Execution and moisture control

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Treteknisk in short

- Since 1949
- Owned by Norwegian mechanical timber industry
- 35 employees
- Accredited labs
- Free field testing
- Mechanical
- Building physics
- Glue and surface treatment
- Industry development

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Execution and moisture control Outline

Failures due to moisture?

Existing requirements

Measure moisture in wood

Moisture control during construction

Weather protection level

Failures due to moisture?

Why?

- 83 000 water damages in 2013 in Norway
  (reported to insurance companies)
- Focus – limit mould growth – negative impact on indoor air quality
- MORE?

Photo: yr.no

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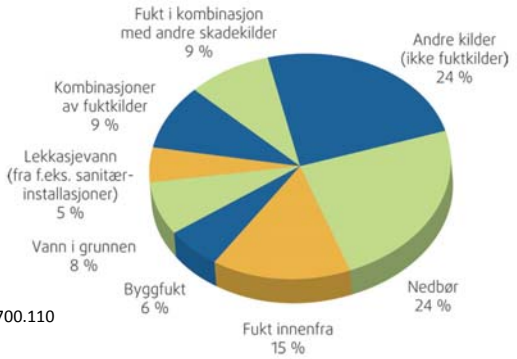
Moisture damage - causes

- Resulting from free water
- Leakage of condensation
- NOT high Relative Humidity



Building design sheet 700.110
Sintef Byggforsk, 2014

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Moisture damage

- Deformation – Design!

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Moisture damage

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- Aesthetical
  - Deformation
  - Stain

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Moisture damage

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  - Stain
- Mould


Foto: Mycoteam

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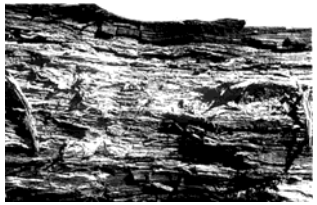
Moisture damage

- Deformation – Design!
- Aesthetical
  - Deformation
  - Stain
- Mould
- Rot



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Requirements

Former requirements, TEK 07

- TEK Norwegian technical building regulations
- § 13-14 Groundwater, surface water, precipitation, supply water and air **may not penetrate and cause damage**, mold and fungus
- HEALTH

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Excisting requirements, TEK 10

- § 8-37 Moisture
- Construction works shall be so made as precipitation, surface water, ground water, supply water and air can not penetrate and cause damage, mold, fungi or other hygienic problems.
- Rough around structures shall have sufficient fall from the structure unless other measures are taken for surface water drainage. Around the building components below ground and under floor structures on the ground, have taken the necessary measures to divert leachate and prevent moisture from penetrating into the structures.
- Curtain walling, windows, doors and installations that go through walls, shall be designed so that harmful moisture to dry out.
- Roofs must be sufficient to allow rain and melting water to drain. If condensation can occur on the underside of the roofing or the roofing is not sufficiently impermeable to prevent the ingress of water, be the underlying structure protected by a waterproof layer.
- Bathroom and laundry room shall have an outlet. Room with floor drains shall have sufficient slope on the parts of the floor which is assumed to be exposed to water regularly.
- Floors, walls and ceilings that are going to be exposed to water spills, leaks or condensation shall be made with moisture-resistant finishes. Underlying structures and space which may be adversely affected by moisture shall be protected by a waterproof surface material or a suitable waterproof layer. Materials are selected such that the risk of fungi and mold formation is minimal.
- Materials and structures shall be as dry by placing / sealing that there are no problems with the growth of microorganisms, decomposition of organic materials and increased degassing.

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Timber at the building site?

- Production standards
  - EN 1408
  - EN 338
- 20 % moisture content (MC)

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Timber at the building site?

- In **Sweden**
- **16 %** moisture content (MC) when delivered
- Trouble: bottom sill, wooden cladding…

Industriell agreement, 2012

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Timber at the building site?

- In **Finland** SFS 5978 Execution of timber structures
- Unless otherwise agreed
  - sawn timber: Due to risk of mould growth > 20% MC
  - glue laminated timber 10 - 12 % MC
  - plywood and laminated veneer lumber 8 – 10 %
  - if delivered from storehouse 20 % MC at most

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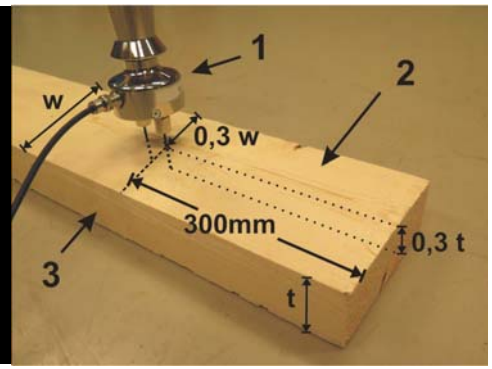
prNS 3512

