Analysis of execution quality related to thermal bridges

ASIEPI, WP4, Thermal bridges

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Purpose of the task

- To make a survey among the participating MS concerning previous individual national studies on the influence of execution quality
- To quantify what affects the execution quality have

- An Information Paper has been written P159 – available on www.buildup.eu

Examples of existing studies

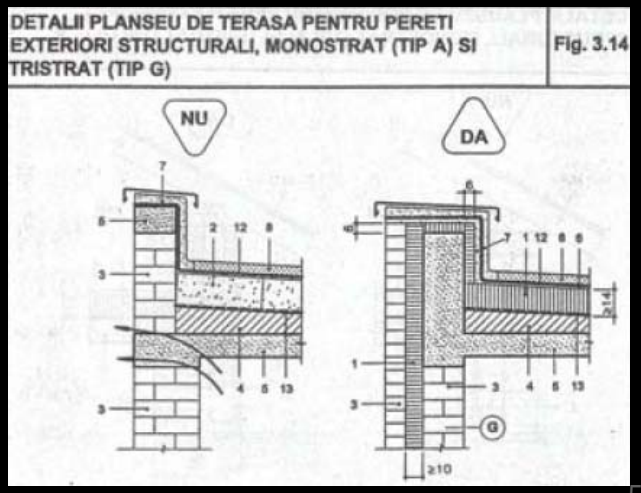
- Only a few studies exist on execution quality with regard to thermal bridges among the participating MS
- Some results from Germany, Romania and United Kingdom will be shown

Germany

- 39 multi-family houses were monitored. Parts of the building process were supervised, i.e. check of building joints in both the design and realisation phases
- On average 2.8 critical design details per building needed correction
- On-site visits resulted in more than 100 protocols concerning both material choices and execution of building details
- All in all execution quality was good; however, the recommendation was to have building inspections during execution in future buildings to avoid defects and increased energy losses

Romania

- A study contains general solutions for increasing the energy performance of existing buildings by renovating especially construction joints (thermal bridges). The study focuses on 37 details that are critical parts of the construction
- Another study is a normative reference concerning methods for assessing the execution quality in existing buildings. Among others, infrared thermography is suggested as a method to assess execution quality
- The third study shows typical building details for 23 cases that are relevant for new buildings. This study shows both good and bad solutions in order to emphasise the importance of correct execution

