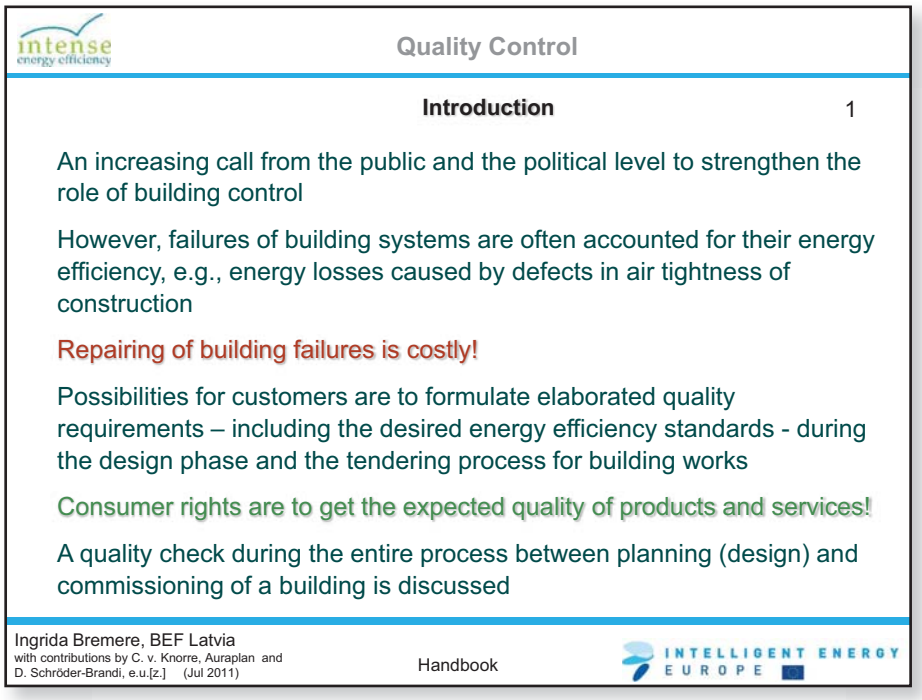


An increasing call from the public and the political level to strengthen the role of building control is associated with the transformation of the European building sector towards higher energy efficiency (refer to the Background).

Building works are meeting certain essential standards of construction safety. However, failures of building systems are often accounted for their energy efficiency. Inefficient constructions will have an implication on energy consumption during the whole operational period (30-50 years of its lifespan).

Repairing of building failures by the reconstruction and/or retrofitting during the operation stage requires additional costs and may also create dissatisfaction and disappointment. Therefore, it is widely accepted that it is cheaper and more efficient to address the energy efficiency of buildings at the construction stage.

Possibilities for customers are to formulate elaborated quality requirements – including the desired energy efficiency standards – during the design phase of the building and the tendering process for building works.

The customer has rights to get the expected quality of products and services.

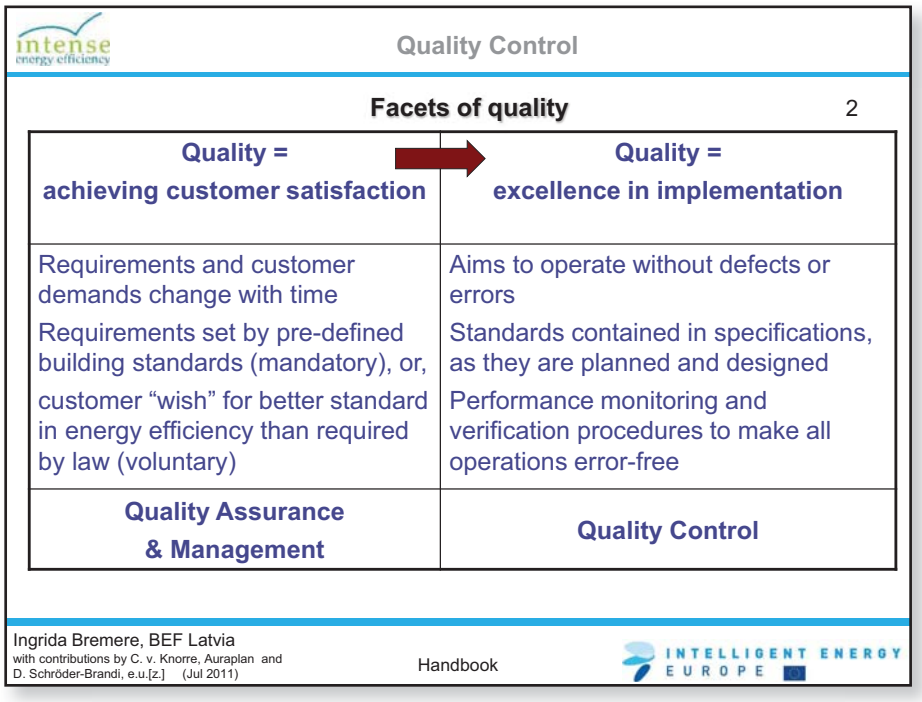
A quality check during the entire process between planning (design) and commissioning of buildings is discussed in further slides.

