ❑ More false negatives
- ❑ Less cluster separation
- ❑ Less sensitive to orientation



(Soubrier, Van Den Bossche, 2025)

Even more complex: XGBoost

- ❑ Perfect classification on binary annotated set
- ❑ Using ALL bands
- ❑ Lack intermediate values for regression



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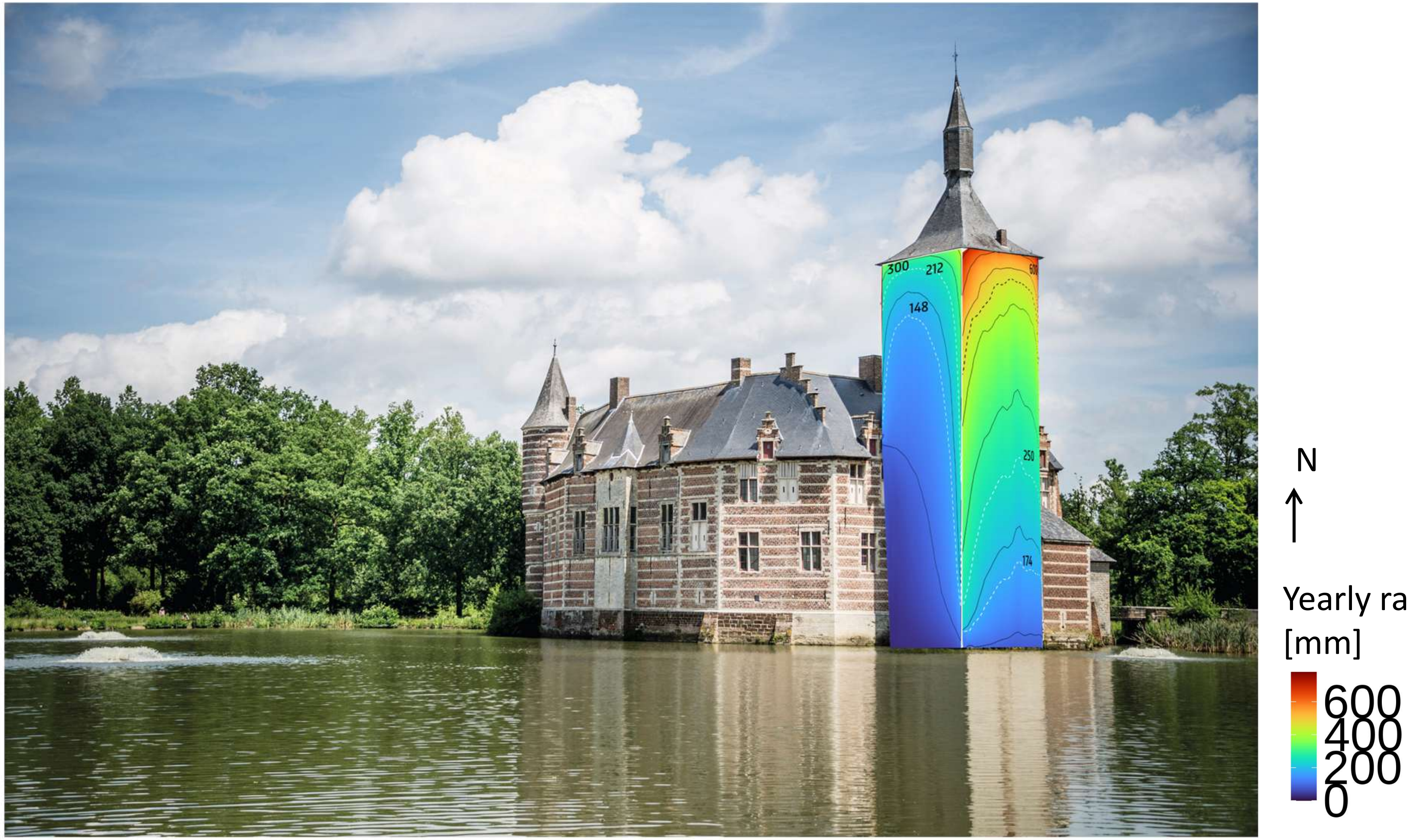
(Soubrier, Van Den Bossche, 2025)



