



Framtidens trähus Timber framed House of the Future

Moisture and mould in prefabricated timber frame constructions during production until enclosure of



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Aim

- What is the climate like?
- How well you can we build with timber/wood?
- Are the Swedish regulations fulfilled during the construction stage?
- Does it require modified designs and erection methods?

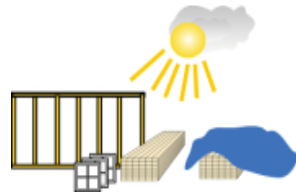




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Zero-hypothesis and regulations

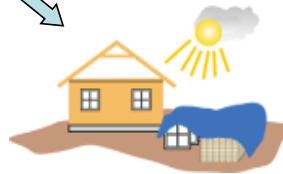
- **The work has started from a ‘zero-hypothesis’: ‘not exposing wood to such conditions that could cause the growth of mould’. This does not include the cladding of the building.**
- Swedish practice (HUS AMA 98) recommend the moisture ratio in stud frames or sills must not exceed 18% (MC) after the timber has been covered or enclosed.
- A moisture ratio over 18 % (MC) or relative humidity over 84 % are critical levels for growth of mould on spruce at 15 C with an duration of two months (based on *laboratory experiments carried out by Viitanen 1996*).
- The Swedish Building Regulations says that critical moisture levels and mold must be avoided



House factory. Installed loggers on wall elements and in the timber store for RH and Temp. Took samples.....



Transport of wall elements and roof trusses.



Erection stage. Took samples.....



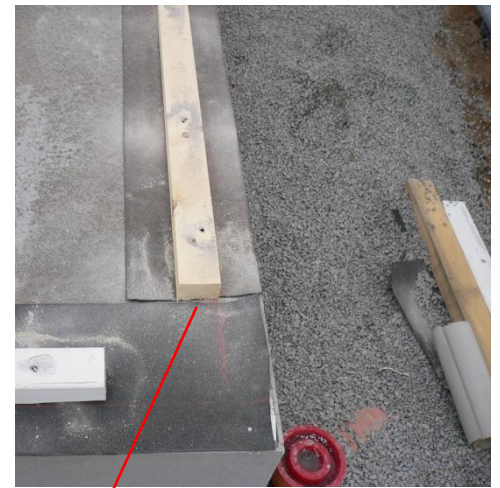
The finished house was not included in the study.

