

Glued Products of Scots Pine Timber

- presentations from the study tour in Trøndelag 12th – 14th April 2010

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Contents

Paper	Author	Title
	Peder Gjerdrum	Introduction and overview
1	Per Lind (keynote)	Adhesives and glued products in Norway
2	Erkki Verkasalo et al.	Pine timber with respect to structural glued products
3	Peter Wilson	New timber architecture in Scotland
4	Bernard Planterose	Nothwoods Construction, timber design
5	Sven Skatun	Nor-Build timber fabrication
6	Neil Sutherland	Post and beam architecture
7	Harald Landrø	TreSenteret (reference to homepage)
8	Tor Kjeldstad	Isn't it good? – on Kjeldstad laminated beams
9	Arne Steffenrem	High quality seed for better wood quality
10	Magne Joar Vandvik	Måsør timber bridge
11	Olof Broman	Scots pine for gluelam panels – a consumer perspective
12	(er Lind	The Norwegian Wood Technology Institute
13	John More	Napier Centre for Timber Engineering



Laminated timber used in a modern trade centre in Trondheim; photo: editor



Preface

A number of presentations were given at the GlueLam Study Tour in Trøndelag arranged by The Norwegian Forest and Landscape Institute April 2010 within the Developing the Scots Pine Resource project. The editor wishes to express his gratitude to all those who contributed to the outcome of the study tour: To the host businesses, to the participants and those giving presentations, and to Northern Periphery Program for contributing to the funding.

The presentations listed in this report has been collected, trimmed and otherwise slightly modified by the editor. However, the content as well as the layout have been the choice and responsibility of each author.

The report is intended for publication in electronic format on the project's web page and distribution to the participants. However, the report is public and free to use for anybody, provided a proper citation is given.

Overview of laminated pine timber products in Norway

Peder Gjerdrum, The Norwegian Forest and Landscape Institute¹

Introduction

Pine timber is a versatile material for a wide range of products, in everyday life as well as for rare occasions, for living houses as well as for artworks; in general, for the benefit of mankind. A crucial trait is the ability of joining solid wood specimens to obtain products with features beyond what can be done with timber made from any single tree. In particular, with gluing and lamination, we can produce stronger, thicker and longer specimens less prone to distortion. I am pleased to give this introduction to the *Pine GlueLam Study Tour* in the Trøndelag region of Norway.

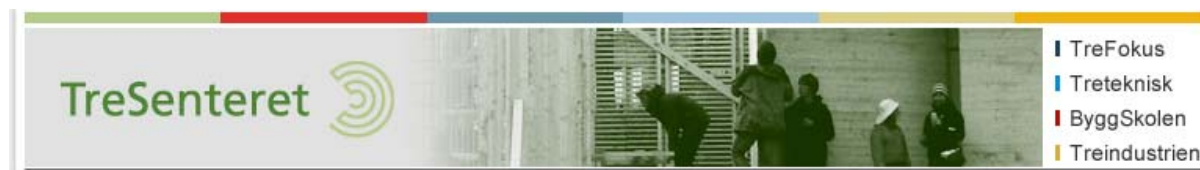


Typical Pine Silviculture in Norway: Natural regeneration (left); harvester thinning (right)

Research and education on timber and timber products

Fundamental research on forest and timber production is continuously being done at The Norwegian Forest and Landscape Institute, www.skogoglandskap.no. Located at the Ås Campus, together with Norwegian University of Life Sciences, www.umb.no, the institute's scientists participate in the university's educational program.

Education in building engineering, architecture etc. is given at Norwegian University of Science and Technology, www.ntnu.no. The university has established a dedicated centre for teaching in timber related topics, TreSenteret, www.tresenter.no. TreSenteret is even part of a joint national initiative to promote the knowledge and use of wood.



The participants share a common logo and have closely linked web pages. The other participants are: Treteknisk - Norwegian Institute of Wood Technology, a research and competence institute for the timber industry; TreFokus, the industries body for providing information and promoting the use of timber towards professionals and general public; ByggSkolen, providing continued education to operators in the timber and building industries; and Treindustrien, coordinating the timber industry's legal responsibility and contact with labour unions, public authorities, etc.

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Gluing – a converging process

Gluing is about joining two surfaces by means of the glue, about the chemical interaction between the glue and the wood. The chemical part is related to wood-water reactions, and to wood modifications which frequently employ chemicals. It is also related to painting, i.e. to the surface treatment bound to the wood. Only the purpose is strictly different: Gluing is done to join small wood pieces into bigger ones.