Hourly rainfall over 1year

(Vanderschelden, Van Den Bossche, 2025)

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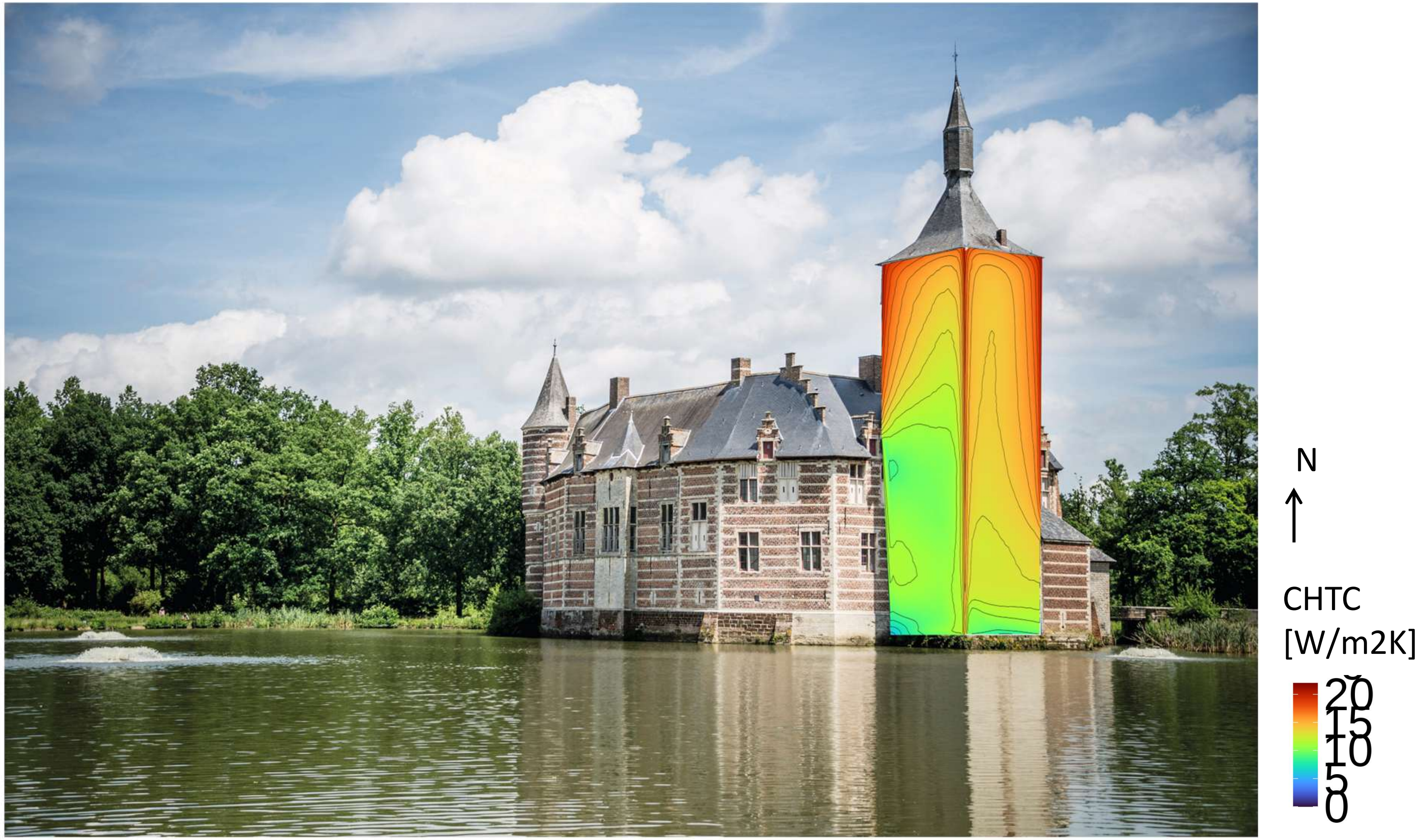

Average CHTC over a year

(Vanderschelden, Van Den Bossche, 2025)

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Algae prediction

Improved Avrami model

(Vanderschelden, Van Den Bossche, 2025)

Why building physics did not solve moisture problems (yet)

It's your fault

VDF: Vapour Diffusion Fetish

Instagram

Prof. Nathan Van Den Bossche

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