Schematic diagram of the investigated phases in the production process

Measurements



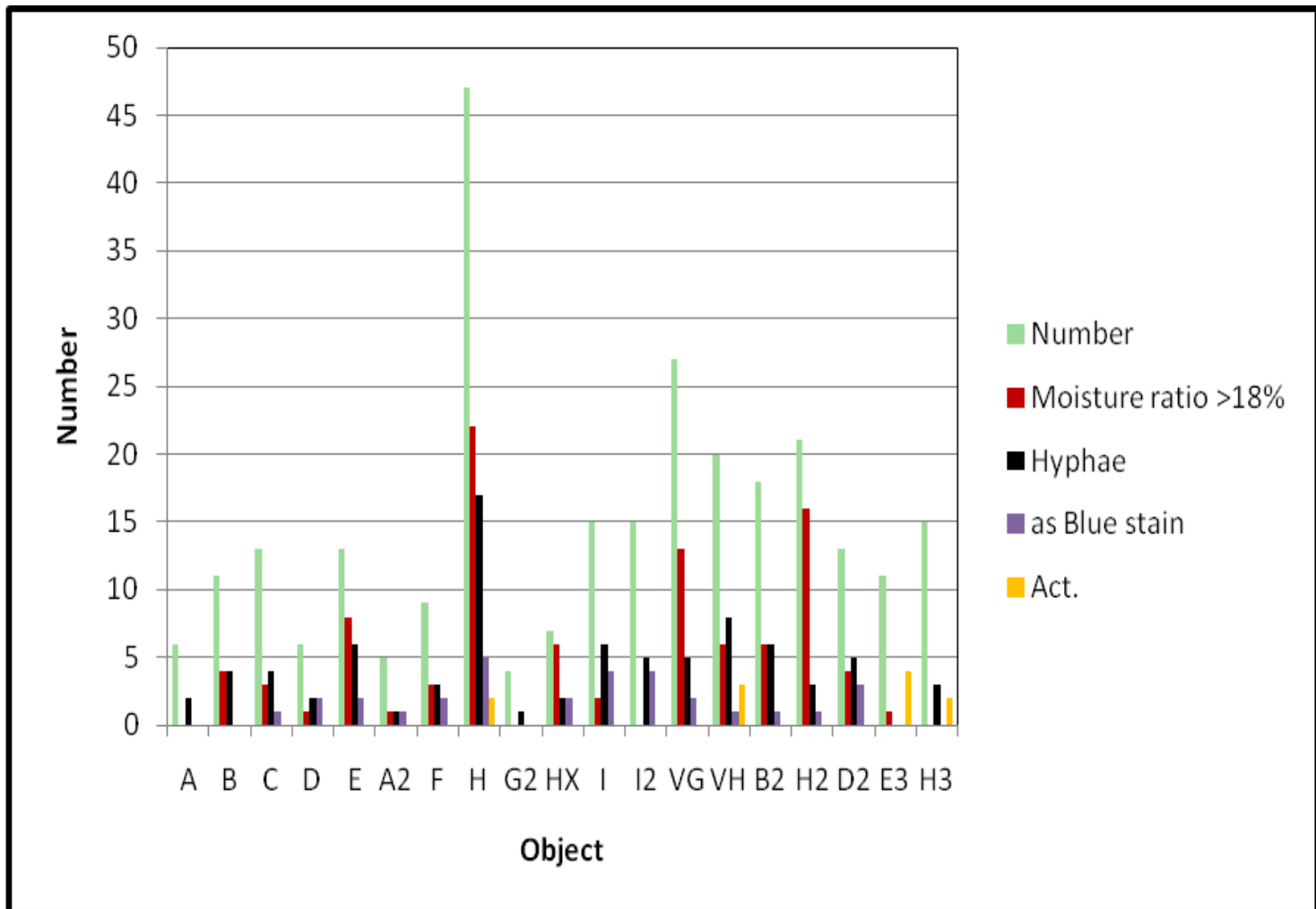
Loggers were placed inside of the wall on the stud



