

# Glued products in Norway

- **Finger joints for structural use**
- **Glued laminated timber (EN 14080)**
- **Solid timber elements**
- **Laminated beams and posts not covered by EN 14080**
- **I-beams**
- **Laminated blanks for windows and doors**
- **Furniture products (laminated curved members, laminboards, veneering, etc.).**
- **Particle boards**

# Adhesives and glued products in Norway

## Finger jointed structural timber

- Spruce, pine and impregnated pine
- Dimensions up to 75 x 225 mm
- 13 production lines
- MUF, MF and EPI (PRF is no longer in use)

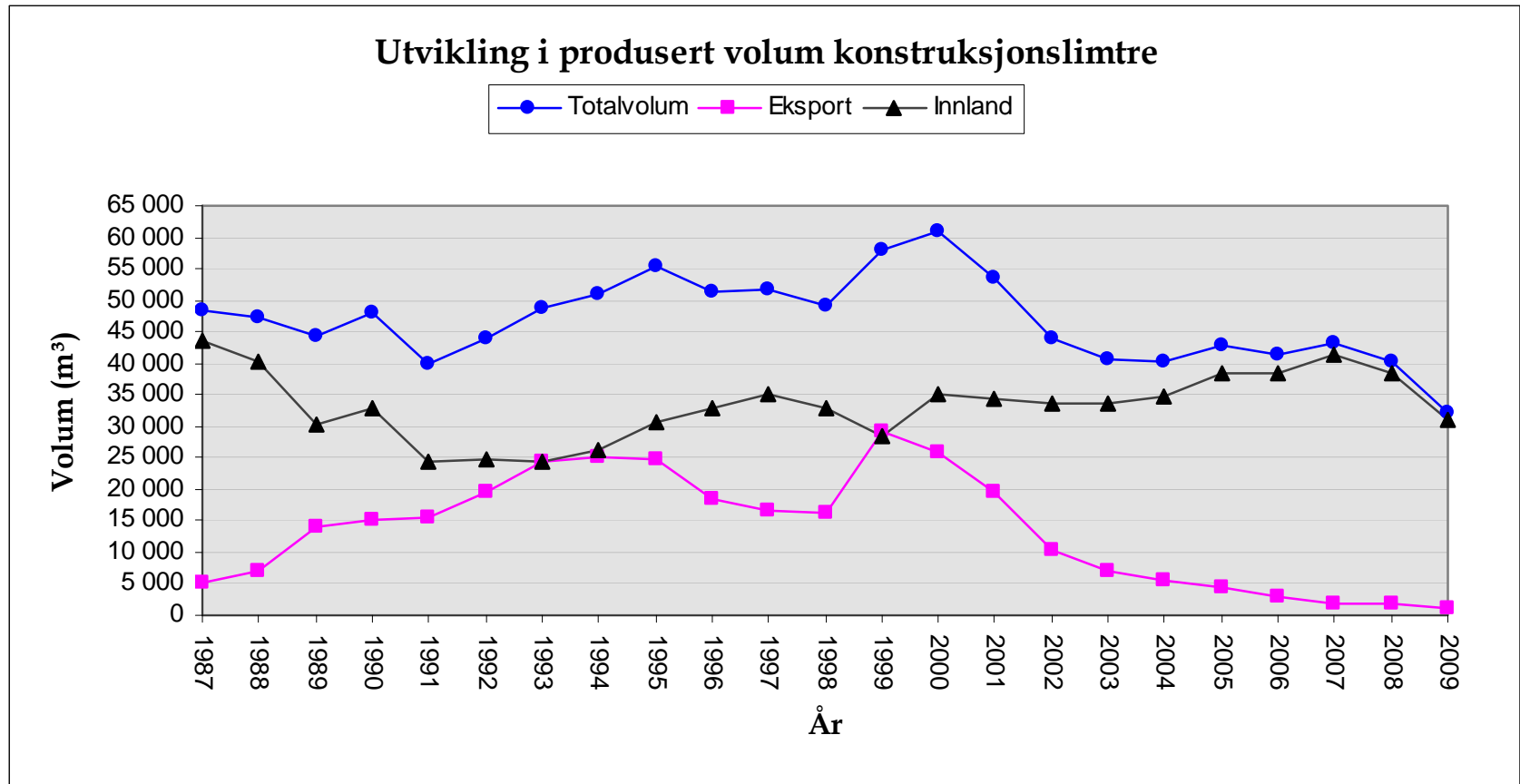
## Glued laminated timber

- Spruce, pine and impregnated pine
- 5 production lines
- MUF

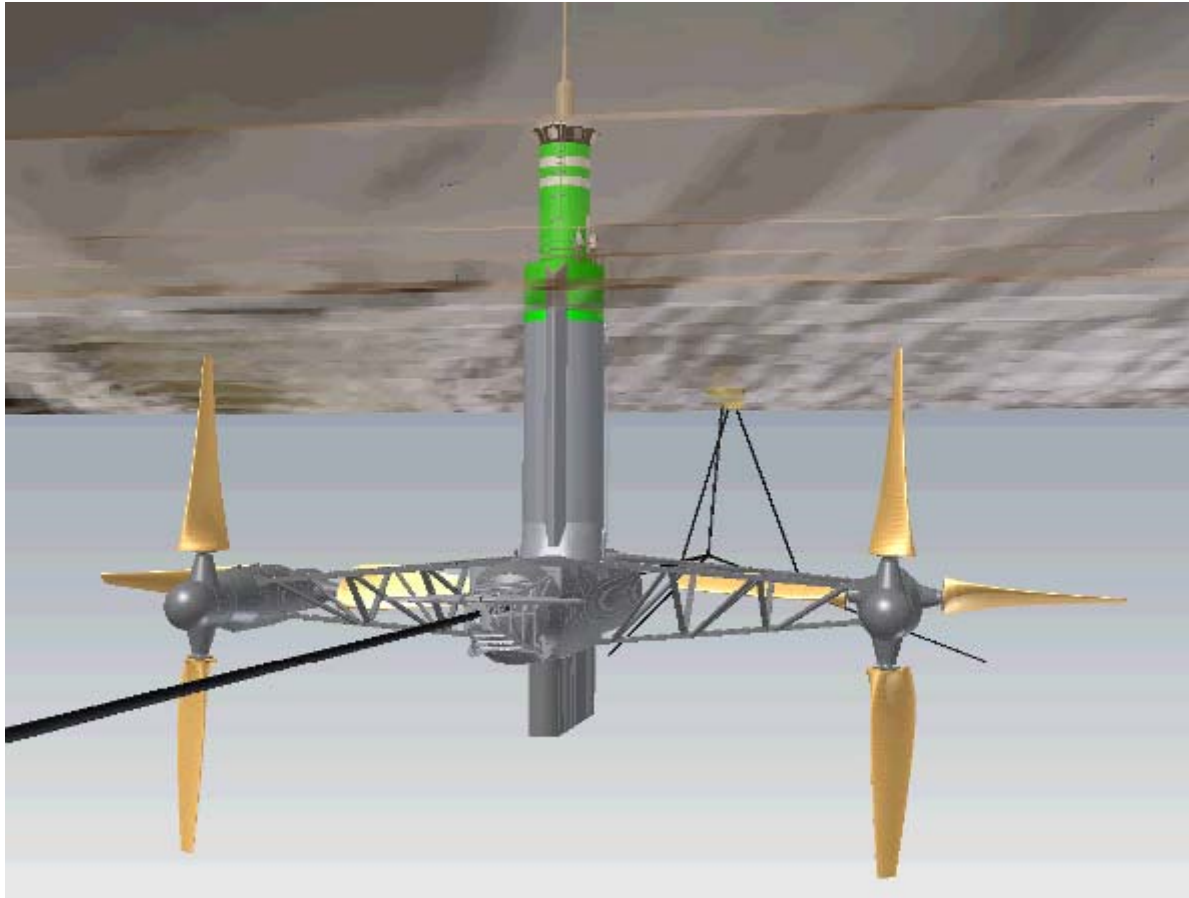
# Adhesives and glued products in Norway