Background:

Buildings are responsible for 40% of energy consumption in EU. Energy performance of buildings is a key to achieve the EU Climate and energy objectives. Thus the EPBD (2002/91/EC and 2010/31/EU) is setting main requirements to achieve energy performance of buildings.

http://ec.europa.eu/energy/efficiency/buildings/buildings_en.htm

Connection to other themes: Legislation



It is essential to consider the "Quality" from its two facets:

Quality is equated with achieving customer satisfaction. Here the requirements and customer demands will change with time. National energy performance requirements will form a baseline for the quality of a building. Member States shall set minimum requirements for the energy performance of buildings, but these may differentiate between new and existing buildings as well as different categories of buildings. Customer may wish for better standard in energy efficiency than required by law. The requirements shall account for the cost optimal balance between the investments needed and the energy savings throughout the life-cycle of the building.

Quality Assurance is looked so, that the quality requirements for a product or service will be fulfilled.

Quality is defined as an excellence in implementation. The aim is to operate without defects or errors throughout the implementation process. Standards will be reflected in specifications as they are planned and designed. Performance monitoring is carried out and procedures for verification are set to make all operations error-free.

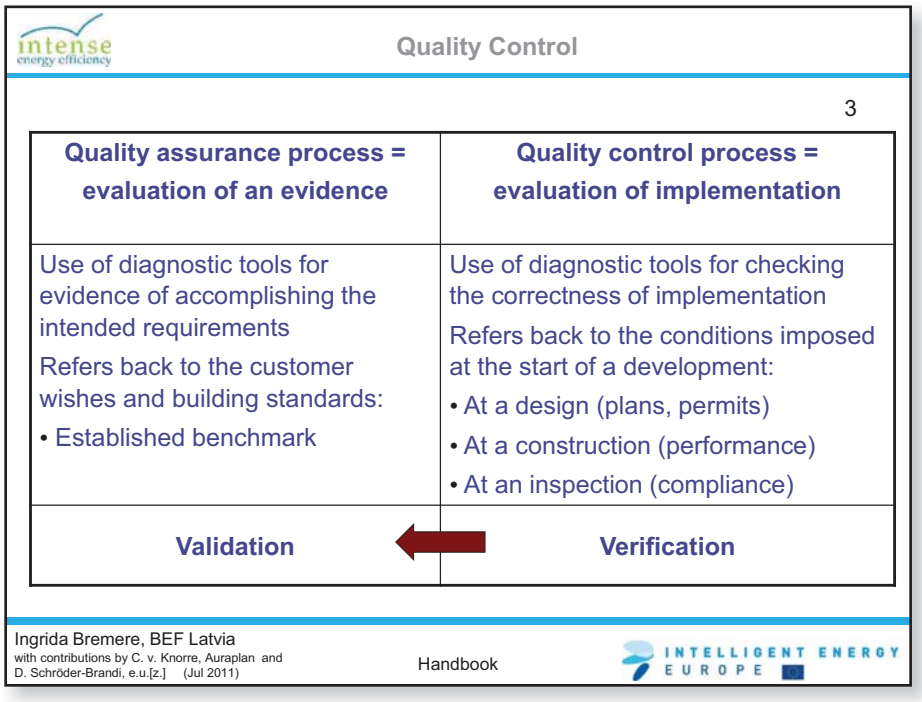
Quality Control is looked as the observation techniques and activities used to fulfil the requirements for quality.

In the building construction sector, the design task shall set the quality requirements to be fulfilled. The Quality Control shall start with the design task.

Connection to other themes: Legislation

Suggestions for presentation:

In order to highlight the situation in your country, please include the information on national energy performance requirements in this presentation.