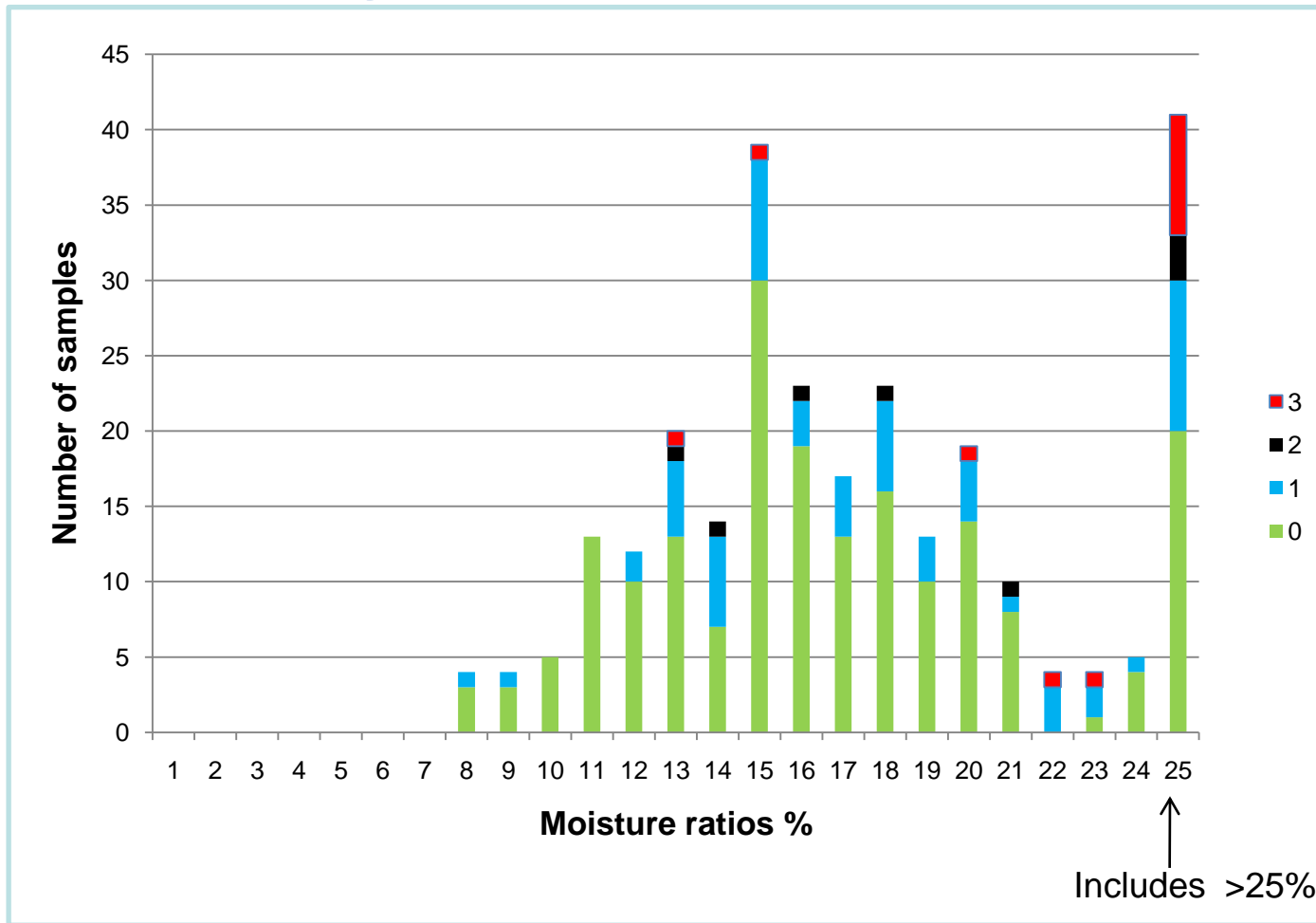
resistance measurement



Summary of results