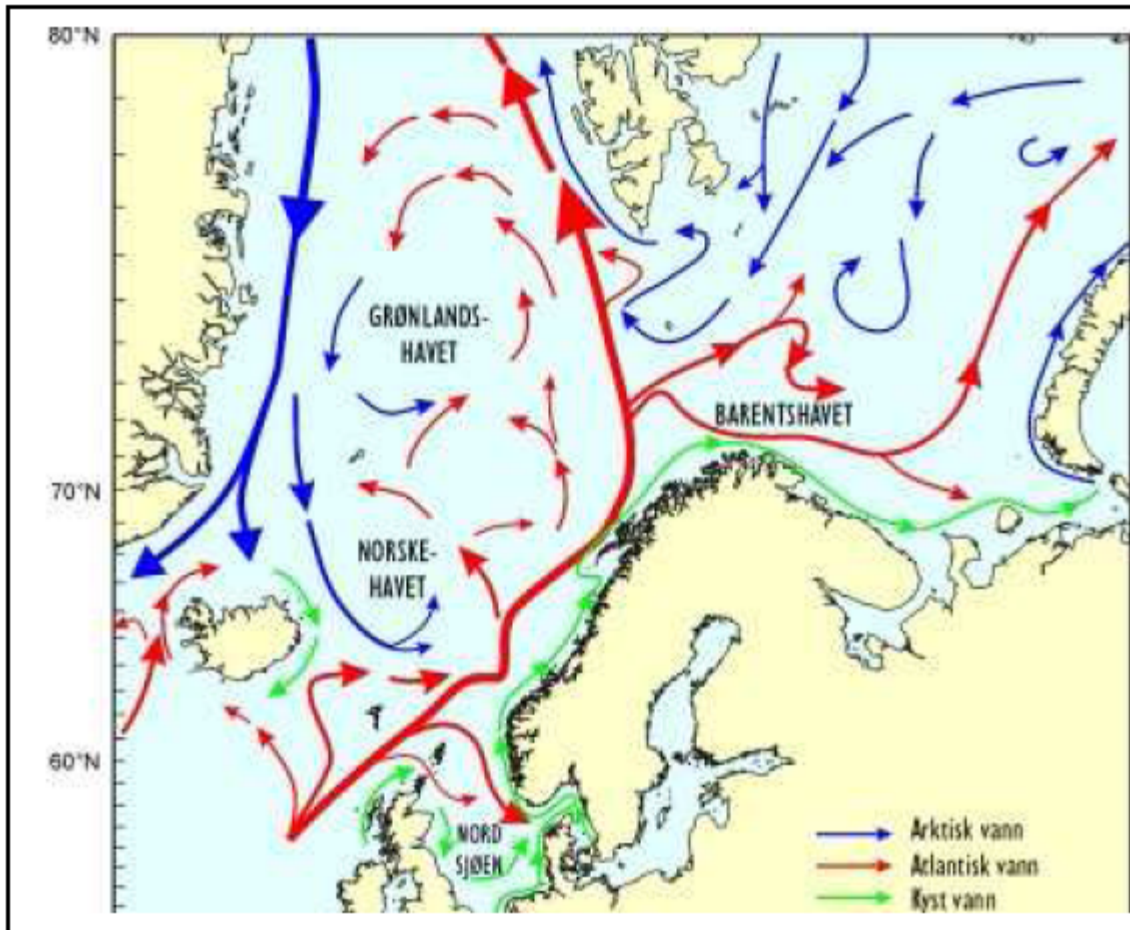
# Adhesives and glued products in Norway



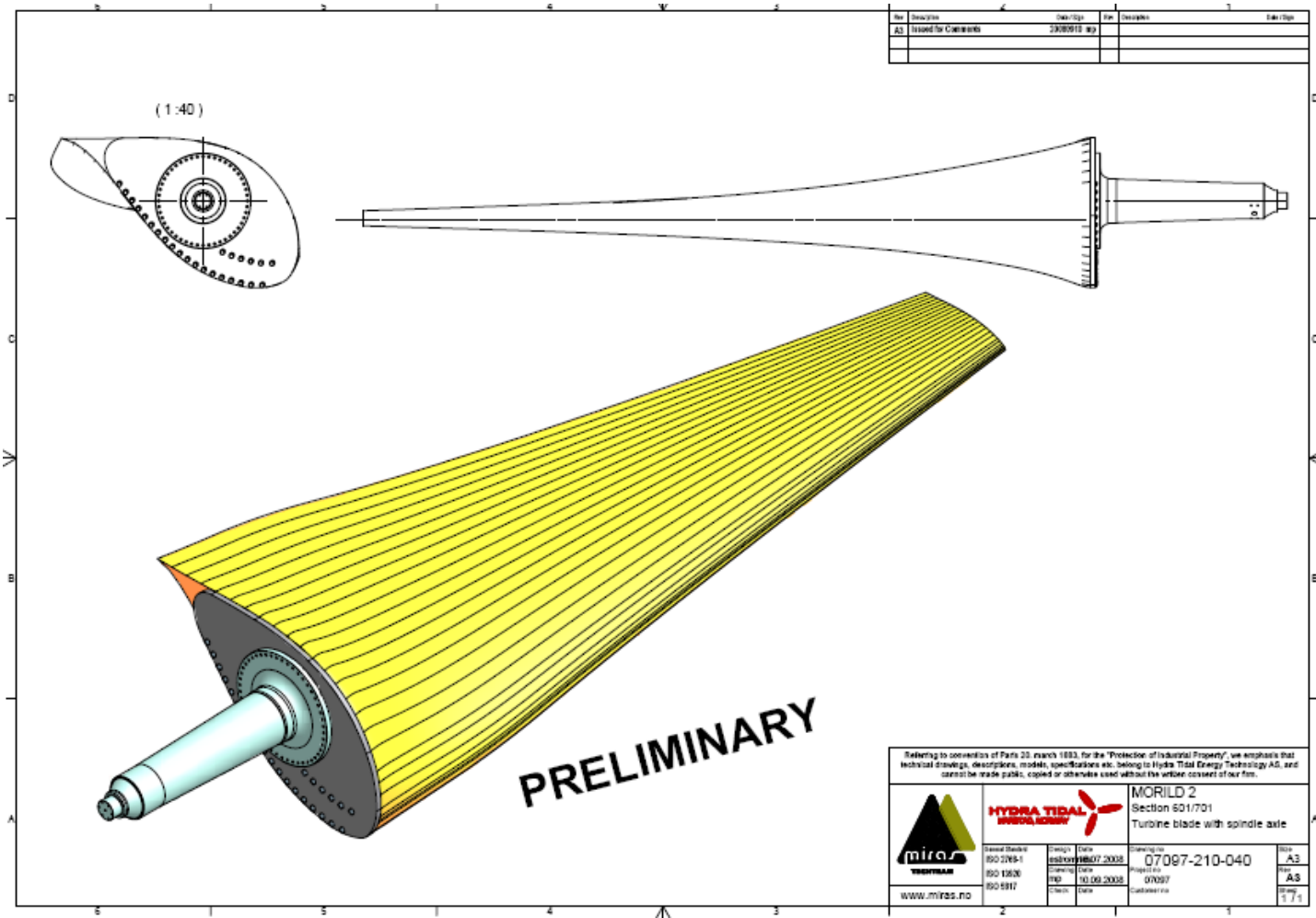
# Project Hydra – Power plants in the sea



