Application of louvres to support ventilative cooling

AVC venticool
the platform for resilient ventilative cooling

June 1st, 2021, Webinar – Resilient Ventilative Cooling in practice

RENSON
Creating healthy spaces

VENTILATION – SUNPROTECTION - OUTDOOR

ivan.pollet@renson.be

About Renson

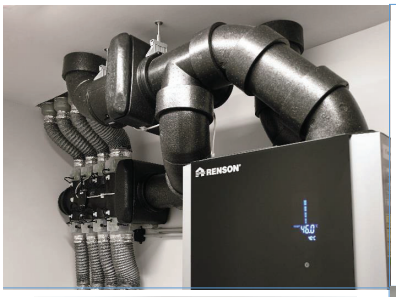
Belgian family business

- 112 years
- Headquarters in Waregem
- Team of 1200 enthousiastic men & women
- Core business: ventilation, sunprotection & outdoor

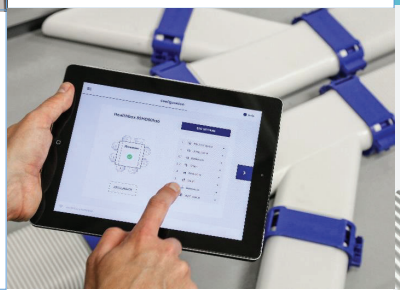
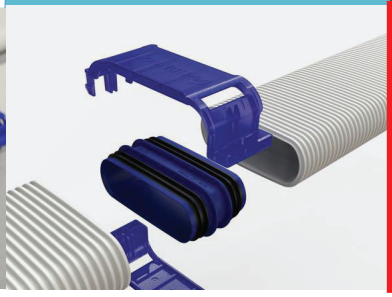
RENSON
Creating healthy spaces

VENTILATION – SUNPROTECTION - OUTDOOR

Products: background ventilation versus ventilative cooling



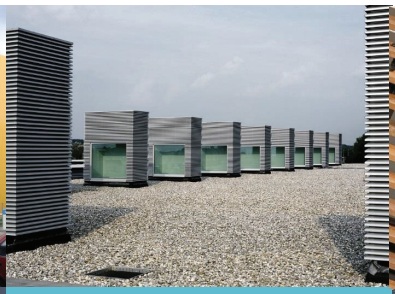
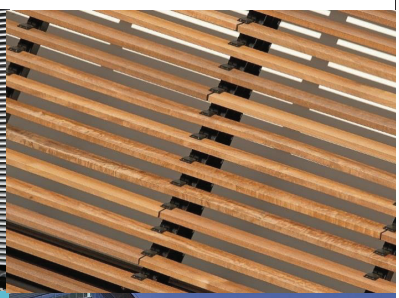
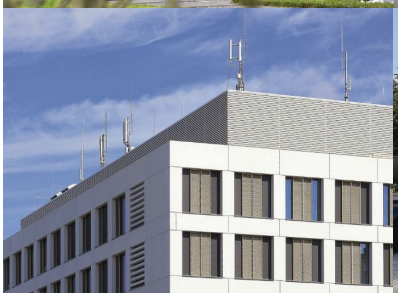
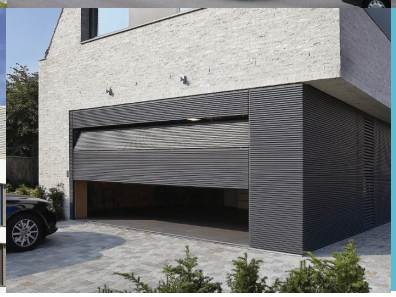



Louvres for ventilative cooling

Continuous louvre systems as façade cladding or ventilative cooling



Integrated architectural design with shapes and colours

Connection of products towards smart buildings > servitization

Services

Data analysis

Connectivity

Actuators/sensors

+

+

+

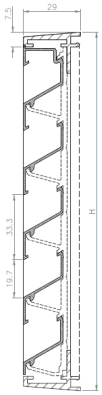
+ ventilative cooling mode

Louvres: characteristics, testing and regulation ?