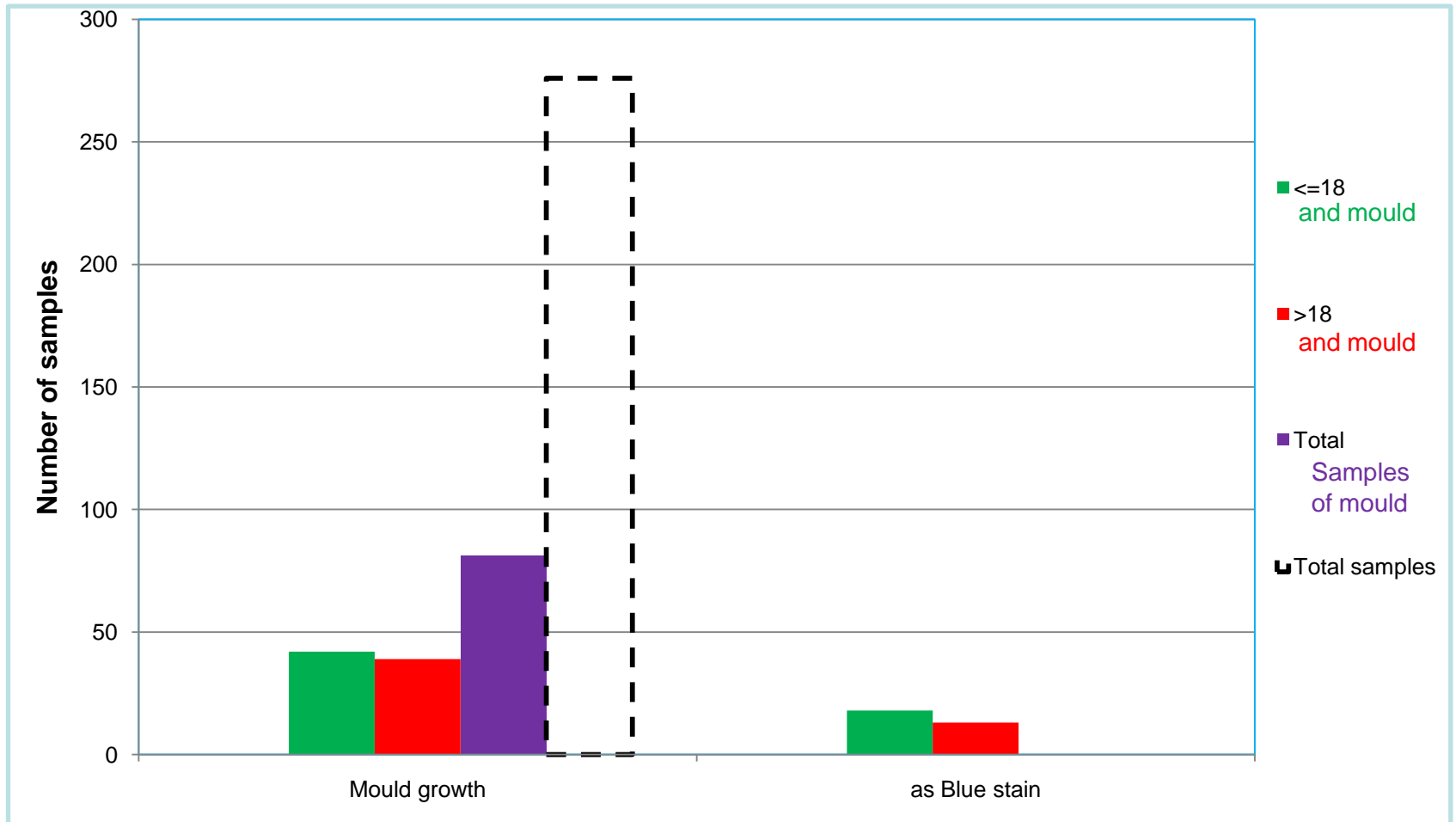


Mould growth and moisture ratio (MC)