Quality assurance process is seen as evaluation of an evidence. The quality assurance schemes are advisable to include into the planning of the building. Quality assurance and management ensures that quality aspects are handled at the front-end rather than at the back-end of a building project. Diagnostic tools (e.g., "Blower door" test) are used to obtain the evidence (quantitative) of accomplishing the intended requirements. Quality assurance process refers back to the customer wishes and building standards. Customer defines the quality requirements at the start of the process, but, the quality required by the customer is measured in the end product – the completed building. So, the quality assurance shall be kept through-out the building process.

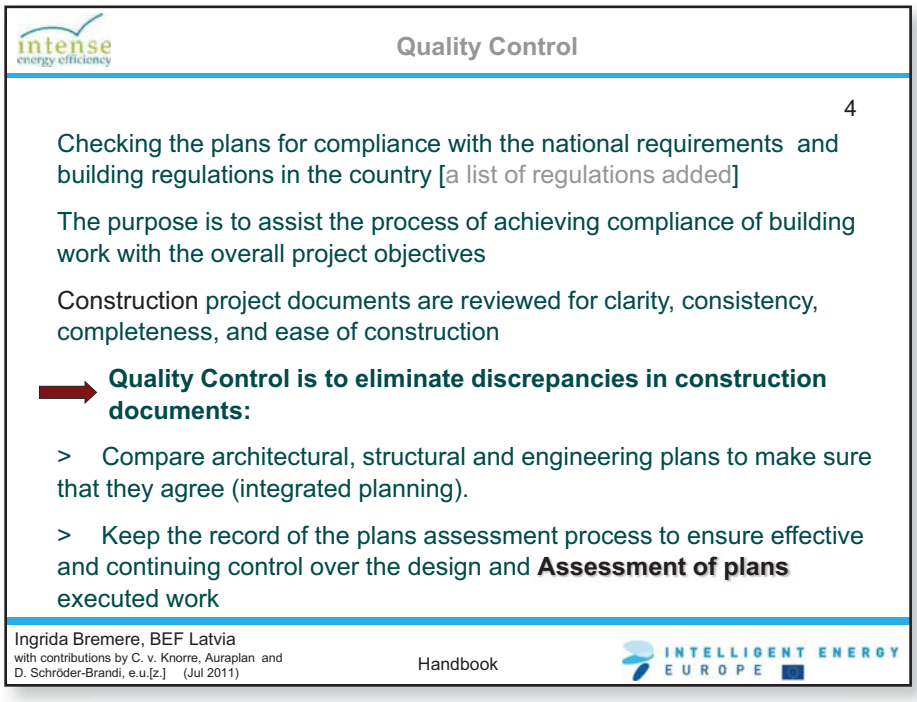
Validation of a certain quality corresponding to the established benchmark is a documented process (systematic and reproducible) for reaching the quality commitments.

Quality control process is seen as evaluation of implementation. This includes the observation techniques and activities to fulfil requirements for the quality. Diagnostic tools (e.g., thermography, "Blower door" test) are used for checking the correctness of implementation (qualitative). Quality control refers back to the conditions imposed at the start of development. Customers increasingly expect and demand for quality of a building, and this require comprehensive control of the quality and standard of work.

Verification of compliance with the quality norms or standards is performed at the design phase by assessment of building plans and approval of building permits, at the construction phase by monitoring the performance, and, at the inspection phase by certification of compliance.

In building sector, the quality control and verification of compliance is a key to the validation for the quality of the established benchmark.

Connection to other themes: Legislation



Assessment of building plans is a necessary step to eliminate any source of conflict caused by errors and discrepancies in the construction documents.

