

# Swedish glulam

New possibilities for halls, arenas, commercial buildings and bridges



Public swimming pool

## Modern glulam technology

Wood is one of the oldest construction materials in the world. Buildings, bridges and ships have been built in timber for many centuries. No other material has such a wide range of uses. Glulam – glued laminated timber – opens up still further possibilities for wood building technology.

Glulam technology was developed in Germany at the end of the nineteenth century and came to Sweden at the beginning of the twentieth, where the world's oldest glulam factory, Töreboda, is still in use today. Swedish production has increased continuously to a current

level of about 150 000 m<sup>3</sup>. Glulam has many applications: schools, sports halls, railway stations, industrial, agricultural and commercial buildings, shopping centres, bridges and even homes.

Glulam consists of individual laminates of structural timber, providing a highly effective utilization of the raw material. The laminates are finger-jointed to give greater lengths and then glued together to produce the desired size. Little energy is needed for the manufacture of glulam, and, due to the production technology, very large structural components are possible.

Glulam has greater strength and stiffness than structural timber of similar dimensions. Glulam also has a better strength to weight ratio than steel. This means that glulam beams can span large distances with a minimal need of intermediate supports. It also means architects and engineers have virtually unlimited possibilities when designing their own constructions in glulam, whether the task is a small house, the roof of a department store or a road bridge.



Glulam bridge for road traffic in Virserum



Glulam bridge by Döda Fallet in Jämtland

# Structural design

The **glulam technology** allows the manufacture of thick, wide and very long components; not just simple straight glulam elements, but curved elements too. Straight beams are manufactured with a constant cross-sectional dimension, mono-pitched or double-pitched. For larger buildings, two or three pin trusses, portal frames or arch frames of glulam components are suitable.

Portal frames can have curved or finger-jointed haunches. Glulam beams can be arranged in the form of a grid. Shell structures provide a wide choice of advanced forms free from columns. There are also many complex structural systems, e.g. arch and beam frame. One advantage is that all glulam components can be made in the factory in suitable



A glulam structure during the building phase

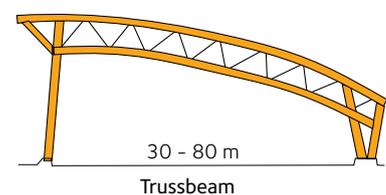
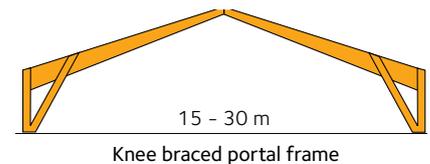
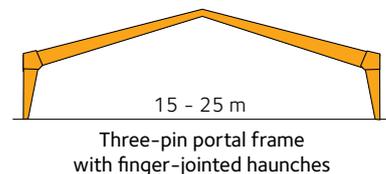
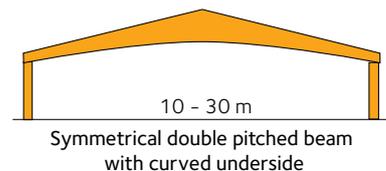
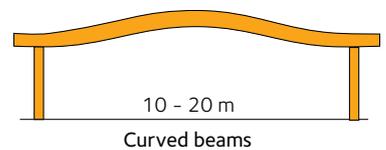
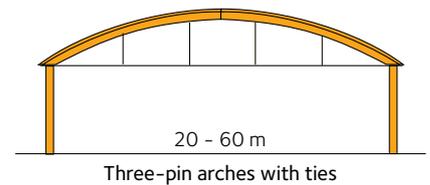
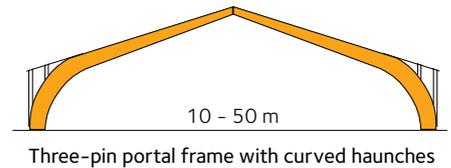
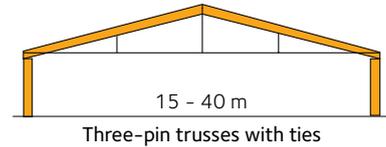
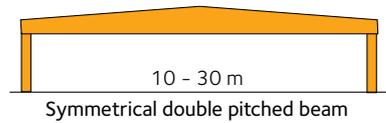
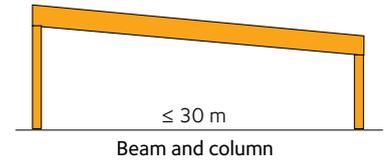
sections for transportation, and then assembled on the building site. Glulam is an exciting construction material, partly because it lends itself so well to curved forms, such as arches, frames etc., and partly because its strength is particularly favourable for large spans. Free spans of over 100 m have been built.

