QUALITY OF VENTILATION SYSTEMS IN RESIDENTIAL BUILDINGS

Status and perspectives in BELGIUM

Paul Van den Bossche – Samuel Caillou
BBRI – Belgian Building Research Institute
Arnold Janssens – Jelle Laverge
Research Group Building Physics, Ghent University

Belgian Building Research Institute– http://www.bbri.be

Content

- Residential ventilation market in Belgium
  - General
  - Field surveys
  - Current status
    - Link to building energy performance assessment
    - Products
    - Design, installation and commissioning
    - Operation, maintenance and inspections
- Q approaches
  - Clear performance criteria – compliance check
  - Information, tools and education
  - Products
  - Installations
- Conclusion

Belgian Building Research Institute– http://www.bbri.be

Residential ventilation systems

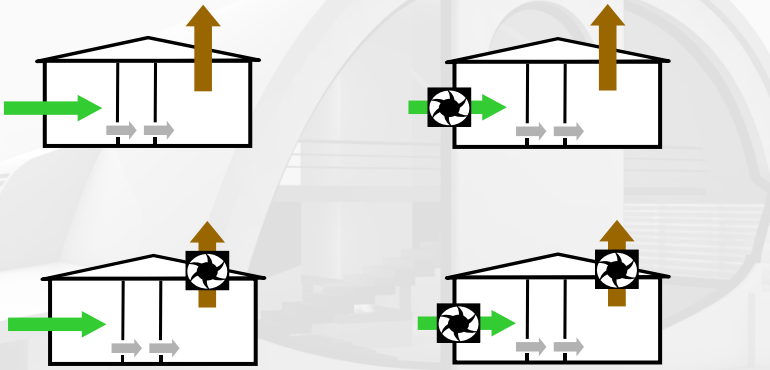
- Based on the standard NBN D50-001:1991
- Fresh air supply flow rates based on floor area
  - generally 3.6 m^3/h (=1 l/s) and per m^2
- Compulsory in 1996/2006/2008 in 3 Regions
- 4 systems allowed

Belgian Building Research Institute– http://www.bbri.be

4 simplified systems (dwellings)

A: natural supply and exhaust

B: mechanical supply + natural exhaust

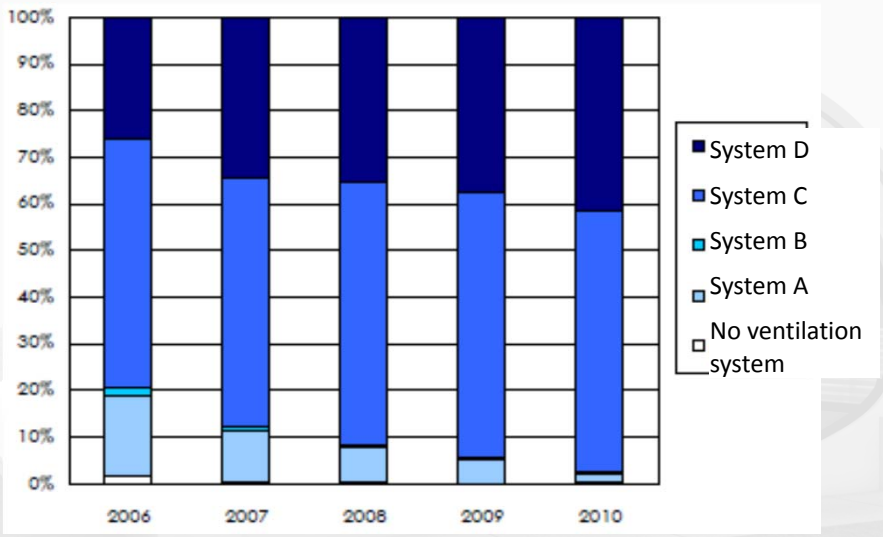


C: natural supply + mechanical extraction

D: mechanical supply and extraction

Belgian Building Research Institute– http://www.bbri.be

Market share (dwellings – Flemish Region)



Source: VEA 2011

Belgian Building Research Institute– http://www.bbri.be

Field campaigns → see paper

- UGhent master thesis
  - Ventilation systems and air-tightness
  - 53 SoD woningen, °2006-2009
- Clean air low energy (LNE)
  - VITO, UGent, BBRI, THL
  - Ventilation systems, airtightness, IAQ, odour
  - 25 low energy dwellings, °2006-2010
- Optivent (IWT)
  - BBRI
  - Ventilation systems, IAQ, µ-biology
  - 40 dwellings, °2009-2011

Field campaigns: general findings

- Campaigns: U Ghent masterthesis, Clean Air Low Energy (LNE), Optivent (IWT)
- Common shortcomings were
  - incorrect ventilation capacity, especially per room
  - sometimes high electricity consumption
  - increased noise levels
  - supply air quality at air intake
  - poor operation and maintenance
  - no major µ-biology problems

Current status in Belgium

- Current status
  - Link to building energy performance assessment
  - Products
  - Design, installation and commissioning
  - Operation, maintenance and inspections

Belgian Building Research Institute– http://www.bbri.be

EPBD approach in Belgium

- "EPB-PEB" = Energy performance and indoor climate
- EPBD declaration of each dwelling
  - After construction is finished
  - Calculation of E-level (actually max "E 70")
  - Ventilation system characteristics included in E-level

Mandatory data: required flow rates,...