# Project Hydra – Power plants in the sea



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# Adhesives and glued products in Norway



## Isolated posts

- Stricter requirements to isolation in outer walls.
- Different solutions to reduce the wood frame in width.
- Composite of wood and a better insulating material is an option.

# Adhesives and glued products in Norway



# Adhesives and glued products in Norway

## Laminated blanks for windows and doors

- Normally PVAc, PVAc with hardener and EPI.
- Adhesive class 1 (not exposed to weather) and 2 (exposed to weather).

**All adhesives in use need to be tested and accepted according to defined procedures.**

# Adhesives and glued products in Norway

## Solid timber elements

### Crossway gluing

- Lamellae in different numbers of layers are glued crossways to give a construction element.
- 1 factory in Norway using spruce, pine and impregnated pine.
- Adhesive type: MUF

### Using plugs of birch – no adhesive

- 1 factory – no formaldehyde emission

# Solid timber elements



# Solid timber elements



# Solid timber elements



# Adhesives and glued products in Norway

## Timber bridges

- A lot of timber bridges has been build the last years.
- The road authority is positive towards using wood in these constructions – both aesthetically and regarding costs.
- Beams are made of CU-impregnated lamellae glued together with a MUF adhesive, followed by an impregnation with creosote
- Some mechanical protection

# Evenstad bridge



# Nybergsund bridge



# Flisa bridge



# Adhesives

- **Testing**
- **Types and range of use**
- **Gluing conditions**
- **What can go wrong?**

# Adhesives - testing

- **Treteknisk is an accredited institute for testing of adhesives according to the relevant European standards.**
- **Covers load bearing and non load bearing products.**
- **Our customers are adhesive producers all over Europe.**
- **A Nordic expert group is responsible for a list of approved adhesives for structural use in the Nordic countries.**
- **MPA in Stuttgart and Treteknisk are the two main testing institutes in Europe (adhesives for structural use).**

# Adhesive types

## Load bearing constructions

- **PRF, RF, MF, MUF, PUR and EPI**  
In Norway: MUF for climate class 1, 2 and 3  
EPI for climate class 1 and 2.
- **EPI is in Norway used for finger jointing and for making beams and posts (1 factory).**
- **EPI has shown to have excellent properties regarding strength and water resistance. Short pressing times (30 min at 20 °C) – wood temperatures down to 0 °C.**
- **PUR is not used in Norway.**

# Adhesive types

- In Finland PUR is used making log houses.
- Trials with PUR gluing wet spruce are going on at the moment. The aim is to get a Technical approval for making posts and beams for structural use (not covered by EN-14080).
- You can find the Nordic list covering all the adhesives approved for use in the Nordic countries at: [www.tretekknisk.no](http://www.tretekknisk.no)