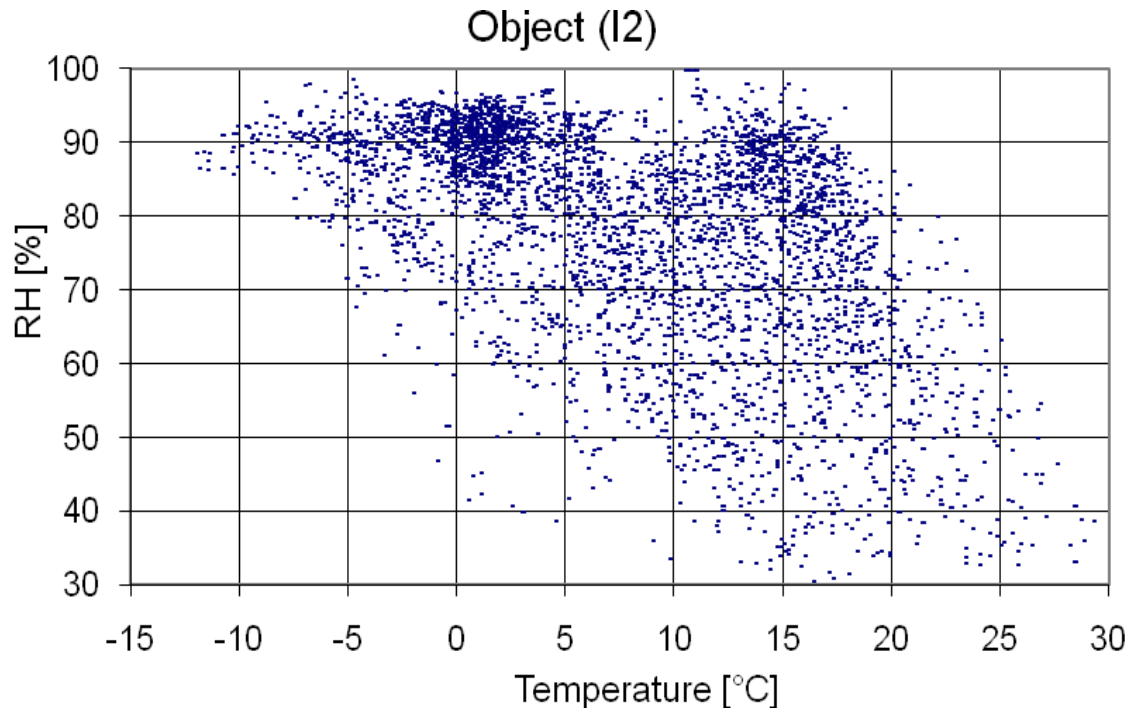


Growth levels: 0 = no growth, 1 = slight growth, 2 = modest growth, 3 = extensive growth. 3-point scale from samples from the field