Voluntary data (but default values are unfavourable)

- Products: self regulating air terminal devices, EC-fans, HX effectiveness,...
- Installation: correct flow rates, flow balancing, duct leakage

9

Belgian Building Research Institute– http://www.bbri.be

E-level as a driving force for quality?

- Compliance check?:
  - Through "as built declaration" of finished dwelling
  - But rather marginally sampled

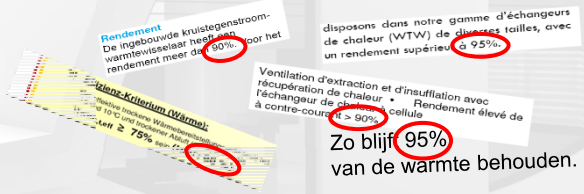
Approach could lead to higher quality, but effect is limited up to now

10

Belgian Building Research Institute– http://www.bbri.be

Products: compliance

- Little legal requirements
- EPBD declaration needs product data:
  - E.g.: flow capacity of air terminal devices, HX effectiveness,…
  - Source of this data:
    - Reports, leaflets, rumours,…? Reliability?



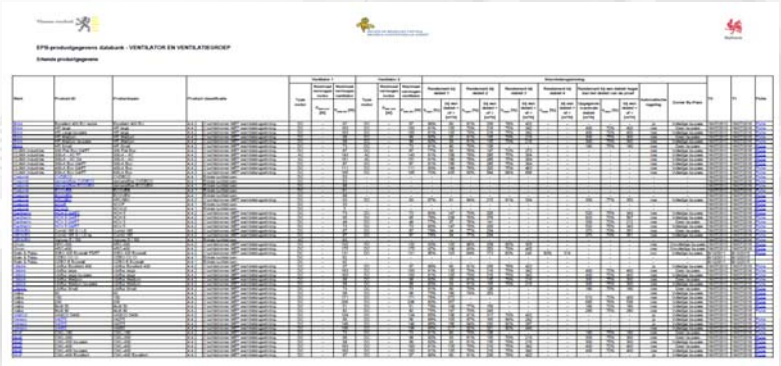
    - → voluntary database with checked data

Source: www.epbd.be

Belgian Building Research Institute– http://www.bbri.be

Products: compliance through EPBD product database

- Procedures refer to standards, clarify interpretation, define type of laboratory,…
- Checked by a neutral body (eg Notified Body)
- Voluntary, supervised by authorities



Source: www.epbd.be

Belgian Building Research Institute– http://www.bbri.be

Products: quality

- In general: no major issue
  - Missing: reliable product data
- No technical approvals up to now

13

Belgian Building Research Institute– http://www.bbri.be

Design, installation and commissioning: compliance

- Little requirements:
  - No requirements on the workmanship
  - Profession “ventilation installer” not defined:
    - No real education schemes
- Incentives through better E-level?
  - On site performance measurements can lower E-level:
    - Correct air flow rates
    - Flow balance: supply-exhaust (if HX)
    - Airtight ducts
  - But quality of measurements?
  - Not for refurbishments

Photo: BBRI

14

Belgian Building Research Institute– http://www.bbri.be

Design, installation and commissioning: quality

- ❖ Poor – see field campaigns
- ❖ Why?
  - Competence of architects and companies
    - Design
    - Installation
    - Commissioning

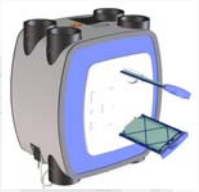
    } Small installation companies
    - Not always specialized, poor education on various levels: labourer, installer, (engineer), architect
  - Missing functional compliance framework
  - Insufficient customer awareness (€€€!)

Major drawback to improve quality

15

Belgian Building Research Institute– http://www.bbri.be

Operation, maintenance, inspections



- ❖ Compliance: no requirements
- ❖ Quality:
  - Poor
  - Why?
    - Lack of information for end user
  - Improvements?:
    - Better design/installation
      - Control approach in operation
      - Avoid acoustical problems
      - To facilitate maintenance

    - Better documentation at commissioning
    - Mandatory inspections?