Louvres: multi-functionality combined within simplicity

Simplicity

Number of horizontal or vertical fixed or adjustable blades (alu/wood)



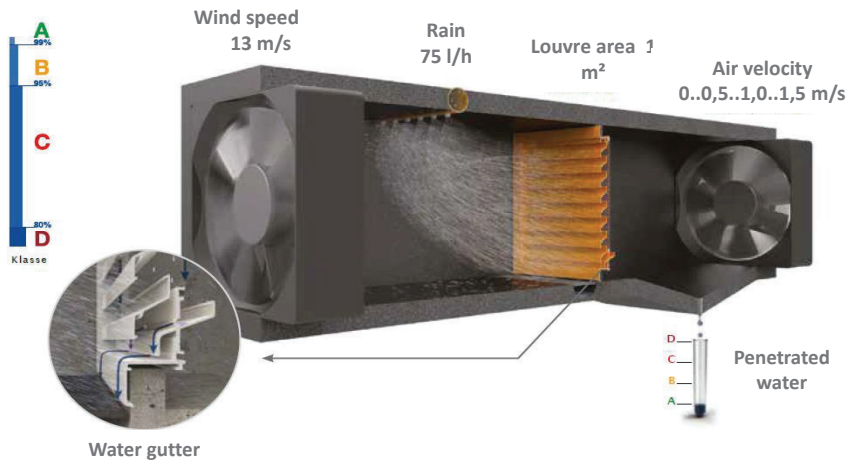
Multi-functionality

- → **Ventilative cooling (renewable)**
- → **Solar shading**
- → **Insect-proof**
- → **Rain-tightness**
- → **Persons from outdoors (burglary) or indoors (fall-through)**
- → **Fire/smoke control**
- → **Noise insulation**
- → **Outdoor pollution control (?)**
- → **Opportunities for creativity, integration, accents, …**

How to characterize ?

Testing and optimization of louvres performance

Aerodynamic and rain tightness characteristics (EN13030)



Water tightness and air flow rate

Table 3 — Penetration classes

Class	Effectiveness ε	Maximum allowed penetration of simulated rain $l \cdot h^{-1} \cdot m^{-2}$
A	1 to 0,99	0,75
B	0,989 to 0,95	3,75
C	0,949 to 0,80	15,00
D	Below 0,8	Greater than 15,00

Table 4 — Discharge loss coefficient classification

Class	Discharge loss coefficient
1	0,4 to 1,0
2	0,3 to 0,399
3	0,2 to 0,299
4	0,199 and below
NOTE The above classes also apply to entry loss coefficient.	

$$q_v = C_d A \sqrt{\frac{2\Delta p}{\rho}}$$

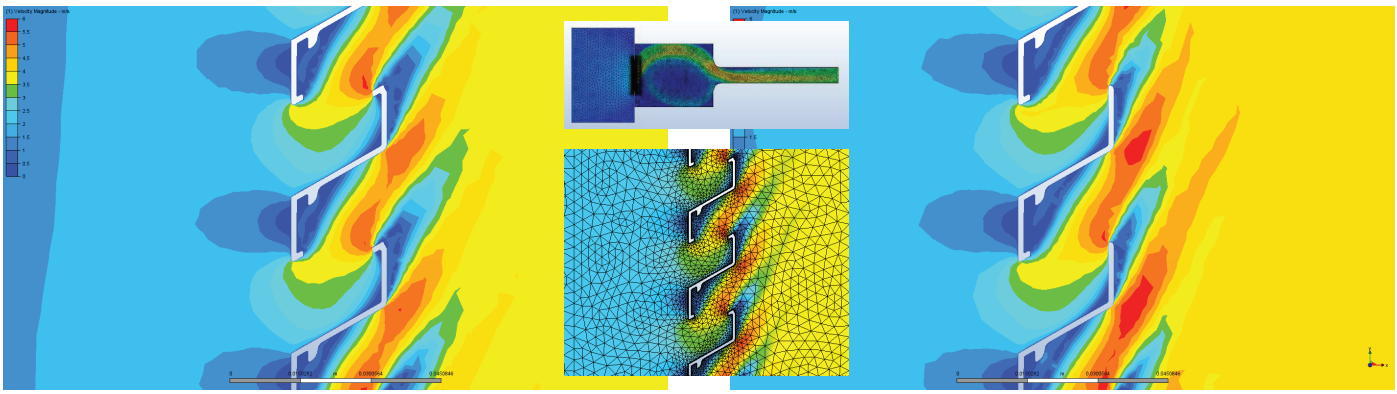
Testing and optimization of louvres performance