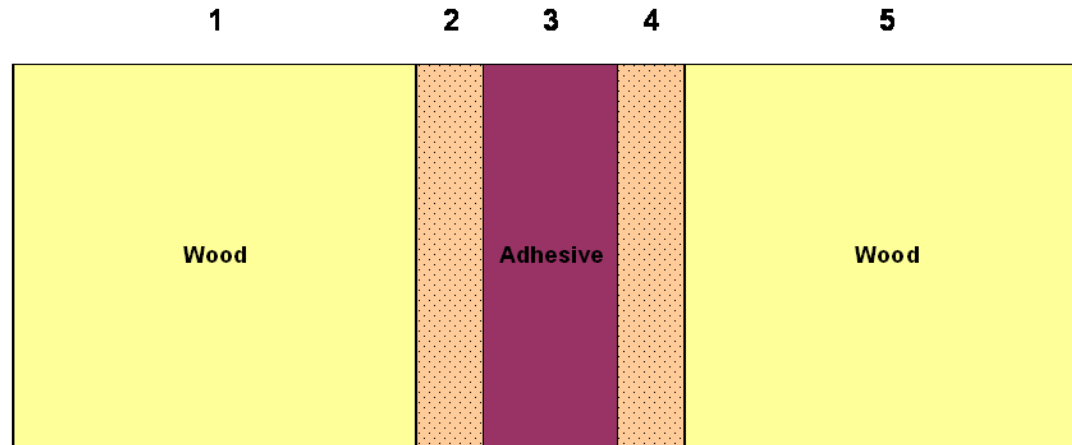
# Adhesive types

## Non load bearing constructions

- **Thermoplastics: PVAc, PVAc with hardener.**
- **Others: EPI (cold pressing). UF and MUF when using heat.**

# Gluing conditions

A bonded member can, regarding strength, be seen as a chain consisting of 5 segments



- 1 Wood strength
- 2 Strength in the transition zone
- 3 Adhesive strength
- 4 Strength in the transition zone
- 5 Wood strength

- To satisfy a strength requirement, all the segments need to fulfil the requirement.
- This places focus on: Wood surface and strength, adhesive penetration and adhesive strength.

# Gluing conditions

**If the bond quality shall fulfil a strength requirement, the following will be of importance:**

- **The use of correct wood quality.**
- **Freshly planed surface with sharp cutters. Gluing to sawn surfaces will give you reduced bond strength.**
- **Problems can occur if the density or the content of oil or resin is too high.**
- **The adhesive shall have sufficient strength properties and water resistance.**
- **Correct wood temperature and moisture content.**
- **Glue amount, pressure, pressure time, pressing temperature.**

# Gluing conditions

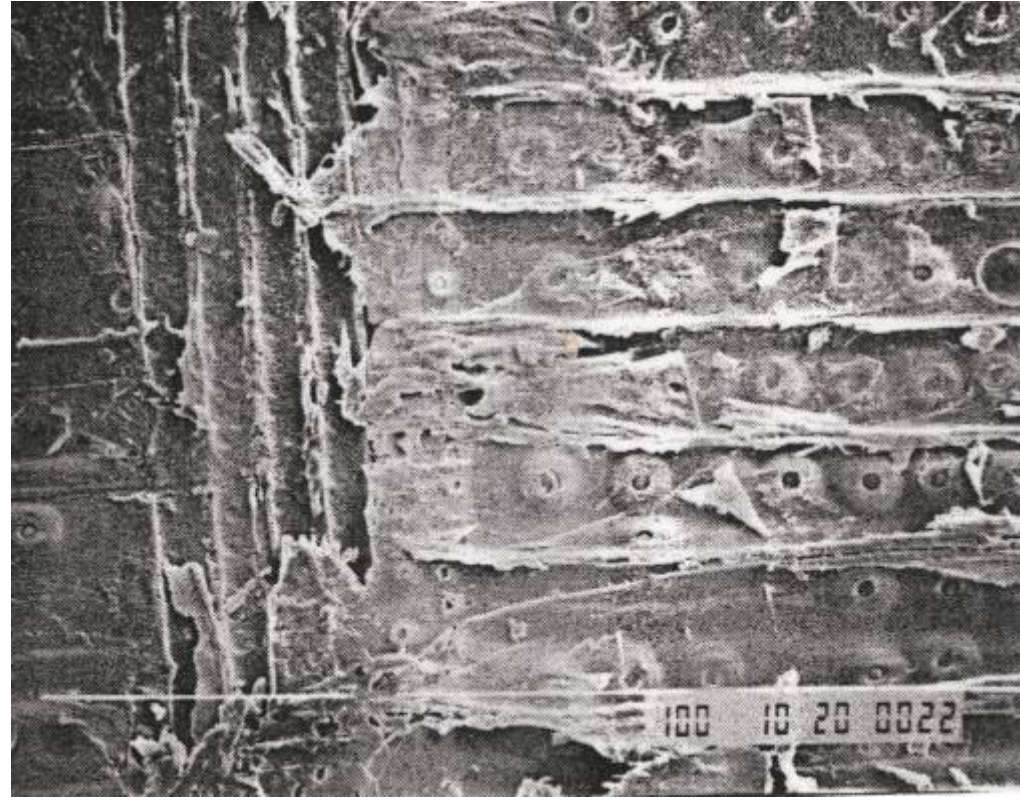
## Transition zone

- The adhesive need to penetrate sufficiently into the top cell layers. Important!