Measurement of wood moisture content

Moisture control in building phase during erection

Bottom sill



Moisture control in the construction phase

prNS 3512

Measurement of wood moisture content

Control schemes

- Delivery
- Construction phase

Tillegg D (informativt)
Måleprotokoll for mottakskontroll for fukt i trelast

Leverandør:
Mottaker:
Målinger utført av:
Produktidentifikasjon:
Antall pakker i partiet:
Antall pakker som måles:
Antall målinger i hver pakke:
Værforhold ved måletidspunkt: (nedbør, sol, utetemperatur)

Pakke 1	
Målepunkt plassering	Fuktinnhold (vektprosent)

Pakke 2	
Målepunkt plassering	Fuktinnhold (vektprosent)

Pakke 3	
Målepunkt plassering	Fuktinnhold (vektprosent)

Pakke 4	
Målepunkt plassering	Fuktinnhold (vektprosent)

Kommentarer:
Avvik fra eventuell fuktspesifikasjon:
Dato/signatur:

SFS 5978 Moisture control plan

To be made in **co-ordination** manufacturer & structural designer

To be **completed before** manufacturing of the building element or the construction phase

Moisture control plan
- Covers the whole chain of production and building process of the timber structure
- It shall be ensured that the contractor follows the moisture control plan

The moisture control plan is drafted for building projects that are carried out in external conditions. The content of the moisture control plan is the following:

1. Basic information of the building project (address and other coordinates of the building site, the person responsible for the construction on site, the main author of the moisture control plan)
2. List of wood materials and products to be used in the construction site
3. The target moisture content of wood and wooden elements at different stages of the industrial production.
4. The target moisture content of wood and wooden elements when delivered to the building site, during assembly and when the building is finalized
5. Inspections on site and the person responsible for carrying them out
6. Possible sources of moisture in the building site (for instance, rain, snow, ground water etc.)
7. The protection level (PL0-PL3) chosen for the building phase and an estimate on the necessary protection duration
8. The protection of wood on the building site:
   - storage method and protection of storage
   - protection during assembly (as determined by the protection level)
   - drying methods applied for wood that has gained moisture (for some reason)
9. Controlled drying of structures to the service conditions of the building
   - analysis and prevention of risks caused by moisture, rain among others
   - sensitivity of the project to unfavourable weather and other exceptions
   - determination of moisture contents of wood, drying times and appropriate drying conditions
   - organizing of drying conditions
   - effects of onsite schedules (contingency plans)
10. Moisture measurement plan (measurement method, timetable, documentation and person responsible)

SFS 5978 Moisture during construction

Sawn timber delivered continues to dry on the building site

On the building site, the material moisture is controlled with weather protection

Drying of wood should be carried out sufficient slowly not to develop drying cracks

Controlled drying

Drying conditions difference between measured moisture content and equilibrium moisture content < 6 % MC

Weather protection level

Fresh produce

Wood may not be treated like precast concrete or steel!

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SFS 5978 Weather protection levels

PL0 No protection

PL1 Plastic or tarpaulin covering
< 20% MC

PL2 Sheltered
< 20% MC, more relaible

PL3 Internal conditions or a tent with heating < 15% MC

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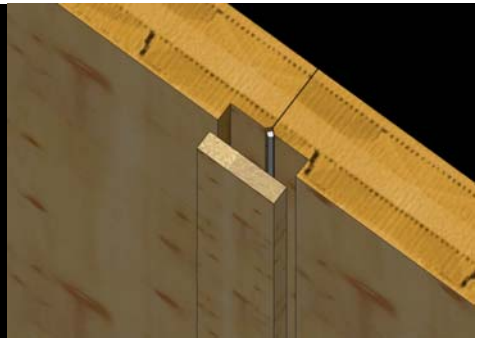
Air thightness

Hinder convection

most effective moisture transport



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Follow moisture development

In construstion phase

To detect moisture prior to damage

To study new materials or assemblies

Need for convection barrier?

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Non-technical challenges

Competence
= knowledge + experience

Architect
Consultant
Entrepreneur
Producer

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Non-technical challenges

Standardise and increase efficiency

Building Information Models (BIM)

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Non-technical challenges

Traditions and culture

→ Construction sector conservative…

→ Architecture eager…

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