Aerodynamic and rain tightness characteristics (EN13030)

Testing and optimization of louvres performance

$$q_v = C_d A \sqrt{\frac{2\Delta p}{\rho}}$$

Optimization based on CFD: air flow resistance ↓ and/or water tightness ↑



RENSON® Creating healthy spaces
VENTILATION – SUNPROTECTION - OUTDOOR
June 1st, 2021 - Webinar "Resilient Ventilative Cooling in practice"

Ventilative cooling: quick design, rules of thumb

- Air flow rate through opening: $q_v = C_d A \sqrt{\frac{2\Delta p}{\rho}}$
  - Available natural pressure difference: **Δp ~ 1 to 2 Pa**
  - Required air exchange rate: **q_v = 4 to 8 volumes/h** → Area (m²) of louvre is known
- Cooling capacity: **~ 5 W/m²/air exchange rate**
- Temperature reduction during night in case of at least 10°C ΔT between max. indoor T and min. outdoor T : **~ 0,75 to 1 °C/(vol/h)**

Louvres: flow resistance ↑ + usage or VC potential ↑

Resistance

Reduction of air flow rate

~ 50%

⇔

Guarantee on higher operation time

Fully openable windows (90°) instead of tilted (10%)

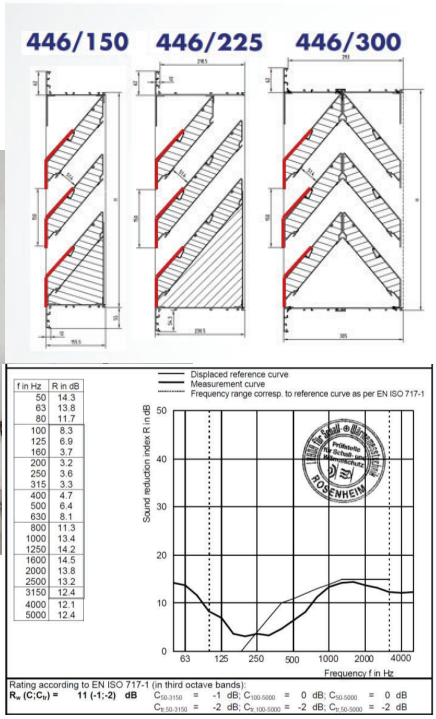
More in use during night and absence

~ higher utilization factor

On average, net effect of louvres on air exchange rate is mostly limited

Testing and optimization of louvres performance

Sound insulation: sound reduction index Rw (EN ISO 10140 & 717)



f in Hz	R in dB
50	14.3
63	13.8
80	11.7
100	8.3
125	6.9
160	3.7
200	3.2
250	3.6
315	3.3
400	4.7
500	6.4
630	8.1
800	11.3
1000	13.4
1250	14.2
1600	14.5
2000	13.8
2500	13.2
3150	12.4
4000	12.1
5000	12.4

Rating according to EN ISO 717-1 (in third octave bands):
$R_w(C;C_{tr})$ = 11 (-1;-2) dB $C_{50-3150}$ = -1 dB; $C_{100-5000}$ = 0 dB; $C_{50-5000}$ = 0 dB
$C_{tr\,50-3150}$ = -2 dB; $C_{tr\,100-5000}$ = -2 dB; $C_{tr\,50-5000}$ = -2 dB

RENSON®
Creating healthy spaces

VENTILATION – SUNPROTECTION - OUTDOOR

Testing and optimization of louvres performance

Burglary resistance of window openings (~ building assurances): RC class

8 Manual burglary attempts

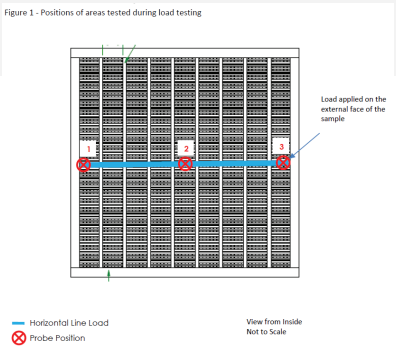
When tested in accordance with prEN 1630 using the tool sets and times specified in Table 6, the test specimen shall not fail at the resistance class claimed. For construction products of resistance class 1 no manual test will be carried out. The tool set A1 is intended for preparation of the test specimen.