**Modern gluing technology, in combination with timber's good strength qualities, makes glulam a highly effective structural material with a unique series of characteristics:**

- An appealing aesthetic appearance which acts as a valuable addition to the interior and exterior environment.
- A high strength to weight ratio, enabling wide spans.
- Small manufacturing tolerances and good form stability within normal temperature and moisture conditions.
- High resistance to fire – often a requirement in public buildings.
- Good heat insulating characteristics, reducing the effect of cold bridges and the risk of condensation.
- Low weight, resulting in low transport and erection costs and reducing the cost of foundations.
- Long life in chemically demanding environments.
- Flexible production, enabling curved structural components to be produced at lower costs than other materials.



Copperhill Mountain Lodge in Åre





*Detail of connections, Universeum*



*Universeum, a science discovery center in Göteborg, Sweden.*

## Architectural design and construction

**No other building material** can be compared with glulam for expressing architectural or structural possibilities. Leading architects all over the world have demonstrated their credentials with spectacular glulam constructions. When dealing with wide spans, glulam products are the best choice for framing.

The possibilities for different architectural and technical design solutions can

be cost-effective. Glulam structures can be erected quickly and simply by using prefabricated units. The parts are assembled by nailing, screwing or bolting, unaffected by the time of the year or the weather, and any adjustments can be made with simple hand tools. A glulam frame can carry its full load immediately after the assembly. It is a well-tested building material which, correctly used, has extremely good durability.



*Shopping mall*

# Glulam

**Glulam** is the term used for beams, arches or columns consisting of several laminates of timber arranged parallel to the longitudinal axis of the member; the individual pieces being assembled with their grains approximately parallel and glued together to form a member which functions as a single structural unit.

In elements of this type, any characteristics or features, such as knots, which may exist in the individual laminates, are equally spread, unlike a solid timber element from the same species. Furthermore, when using glulam it is possible to obtain larger cross-sectional dimensions and longer lengths than solid construction timber.

**Certified glulam** is the accepted term for glulam with at least four laminates, that has been manufactured, controlled and marked according to certain rules. Swedish glulam complies with the requirement in the European standard EN 14080 Timber Structures – Glued laminated timber – Requirements. This European standard specifies the requirements for glued laminated timber products for use in load-bearing structures, and deviations from target



CE marking

size corresponding to tolerance class requirements of EN 390. Certified glulam is marked in accordance

with the standard.

Swedish glulam producers are certified in accordance with ISO 9002.

Glulam that has been manufactured in accordance with the rules given in national or European codes, is graded in **strength classes**.

The appropriate class is determined by the strength of the timber used and its position in the cross-section. The strength and stiffness values of the various strength classes are then given in the code. Glulam manufactured in Sweden corresponds to strength classes in accordance with Eurocode 5. Glulam manufactured by other methods than according to the regulations contained in the codes, e.g. with a different layup of the cross-section, can be used structurally if it is an approved product.

**The glue** used in glulam manufacturing has documented high strength and durability under long-term loading. Only glues of which the industry has long-term practical experience are used. The formal requirements are given in EN 301, which classifies two types of glue: I and II. Glue type I may be used for glulam construction in any service class, while glue type II is for limited use. A list of approved glues is kept by the national glulam control boards.



## Glulam production standards – stock sizes

Straight glulam components of rectangular cross-sectional dimensions are normally made of 45 mm thick laminates in widths corresponding to the sawmills' standard range. After planing of the sides, the finished width is a few millimetres less than the width of the laminates. The exact size depends on whether the sides are planed.

The following sizes, in mm, are in stock and should be the first choice, especially if only a few beams are involved. The sizes apply to components with planed surfaces at a moisture content of 12%.

Other dimensions are also available since Swedish glulam manufacturers can adapt their production to both the international and Swedish market.

### Thickness x Width

90 x 90	90 x 405
115 x 115	90 x 450
140 x 135	115 x 180
140 x 140	115 x 225
160 x 160	115 x 270
165 x 165	115 x 315
42 x 180	115 x 360
42 x 270	115 x 405
56 x 225	115 x 450
56 x 270	115 x 495
66 x 270	115 x 630
66 x 315	140 x 225
90 x 180	140 x 270
90 x 225	140 x 315
90 x 270	140 x 360
90 x 315	140 x 405
90 x 360	

## SWEDISH WOOD

part of the Swedish Forest Industries Federation

**Swedish Wood** spreads knowledge, provides inspiration and encourages development relating to wood, wood products and wood construction. The goal is to increase the use of wood in Sweden and in selected international markets through information and inspiration.

Swedish Wood is a department within the trade and employer organisation the **Swedish Forest Industries Federation**. Swedish Wood is supported by the Swedish sawmill sector.

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