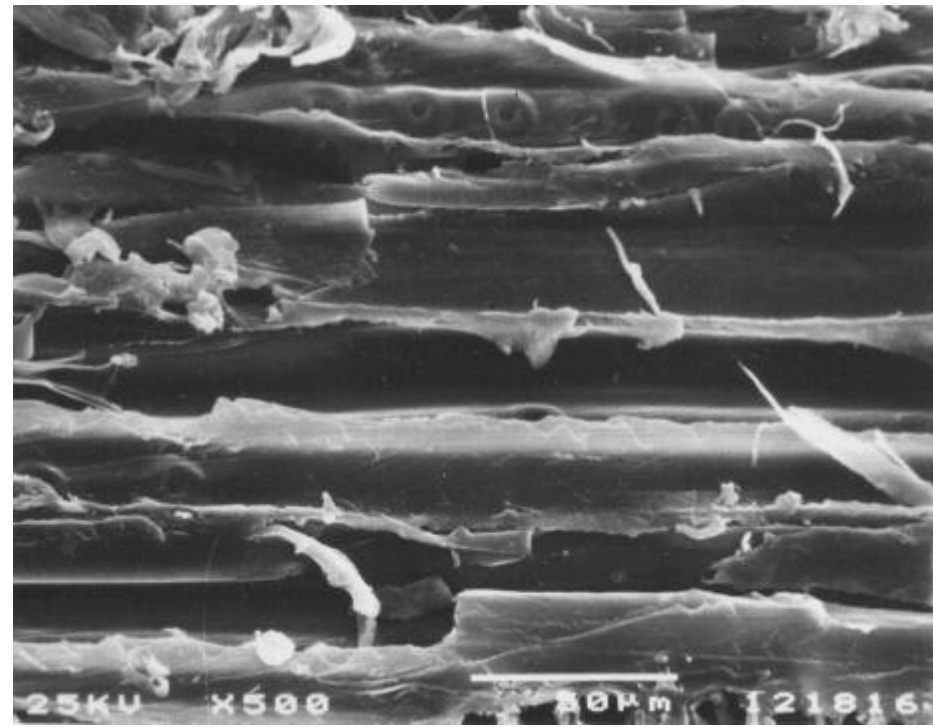
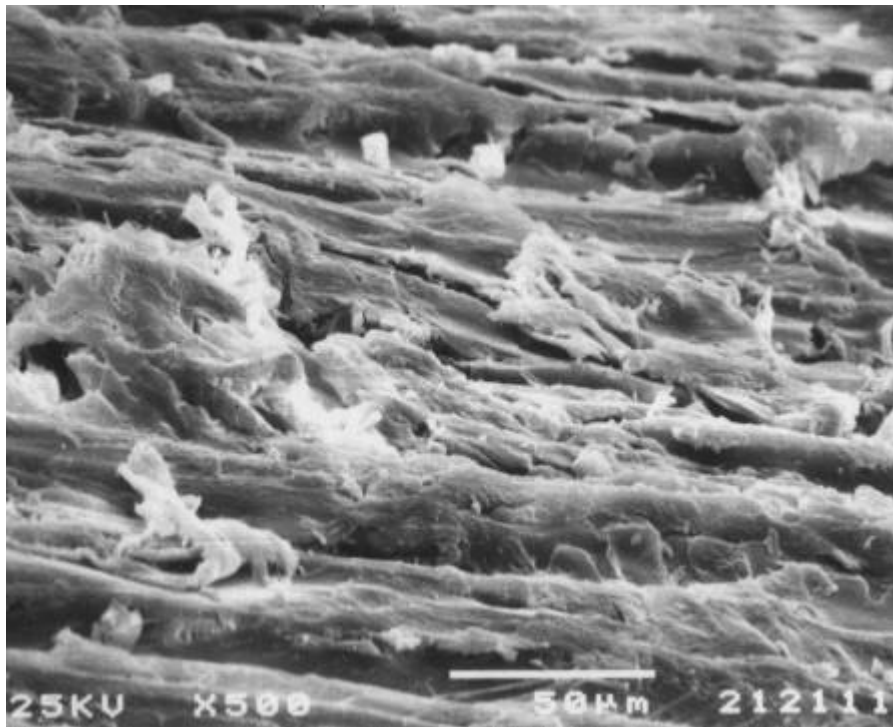
**To achieve this, the following is important:**

- High density wood can be problematic.
- Again: The wood surface need to be freshly planed with sharp cutters.
- Follow the requirements given by the adhesive manufacturer.