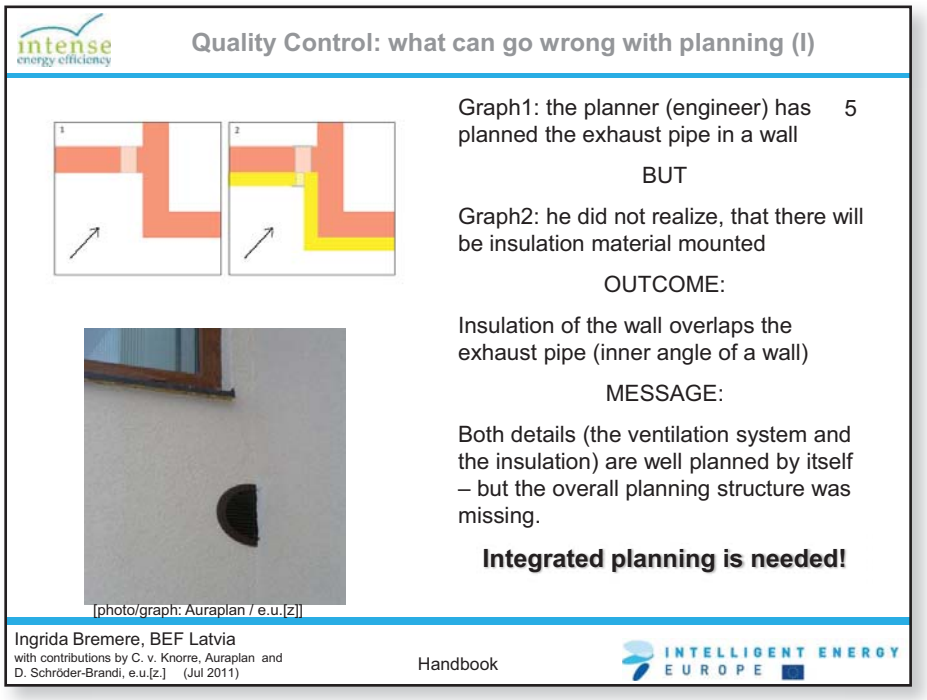
Obligatory building permission procedure requires conformity check with legal requirements. In many of EU countries, building plans are required to be approved by the building authority (state or local level). Some countries also permit approval of building plans by private independent experts (source: Building Control Report, May 2010, www.cebc.eu/files/reports/CEBC_BCR3_web.pdf).

The purpose for assessment of building plans is to achieve compliance of building work with the overall project objectives. Documents are reviewed for clarity, consistency, completeness and ease of construction.

Aim of the quality control is to eliminate discrepancies in construction documents. Architectural, structural and engineering plans are compared to make sure that they agree. An integrated planning of a building could correct simple planning mistakes. Records of the assessment process will ensure effective and continuing control over the design and executed work.

Connection to other themes:
Legislation, Settlement planning

Suggestions for presentation:
In order to highlight the situation in your country, please include the information on the building permission procedure and national building regulations in this presentation.



What can go wrong with the planning?

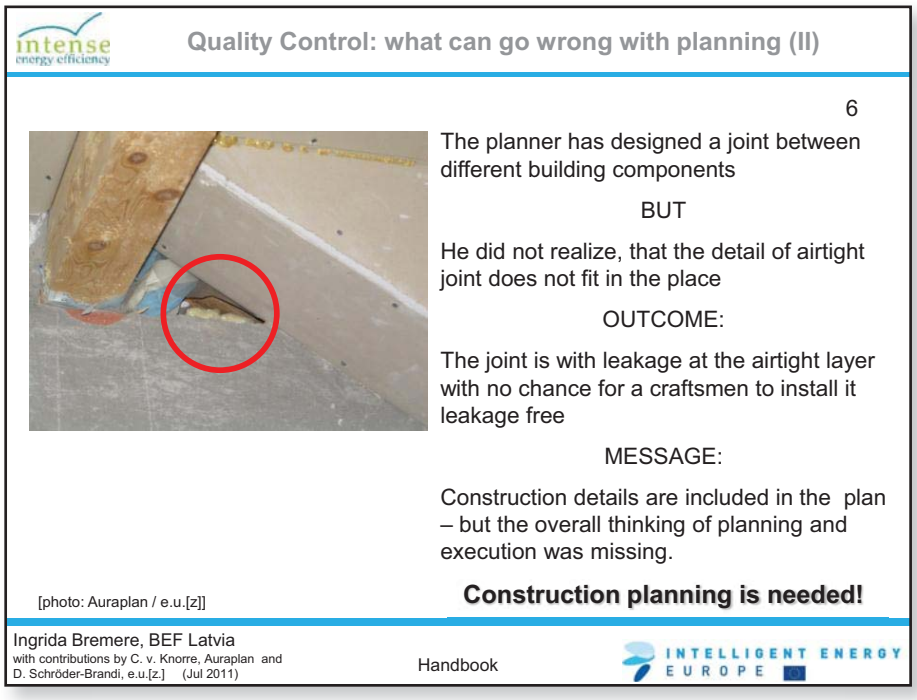
In the shown example the planner (engineer) did not realize, that after installing the exhaust pipe (graph 1) there will be insulation material mounted (graph 2). Insulation of the wall overlaps the exhaust pipe (well seen on the photo). The function of the ventilation system is now affected and this influences the capacity of air exchange.