Mould growth

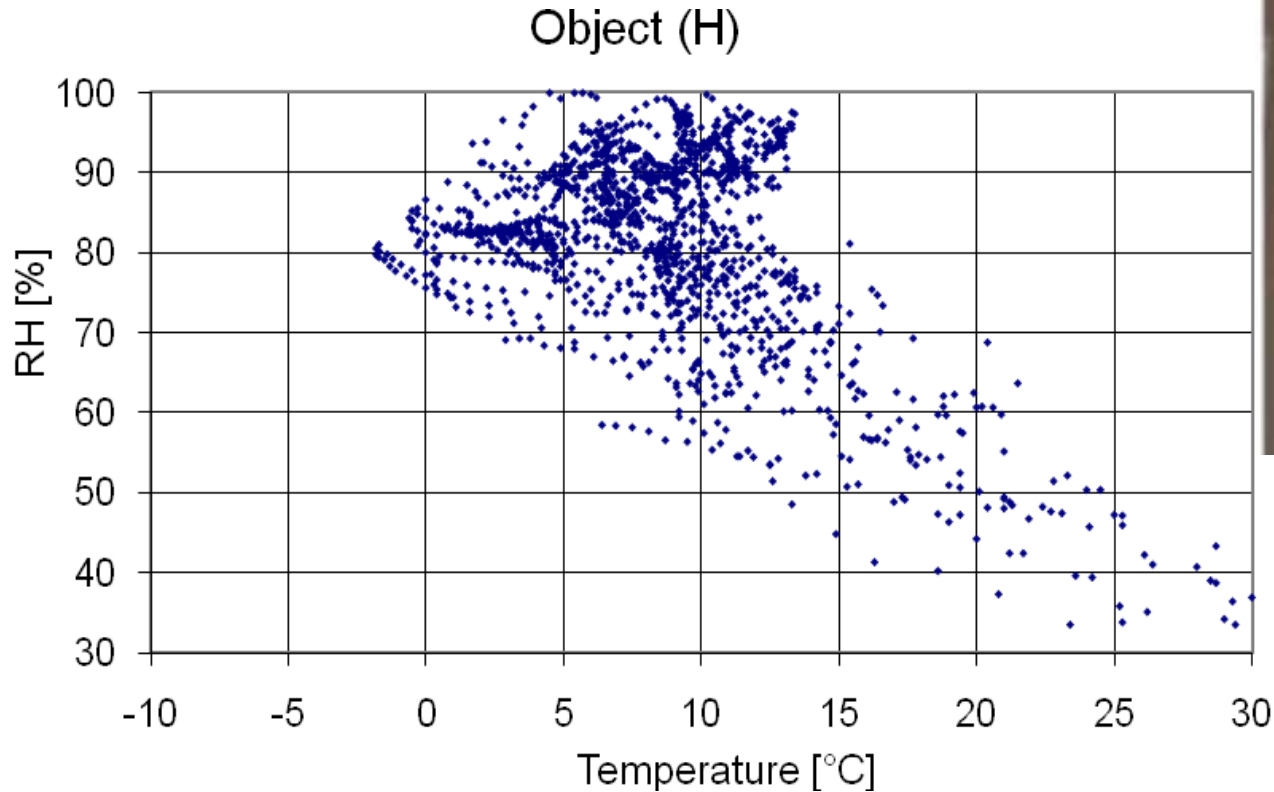


Outdoor timber store under cover



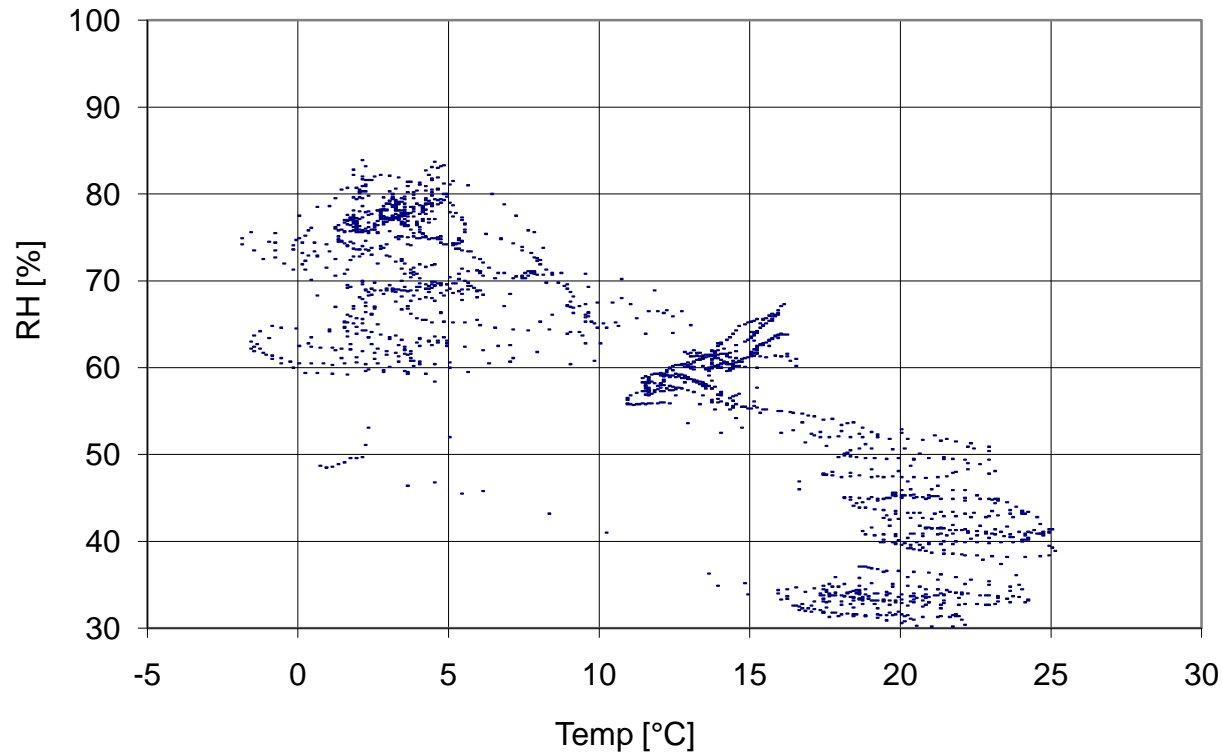
*Climate conditions were recorded every second hour (**each point represents two hours**) over almost a year from December 2008 until November 2009.*

Wall element/building object (H)



Climate conditions were recorded each hour (each point represents one hour) from 24th September 2008 to 21st November 2009 on wall element/building object (H).