## Surface conditions – sharp and dull cutters



# Surface conditions – sharp and dull cutters



## Gluing conditions – wood surface

### Exposure to daylight after planing and before gluing

- Small overlapping test samples
- Spruce, pine and CCA impregnated pine
- Exposed in darkness (20/65) and in daylight behind a window
- Glued after 0.5, 3, 14 and 90 days
- PRF
- Annual ring orientation: Radial and tangential

# Gluing conditions

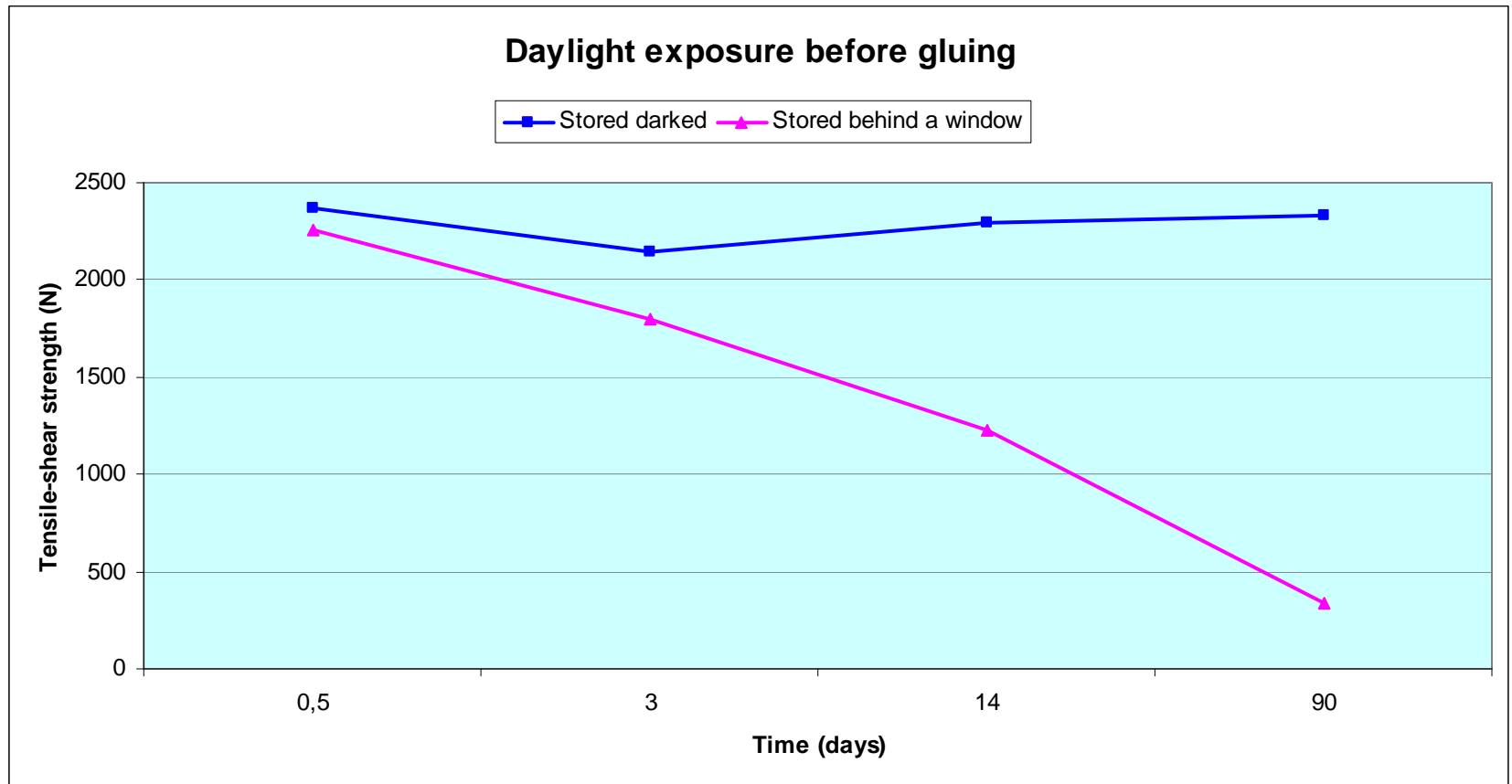
## Results

- **No significant difference between the materials or the annual ring orientation.**
- **Daylight exposure strongly influence the strength and the wood failure pattern.**