This example shows a consequence of an isolated view on technical details. Both details were well planned - the ventilation system as well as the insulation – but there was no sufficient control over the planning of all construction. Therefore integrated planning approach is needed!

Connection to other themes: Building physics, system engineering

Suggestions for presentation:

If you have another positive or critical example on the integrated planning of a building from your country, please consider adding it to the presentation



What can go wrong with the planning? – another example

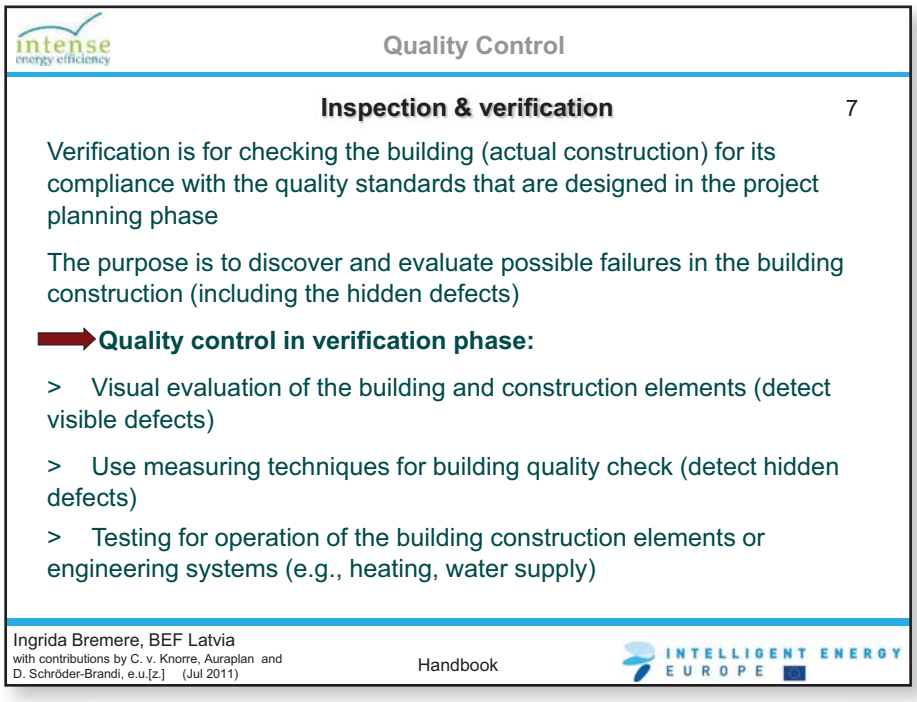
In this example the planner has designed a joint between different building components, but he did not realize, that the detail of airtight joint does not fit in the place. The joint is with leakage at the airtight layer. There is no chance for the craftsmen to install it leakage free.

This example shows a consequence of a poor thinking from different angles – planning and execution. Construction details have to be thought over that there is no gap between planning and execution. The design of the building construction must be installation friendly. Therefore the quality control over the construction planning is needed!

Connection to other themes: Building physics, system engineering

Suggestions for presentation:

If you have another positive or critical example on the construction planning of a building from your country, please consider adding it to the presentation.



Quality control by inspection and verification of the building at its actual construction is for the checking of compliance with the quality standards that were designed in the project planning phase. The purpose is to discover and evaluate possible failures in the building construction.