*Primary breakdown (left)
- a diverging process: one → many*



*Gluing (right) – a converging
process: many → one*

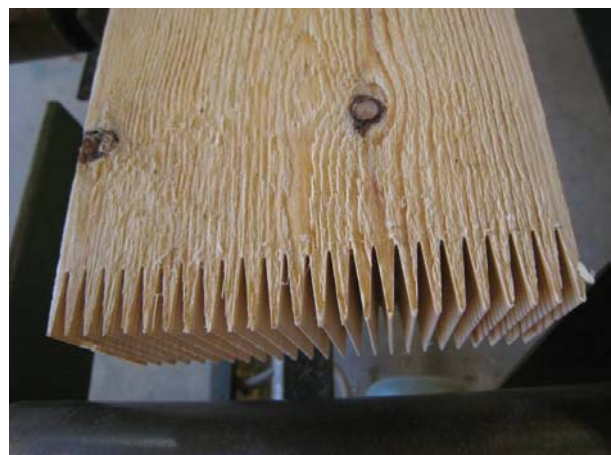
There certainly exist other methods for joining wood pieces: nails and dowels, and the innovative procedure of 'welding' green wood by friction. Such methods will not be covered in this report.

Further, several glued wood products are beyond the scope of this report, so for plywood, particle boards, and finger jointing (other than in combination with lamination).

Some typical GlueLam products

Finger jointing

can be used as a stand-alone process to produce long-length beams or beams of 'infinite' length for cross-cutting to certain lengths. In this report, finger jointing is



considered the base of other gluing and lamination procedures, to have suitable length for all specimens in the final product. Finger jointing can be done for all board sizes, and with vertical (*right picture*) or horizontal (*left picture*) fingers.

Structural use indoor

GlueLam beams for structural use are typically produced from softwood timber, either spruce or pine. The beams might be straight or curved, and are used in all kind of constructions. Laminated members demonstrate very favourable strength-to-weight ratio, can be used to bridge huge spans, and are extremely fire- and heat resistant. In case of fire, the surface will just be reduced to a protecting layer of carbon.



Pictures:

The Viking Ship Arena, (left) http://en.wikipedia.org/wiki/Vikingskipet_Olympic_Arena

Large, open industrial hall (right))

Structural use outdoor

For outdoor use laminated beams are typically impregnated to improve durability. While spruce is more common for indoor structures, pine must be used to have an efficient preservative penetration.



Pictures:

CCA treated laminated beams after ca. 20 years direct exposure (left)

Creosote treated laminated power-line poles (right)



Wooden bridges

are highly engineered timber constructions produced for extremely long service lives (several decades). The process for producing impregnated, structural gluelams requires several steps (some steps might be optional):

1. sawing
2. kiln drying
3. machine strength grading
4. water-dissolved preservation
5. kiln drying
6. finger jointing each lamellae
7. planing each lamellae
8. gluing and curing
9. planing the gluelam beam
10. creosote preservation
11. furnishing of essential parts (copper fittings, asphalt)



Glued boards for appearance

Rough pine timber are regularly resawn, planed and glued to panel boards, furniture parts, DIY boards etc. Reaswing might be done after gluing. The boards might be finger jointed, edge- or flatwise glued, or edgewise glued and then laminated. The objective is to have wide and homogeneous boards and prevent distortion.



Pictures: Typical pine boards for appearance applications

DIY panel board (left)

Stairs, railings and a door (right)

Timber for insulation, structure and appearance – at the same time



Traditionally, loghouses were built of roundwood, adapted to each other and interlocked, i.e. without gluing. The logs provided the structure of the house as well as heat insulation and the visual surface of the walls. Modern loghouses are built in a similar manner; only today glued logs are preferred to have a more homogeneous material with no cracks and distortion (*picture to left*).

An 'engineered' equivalent is found in massive timber buildings (*pictures under*). Boards, usually basic quality softwood boards, are connected in cross-wise layers. More layers can be added for thicker elements, and appearance or durability criteria might be added for interior or exterior surfaces. Nails, dowels or glue are used for lamination. The elements are used for structural as well as non-structural walls, and for floors and roofs.

This way of building has gained rather some attention, and a separate handbook is available to promote the application (see References).



Literature and textbooks

Many innovative glued timber products have first been introduced in North America. Consequently, many important textbooks have been published in the English language. Two examples are given here, the first on engineered wood, the second a general handbook with several chapters dedicated to gluing and glued products.

Smulski, Stephen (ed.) 1997: Engineered Wood Products, A Guide for Specifiers, Designers and Users. PFS Research Foundation, Madison, 294 p + appendixes. ISBN 0-9656736-0-X

Wood Handbook, Wood as an Engineering Material 1999. Forest Products Society,, Madison. ISBN 1-892529-02-5

For the Nordic audience, a Gluelam Handbook is available, resulting from a joint project with Norwegian, Swedish and Finnish participants. The handbook is available online in English as well as native languages.

Gluelam is mainly produced for structural use. Massive Wood Elements, on the other hand, generally serve several purposes: structural, insulation, appearance, etc. Such elements (produced from generally basic quality boards by gluing, stress lamination, nailing) have gained in popularity the last few years. A comprehensive handbook is available in Norwegian; similar book might be found in other languages.

Gluelam Handbook, printed version (Norwegian) 2002, ISBN 91-631-1454-2; online version at www.svensktlimtra.se/en/limHTML

Håndbok - bygge med Massivtreelementer (Handbook – building with Massive Wood Elements 2006. Treteknisk, Oslo. ISBN 82-7120-000-3. Major part available (in Norwegian) at www.treteknisk.no