Building regulations can foster quality management: the French example on building airtightness

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Regulatory requirements on airtightness

2 ways of justification:
- Either by a measurement
- Or by a certified quality management approach
Quality Management (QM) approaches

- QMA philosophy:
  - An approach during the conception and the construction of the building;
  - For each step, to wonder how envelope airtightness is taken into account;
  - For each step, who does what, when, how;
  - Documents to trace each step;
  - The application of the approach must guarantee a good envelope airtightness (better than the limit value);
  - Proof of the QMA efficiency: tests on a sample of buildings.
Quality Management (QM) approaches: requirements

- Identify the **scope** of the approach regarding the types of buildings concerned;
- Fix the **limit airtightness value** (between 0.3 and 0.6m³.h⁻¹.m⁻² for single family dwellings and between 0.3 and 1m³.h⁻¹.m⁻² for multi-family dwellings);
- Implement **technical detailed drawings** complying with the scope;
- Show the involvement and **train** the workers (internal to the company or subcontracted);
- Show **site supervision documents**;
- Show how remedial actions are implemented and **traced**;
- Prove that the approach is **effective**, based on measurements on a sample (bar chart of airtightness measured values);
- Guarantee the actual application of the QMA **with time**;
- Get the system **audited** according to quality standards.

Process to get the certification

- The Ministry in charge of construction set up a national committee to analyse QMA (the Annexe VII committee).

- **National Committee:**
  - Around 10 experts (used to be 12).
  - Around 10 commissions a year.

- **National Committee rule:**
  - To analyse candidates’ quality management approach (with a public evaluation grid);
  - To propose the certification;
  - To analyse the annual follows-up (with a public evaluation grid);
  - Each year, to propose the validation or cancelation of the certification.
Control of the certified QMA

- Two control processes:
  - Annual follows-up:
    - Files analysis,
    - Sample testing. Tests by an independent measurer.
  - Control campaign:
    - Set-up and implemented by state controllers:
      - Files control,
      - In-situ audits,
      - Measurement.

Penalties

- Failures can lead to the certification cancellation.
  - Would compel the certified entity (builder) to implement systematic measurement,
  - In case of non-compliant measured value (above the limit of the certified QMA), corrections to be adopted for the building airtightness compliance.
Status on the ground: Number of certified QMA

Certified entities represent 10% of the French annual construction of residential buildings.

83 certifications for single-family dwellings, 1 on single and multi-family dwellings.

Distribution of builders applying a certified QMA according to their production:
Status on the ground: Number of certified QMA

- Among the 84 certified QMA, 40% (35/90) have a better limit value than regulation requirement.

**Performances of QM approaches**

- Distribution of measured single dwellings, with or without certified quality management (QM) approach
  - France, March, 2015

![Graph showing the proportion of certifications with their limit value](image1)

![Graph showing the distribution of measured single dwellings](image2)
Status on the ground: follows-up

Evolution of RT 2005 certified QMA measured values

Evolution of RT 2012 certified QMA measured values

Status on the ground: control campaigns

CONTROL OF THE APPROVED QUALITY MANAGEMENT APPROACHES 2011-2012

Q.M. APPROACH  | MEASURED VALUES
----------------|------------------
CONFORMITY MANAGED | Constructor 1, Constructor 3
CONFIDENCE | Constructor 4, Constructor 1
NON CONFORMITY MANAGED | Constructor 2, Constructor 10
NO DATA AVAILABLE | Constructor 9, Constructor 11

CONTROL OF THE CERTIFIED QUALITY MANAGEMENT APPROACHES 2014

Q.M. APPROACH  | MEASURED VALUES
----------------|------------------
CONFORMITY MANAGED | Constructor 1, Constructor 3
CONFIDENCE | Constructor 4, Constructor 1
NON CONFORMITY MANAGED | Constructor 2, Constructor 10
NO DATA AVAILABLE | Constructor 9, Constructor 11

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Status on the ground: control campaign

- Consequences of the first control campaign:
  - Only a warning given.

- Consequences of the second control campaign:
  - A last chance given.

- Issues:
  - How many certified QMA should be controlled?
  - How many tests for each controlled QMA?
  - What decision to take when 1 measure upon 7 is over the limit value?

Evolutions needed and issues to be faced up

- Control campaign:
  - Pros:
    - Certified entities fear the control campaign,
    - Compel certified entities to an actual application of the certified QMA,
    - Positively welcomed by the majority of the certified entities.
  - Cons:
    - How to analyse results? Which importance to give to them (in particular for a measured value worth than the limit one)?
    - Which sample to control (balance between the cost and the efficiency).
Evolutions needed and issues to be faced up

- Certification process:
  - Because of the increase of the candidates, accredited certification bodies will analyse and deliver certifications for QMA,
  - Begin on July, 2015.
  - Pros:
    - Process attribution more effective (4 months delay instead of around 10 months),
    - Bigger capacity to meet the growing demand,
  - Cons:
    - The State will get less lisibility of QM approaches’ evolution and contents,
    - Control campaign set up by certification bodies.

Evolutions needed and issues to be faced up

- Approaches on multi-family dwellings and on ducts airtightness:
  - Need to find a scheme adapted to the market and to the workers.
## Overall evaluation

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
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</thead>
<tbody>
<tr>
<td>✓ Encouraging builders to question their current practice and engage a QMA</td>
<td>✓ Cost for developing the approach and independent audits</td>
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<tr>
<td>✓ Great market impact</td>
<td>✓ Find a good way for each stakeholder to be implicated</td>
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<tr>
<td>✓ Reduce testing cost if production is sufficient</td>
<td>✓ Applicable mostly to single-family builders with a production of at least 50 houses/year</td>
</tr>
<tr>
<td>✓ Possible monitoring of the progress as the applicants have to file an annual file</td>
<td>✓ Examination/approval of the application is time consuming and requires well-developed procedures</td>
</tr>
<tr>
<td>✓ Improvement of workers skills</td>
<td>✓ Finding independent examiners and confidentiality of the approaches</td>
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</tbody>
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Thank you for your attention

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