Table 6 — Tool sets and resistance time

Resistance class	Tool set (see prEN 1630:2009, Clause 7)	Resistance time min	Maximum total test time min
1	A1	–	–
2	A2	3	15
3	A3	5	20
4	A4	10	30
5	A5	15	40
6	A6	20	50

Testing and optimization of louvres performance

Barrier load testing / Fall prevention safety (EN13049)

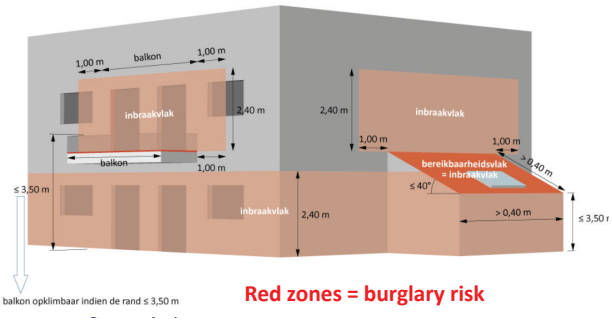


Integration of VC louvres within EPBD regulation

Impact of VC on overheating risk and PE consumption depending on:

Belgium (residential)

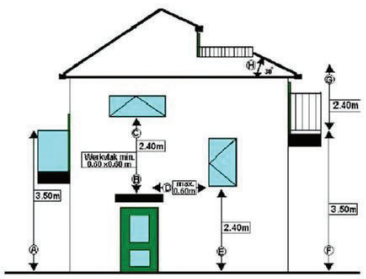
- Physical free area of VC openings
  (≥ 6,4% of room net floor area)
- Accessibility/burglary resistance
  (location, max opening, resistance class ≥ 2)
- Control possibilities



Red zones = burglary risk

The Netherlands (all buildings)

- Physical free area of VC openings
- Accessibility/burglary resistance
  (location, max opening, resistance class ≥ 2)
- Control possibilities
- Insect-proof requirement
- Rain tightness requirement (louvre, sensor)

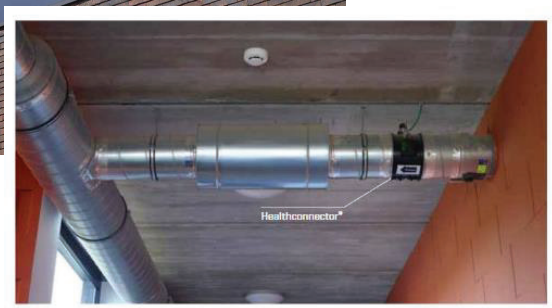


Louvres applications in-situu

Schools (Gent, Belgium)

Passive cooling measures, no active cooling, small or no occupation in summer

Schools (Gent, Belgium)



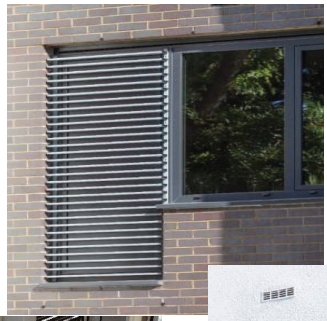
RENSON®
Creating healthy spaces

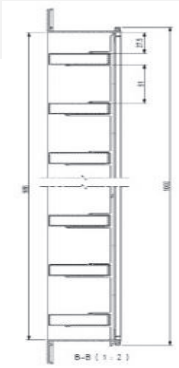
VENTILATION – SUNPROTECTION - OUTDOOR

Student homes (Bournemouth University, Southern England)