16

Belgian Building Research Institute– http://www.bbri.be

Quality approaches under development: Overview

- ❖ Verifiable performance based requirements
- ❖ Practical guidelines to design, install, commission, operate, maintain:
  - Codes of good practice
  - Calculation tools
  - Measuring and adjustment methods
- ❖ Define education schemes on various levels
- ❖ Product approach
- ❖ Check compliance on site

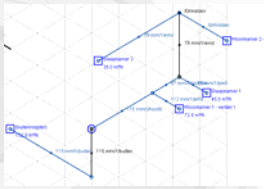


Photo: BBRI

17

Belgian Building Research Institute– http://www.bbri.be

Performance based requirements

- ❖ Focus on the end-user expectations
  - Performance based… and not descriptive
  - Final results… whatever the means used
- ❖ Advantages:
  - Promote innovation
  - Towards end user
- ❖ Disadvantages:
  - More difficult for installers and designers
  - In parallel: codes of good practice are necessary

Belgian Building Research Institute– http://www.bbri.be

Example: performance based

Buy a house?

Performance based

- *Offer shelter*
- *4 rooms*
- *Good IAQ*
- *…*

Descriptive

Belgian Building Research Institute– http://www.bbri.be

Example: performance based

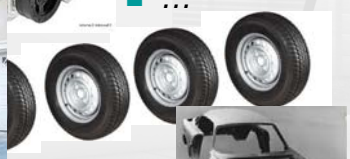
Need a car?

Performance based

- *Transport 4 persons*
- *At 120 km/h*
- *Max 125 g CO_2/km*
- *…*

Descriptive

- *4 tyres*
- *An engine*
- *A frame*
- *…*



Example: performance based

Acoustic and ventilation

Performance based

Max 30 dB in bedrooms

→ *Quality requirement*

Descriptive

By which means?

- *max air speed… 1.5 – 3 m/s*
- *silencers*
- *air terminal devices*
- *fans*
- *…*

→ *Codes of good practice*

Belgian Building Research Institute– http://www.bbri.be

Verifiable requirements

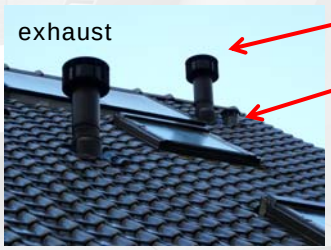
- Not enough to define requirements
- Need a true verification scheme
  - Who is verifying? Notify body, accredited labo, …
  - How to verify?
    - Not only test/measurement methods…
    - But above all: sampling, control frequency, …
  - Consequences?
    - Fines, penalties, loss of recognition, etc.

Belgian Building Research Institute– http://www.bbri.be

Compliance check on site

❖Evaluation of ‘as installed’

- = Performance based
- Can be checked visually or measured



Supply!

Airing sewage system

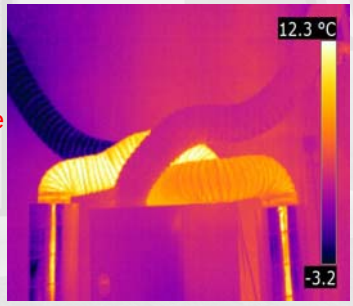


Photo: BBRI

23

Belgian Building Research Institute– http://www.bbri.be

3 considered compliance check approaches

1. By a third party: each installation (100 %)

2. By the company itself – compliance check under certification
   - Training guarantee
   - Sample installation checks by certification body

3. By the company itself - company as a whole under certification (ISO 9001,...)

24

Which requirements are checked?

- Compliance with legal requirements?
  - Not enough
- Additional Q requirements?
  - Beyond legal, so no obligation possible
  - Market penetration of this voluntary approach too low?
- Using EPBD declaration as driving force?

The **3 main pillars** for quality schemes

- Skills (→ persons)
  - Qualification …required to increase their skills and competencies
- Product level (→ manufacturers)
  - Probably not the main problem
- Installation level (→ installers)
  - Surely the priority!

Belgian Building Research Institute– http://www.bbri.be

Inventory of quality problems

Topic	Major cause	Schemes/incentives
Product	Missing information	EPBD database
Design	Not done as required	Quality scheme under development with focus on result
Installation	Missing design Ad hoc modifications Cleanliness duct system	
Commissioning	Neglected Measurement methods	EPBD declaration
Operation	Missing information	Required in quality scheme
Maintenance	Missing information Neglected	Required in quality scheme ???
Inspection	Absent	???

27

Belgian Building Research Institute– http://www.bbri.be

Conclusion

- Problems +/- known
- Technical solutions +/- available
- Quality scheme under development, involvement market stakeholders is crucial

Thank you for your attention

28