Wall element/building object (J)



Climate conditions were logged each hour (i.e. each point represents one hour) from 19th September 2008 to 4th December 2008

Observations



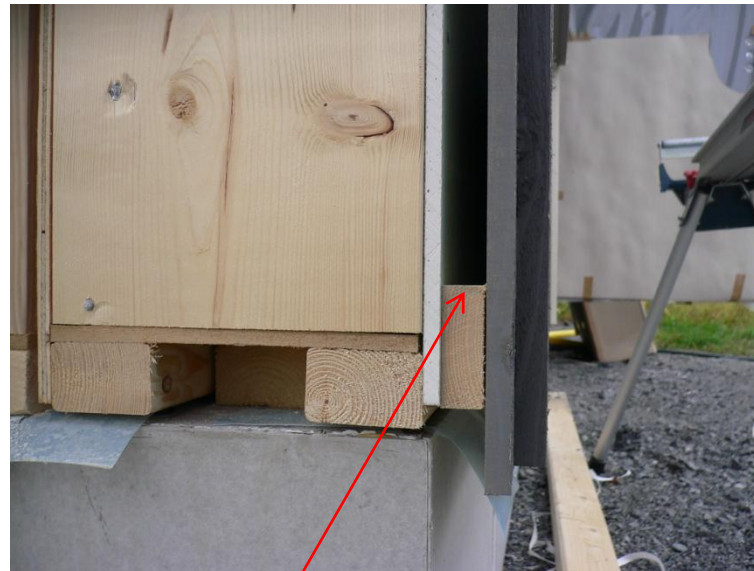
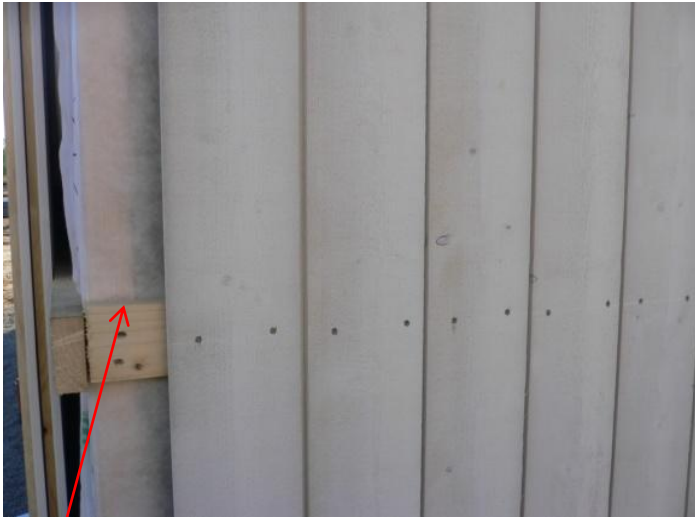
Observations



Observations



Observations



Observations



Conclusion

- Climate conditions (air humidity and temperature) during transport or the erection stage were not sufficiently favourable to permit growth.
- 1 / 3 of material samples had mould and half of them (MC) > 18 %.
- 1 / 3 of the measurements showed elevated or high moisture content and some of them had ongoing mould growth.
- Blue stain growth was found and particularly on dry samples
- **The Hypothesis was not fulfilled which is based on Swedish Building Regulations**

Recommendation



There is a risk that material becomes wet (most critical part is sills) and can be reduced by :

- modifications of the design (replace to moisture-resistant materials)
- Or appropriate changes to the method of erection
- Or better weather protection or coverage of the site.
- Also need for sealed joints for wind barrier.