Burglary resistance, fall prevention safety, daylight

Different shapes and colors
> attractive façade



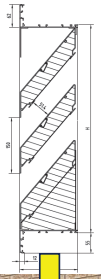


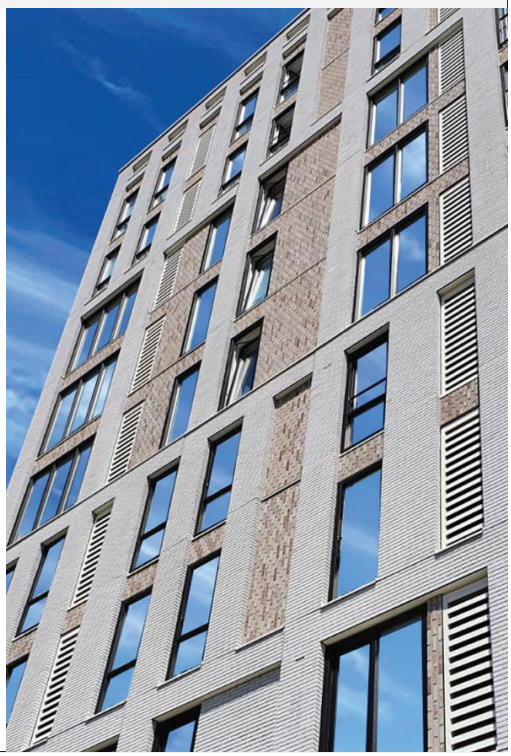
RENSON®
Creating healthy spaces

VENTILATION – SUNPROTECTION - OUTDOOR

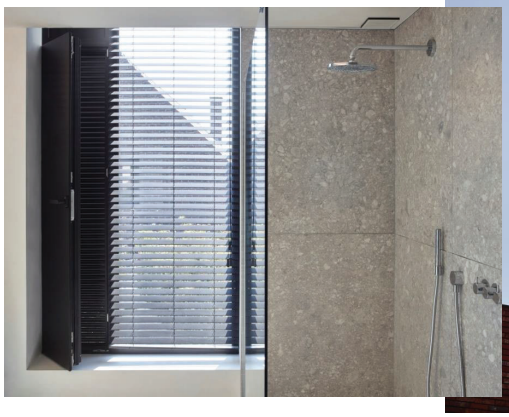
Student homes (Campus Diemen Zuid, The Netherlands)

Acoustic insulation for intensive ventilation and ventilative cooling

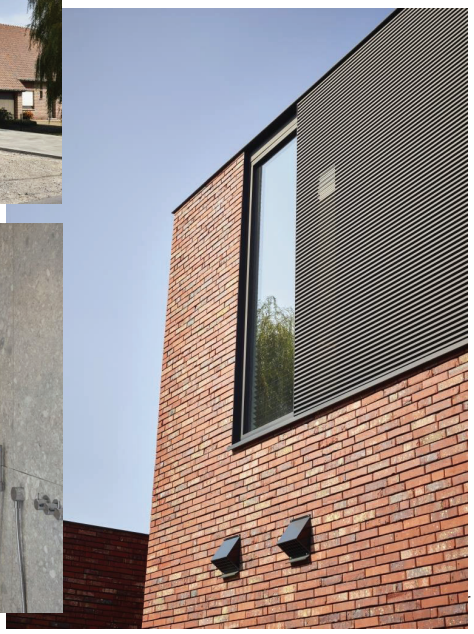




Continuous louvre systems as façade cladding and VC louvre



Private home > Belgium



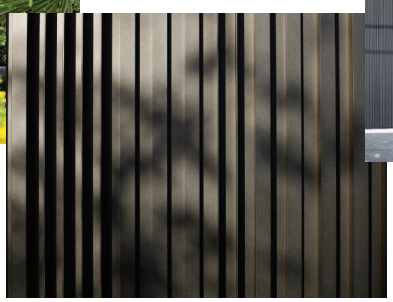
Continuous louvre systems as façade cladding and VC louvre

International Lyceum > Luxembourg

Private houses (Belgium)

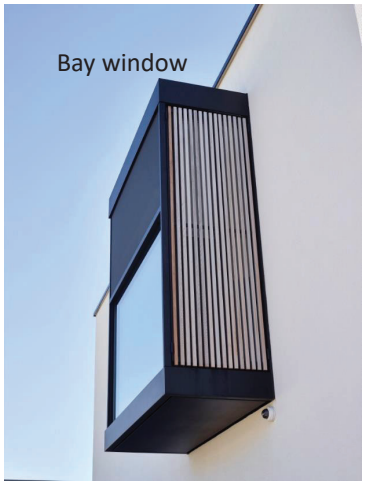
Vertical blades, integration in façade/LED-lighting

Privacy ↔ daylight



Concept home of Renson (Waregem, Belgium)