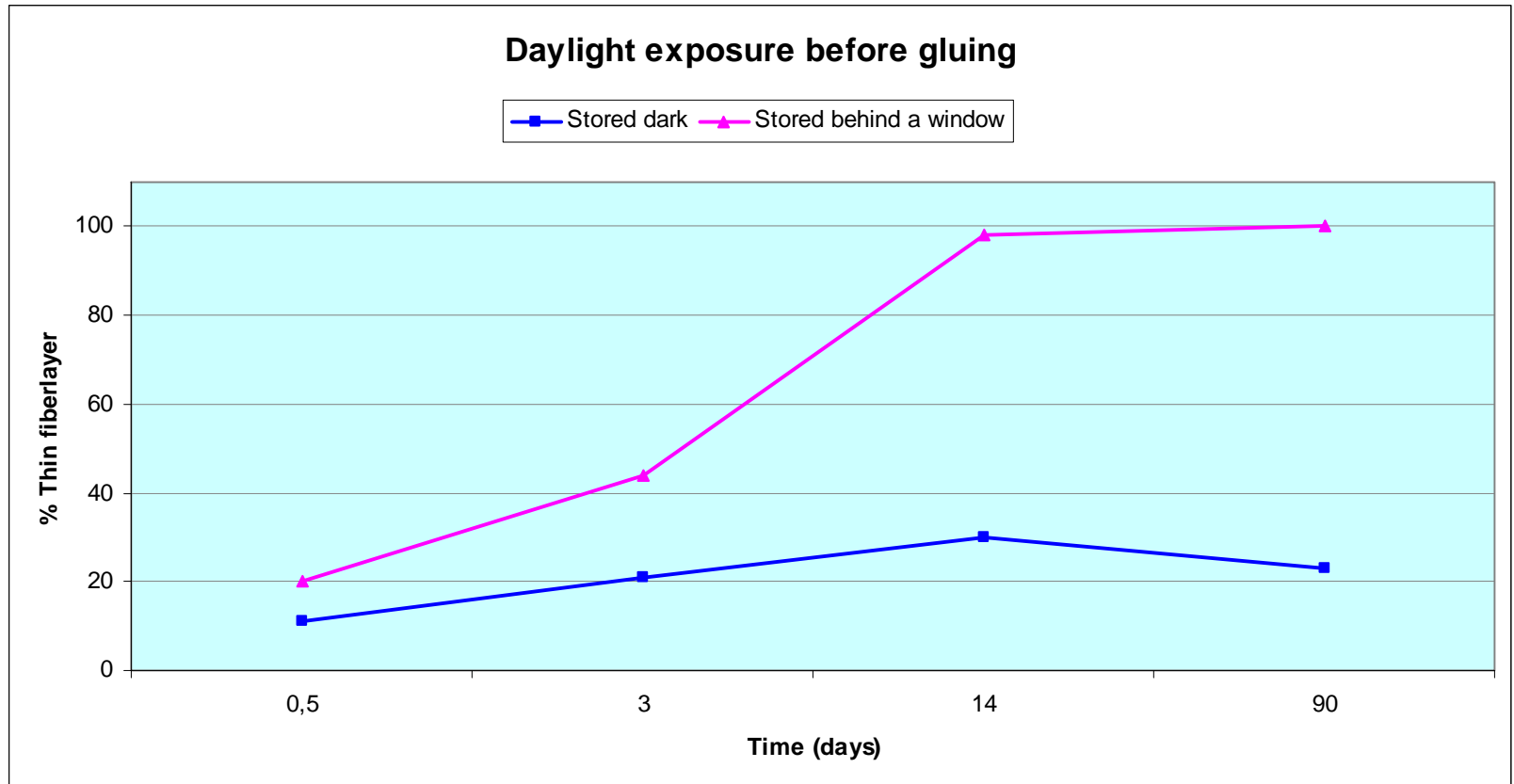
**The ratio between thin fibre failure and clean wood failure increases with increased exposure time.**

**Conclusion: Gluing needs to be done shortly after planing if not stored dark in a correct climate.**

# Gluing conditions



# Gluing conditions



# Gluing of modified wood

**Modification is first of all done to improve the dimension stability, but can cause gluing problems.**

- **Heat treatment**
- **Acetylating**
- **Furfural alcohol treatment**

**Testing is necessary!**