Quality control in verification phase can be three-fold:

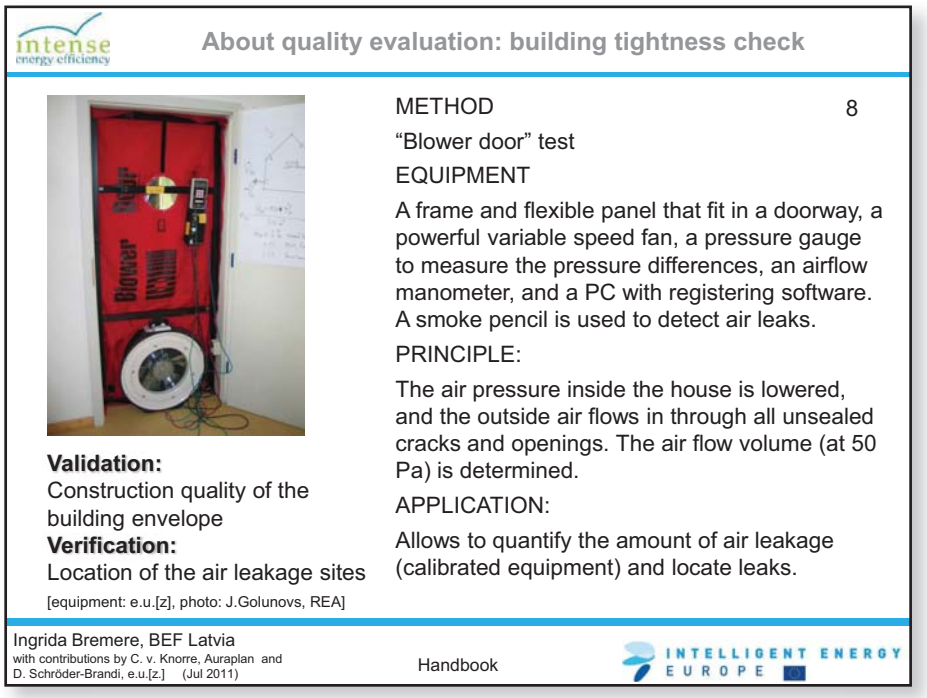
Visual evaluation of the building and construction elements will help to detect visible defects. Severe defects in construction elements can be dangerous. Possible fall of a construction element may result in physical injury or damage to people or property.

Detection of hidden defects is mostly possible by using of measuring techniques for building quality check. Hidden defects usually present no increased risk of injury or damage, however, these cause harm to the property owner in the form of loss of use, diminished value, increased maintenance and operational costs and additional expenses needed for repairing of building failures.

Testing for operation of the building construction elements or engineering systems is used to make certain the proper functioning e.g., of heating system, water supply.

Suggestions for presentation:

If you possess an information on the country specific approaches for inspection and verification, please consider adding it to the presentation.



A "Blower door" test can be applied for validation and verification of the building construction quality.

Brief description of the equipment, principle of the method and application are indicated on the slide.

Background

"Blower door" technology was first used in Sweden (1977). The name comes from the fact that this technology uses a fan (i.e., blower) mounted in a door (source: M.Sherman, http://epb.lbl.gov/blowerdoor/BlowerDoor.html)

Air exchange coefficients are determined for buildings of different energy efficiency standards. For passive house air exchange coefficient (n50) shall not exceed 0.6 h^{-1}. (source: Energy efficiency of buildings: A Glossary, www.intense-energy.eu/you-are/a-professional/)

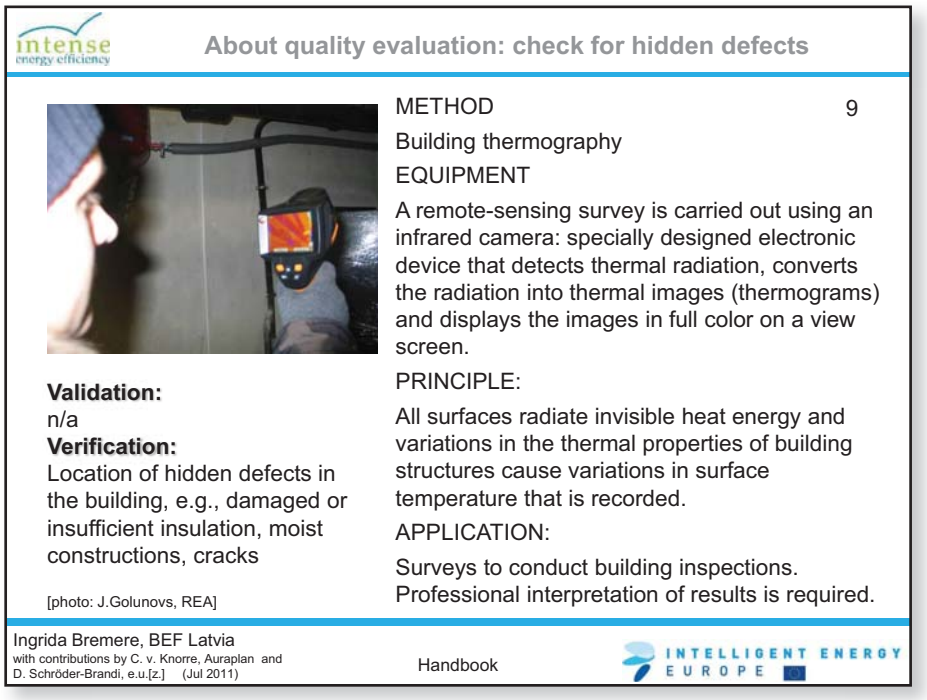
Air exchange coefficient can be defined by national legislation in countries by national building codes.