Vertical blades, integration in façade



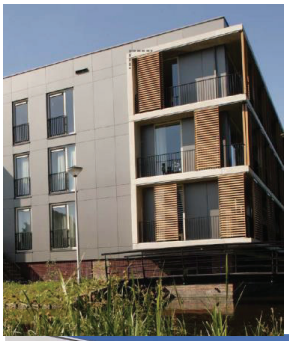
Privacy ↔ daylight

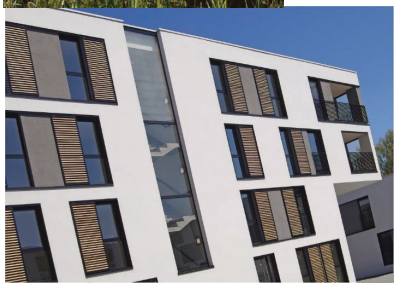
RENSON®
Creating healthy spaces

VENTILATION – SUNPROTECTION - OUTDOOR

Louvre: movable/adjustable versus fixed

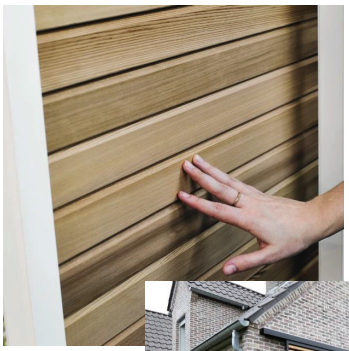
Movable/sliding louvre panels



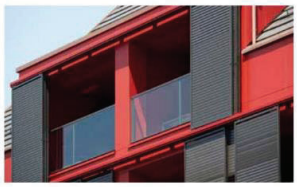


Green office (Paris – France, 2011)

Adjustable/orientable blades



Apartments (Weinfelden, Switzerland)



Adjustable in zones
Personalization

Combination of ventilative cooling and solar shading

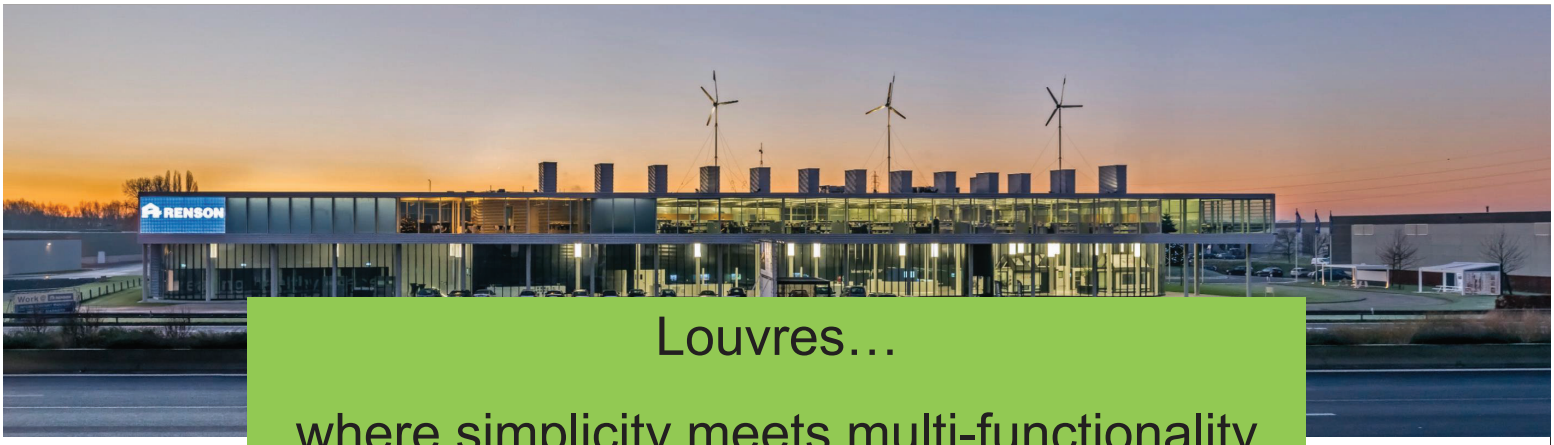
Screens and awning

Screens on roof windows

Integrated screens

Renson offices/showroom (Waregem, Belgium, 2002)

Designed 20 years ago as a living lab of bioclimatic architecture, and still contemporary



Louvres…

where simplicity meets multi-functionality

AVC venticool
the platform for resilient ventilative cooling

June 1st, 2021, Webinar – Resilient Ventilative Cooling in practice

RENSON
Creating healthy spaces

VENTILATION – SUNPROTECTION - OUTDOOR

ivan.pollet@renson.be