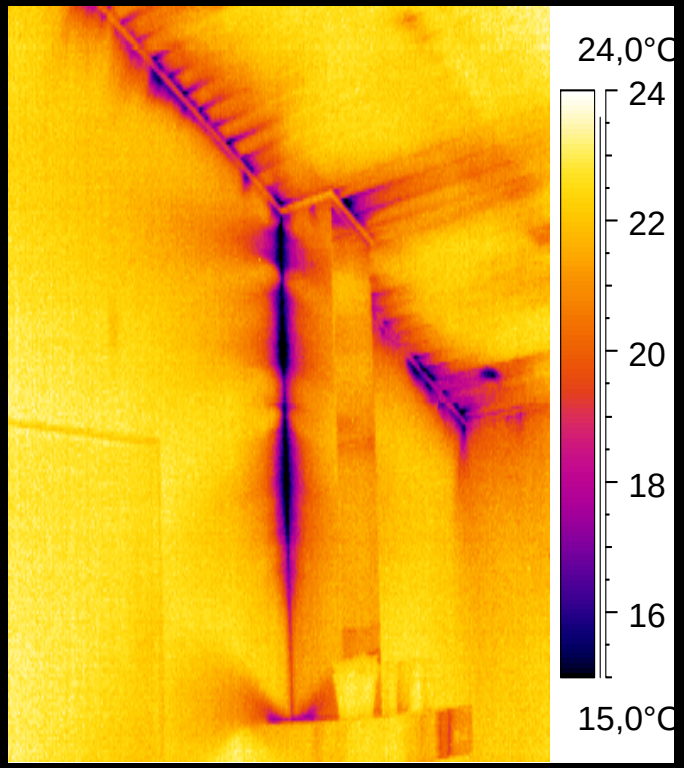


United Kingdom

- The England and Wales 2010 proposals include inclusion of so-called safety factors for claimed thermal bridge heat losses that are not accredited and well-tried details
- These safety factors are introduced because they might cause problems with regard to execution quality (i.e. since builders have not used them before they are more likely to make mistakes), and furthermore hence their values (linear thermal transmittances or point thermal transmittances) are uncertain
- Evidence for theoretical values will be required so - in principle - that uncertainty should not be any greater than for accredited details
- Execution quality is certainly a concern for unfamiliar/untried details

Stimulation of improved execution quality

- A questionnaire was distributed among the participating MS in ASIEPI
- Infrared thermography is the most powerful technique for determining position and to some extent magnitude of thermal bridges in existing buildings



Infrared thermography

- There is a legal requirement in the Danish Building Regulations stipulating that at least 5 % of new buildings should be tested for airtightness by blower door, and that this test should always be accompanied by infrared thermography in order to pinpoint the location of any leakages
- It is the responsibility of the local authorities to ensure that this part of the Building Regulations is fulfilled

Building inspections

- Building inspections with focus on energy during and after the building process of new buildings is ensuring that the building is realised as originally planned
- In opposition to infrared thermography, building inspections can be carried out during the building process, making it possible to pinpoint and correct any faulty execution before the building is finished
- In most countries, there are legal requirements for inspections; however, these inspections seldom/never focus on energy consumption and thermal bridges, but rather on health, safety, structural elements and load-bearing capabilities

Building inspections

- Norway has recently drafted new rules, proposing compulsory independent third party inspections after the building process
- Denmark uses a third party energy certification scheme for all new buildings. The certification covers all energy-related installations/parts of the building that can be inspected visually (pipe insulation, boiler characteristics, fan power usage etc.)

Alternative methods

- In Germany, visual checks (inspections) are performed with specific focus on checking for thermal bridges if requested by the building owner
- Norway uses especially trained people to investigate the building design before the building process is initiated for some building projects
  - This investigation focuses on weeding out details that may cause problems
  - The investigation will typically also result in a series of suggestions concerning specific inspections or measurements that should be carried out during the building process

Incentives or penalties

- Most MS have penalties that have
  - Direct economic consequences for the building contractor (fines)
  - Indirect economic consequences (halting the building process or prohibiting building use)
  - The responsible executive manager and/or technical supervisor may loose their certificates/licenses
- Only a few countries have incentives for stimulating good execution quality
  - Governmental funding or reduced taxes for building low-energy buildings or passive houses
  - The incentives are typically connected with time-limited programmes

Stimulating execution quality - Sticks

- Inspections by energy specialists before, during and after the building process (photos, measurements)
- Increase number of mandatory blower door (IR thermography) tests (e.g. to 15% of all new buildings), and utilise the IR results
- Possibility of withdrawing license of designer/contractor
- Bad examples of building contractors should be published

Stimulating execution quality - Carots

- Funding programmes
- Reduction of green taxes and interest rates for low energy buildings/passive houses
- Good examples of building contractors should be published

Other stimuli

- Courses for designers and construction company staff or craftsmen on how to design and realise building joints with focus on air tightness and thermal bridges
- Good practice guidelines
  - In general passing on expert knowledge concerning the understanding of the key elements of low energy building and good workmanship
- Introduction of U-Values that take into account the installation of windows
  - This would motivate the window industry to have stronger guidelines for installation, and thereby more training for installers

Conclusion

- There is a need for increased focus on execution quality
- The proposal for stimulating and assessing execution quality contains different measures described as sticks and carrots
- The proposed measures are aimed at different target groups, but for most of them, it is the policy makers, who will be responsible
- The standardisation bodies have to follow up and prepare the standards
- The building industry and the building practitioners have to arrange courses for designers and construction company staff or craftsmen
- Good practice guidelines will be helpful in passing the newest expert knowledge from theory to practice

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