Connection to other themes: Legislation, building physics, system engineering

Suggestions for presentation:

In order to highlight the situation in your country, please include the information from national building codes in this presentation.

If you have a possibility for practical demonstration of the "Blower door" test, please consider organizing a separate session in the training course.



A building thermography can be applied for the verification of the building construction quality. This method in its usual application mode does not provide quantitative results and therefore is not suitable for validation purposes.

Brief description of the equipment, principle of the method and application are indicated on the slide.

Background

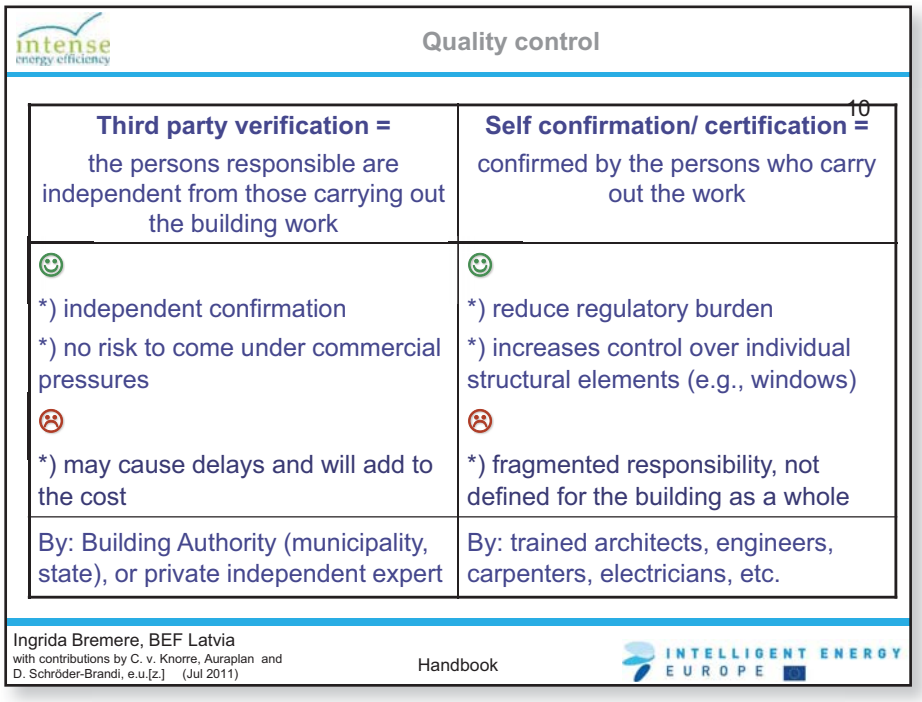
Building thermography is a method used for indicating the heat distribution over the surface of a building envelope. It is possible to get a qualitative detection of thermal irregularities in building envelopes.

Although, infra-red camera can be easily obtained for use, it is strongly recommended to look for professional thermographer to carry out the test. The professional judgement is required to differentiate between real faults and other sources causing variation in temperature. Inspections of outer surfaces may be influenced by radiation emissions and reflections from e.g., adjacent building or a cold clear sky, or the heating effect that the sun may have on a surface.

Connection to other themes: Building physics, system engineering

Suggestions for presentation:

If you have a possibility for practical demonstration of the building thermography test, please consider organizing a separate session in the training course.



intense energy efficiency

Quality control

10

Third party verification = the persons responsible are independent from those carrying out the building work	Self confirmation/ certification = confirmed by the persons who carry out the work
☺ *) independent confirmation *) no risk to come under commercial pressures ☹ *) may cause delays and will add to the cost	☺ *) reduce regulatory burden *) increases control over individual structural elements (e.g., windows) ☹ *) fragmented responsibility, not defined for the building as a whole
By: Building Authority (municipality, state), or private independent expert	By: trained architects, engineers, carpenters, electricians, etc.

Ingrida Bremere, BEF Latvia
with contributions by C. v. Knorre, Auraplan and D. Schröder-Brandi, e.u.[z.] (Jul 2011)

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Building quality control can be performed either through independent inspections (third party verification) or persons who carry out the construction works (self confirmation). Each country in Europe has its legislation how the compliance with building standards shall be ensured and verified.

Third party verification is an independent confirmation that the works satisfy relevant requirements. Independent building control body does not risk coming under commercial pressures. However, this form may cause delays to the work and will add to the cost of construction.

Third party verification is usually performed by state or municipal building authority, or private independent expert.

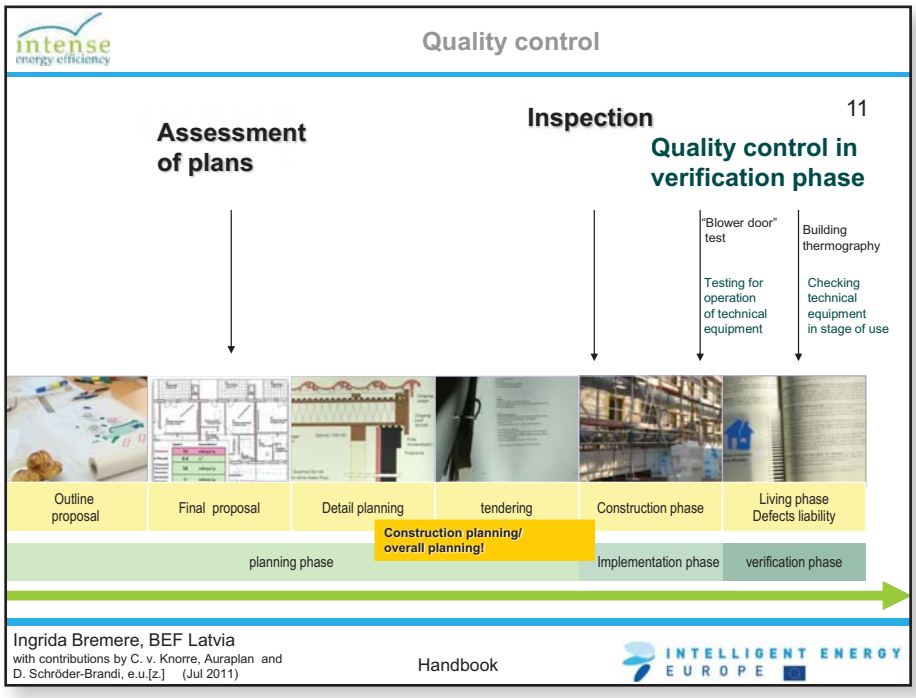
Self confirmation is used to reduce regulatory burden and bureaucracy in countries. Benefit of self confirmation is wider control over individual construction elements by person carrying out the work. Self confirmation can be applied at various stages of a construction project – at the design stage, during construction or at completion of the work. However, drawback of this approach is fragmented responsibility. Therefore assessment of the building as a whole by a third party verification is considered essential.

Self confirmation is performed by trained persons (architects, engineers, craftsmen) who are approved to self confirm their work.

Connection to other themes: Legislation

Suggestions for presentation:

Please indicate the information on how the verification systems operate in your country.


intense
energy efficiency
Quality control
11
Assessment
of plans
Inspection
Quality control in
verification phase
"Blower door"
test
Building
thermography
Testing for
operation
of technical
equipment
Checking
technical
equipment
in stage of use
Outline
proposal
Final proposal
Detail planning
tendering
Construction phase
Living phase
Defects liability
Construction planning/
overall planning!
planning phase
Implementation phase
verification phase
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EUROPE

Role of municipalities in building quality control process is defined by national legislation.

When municipalities are aassigned a role of third party verification, there is a clear need for adequate resources and capacities from municipalities to fulfil duties of building quality control and verification. Different examples from various countries are presented in literature (source: Building Control Report, May 2010, www.cebc.eu/files/reports/CEBC_BCR3_web.pdf).

Connection to other themes: Legislation

Suggestions for presentation:

Please indicate the information on how the verification systems operate in your country.