INFORMATION SHEET

STRUCTURAL MATERIALS

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GLUE-LAMINATED TIMBER
USES

The information provided below has been taken from the New Zealand Timber Design Guide 2007, published by the Timber Industry Federation and edited by Professor A H Buchanan. To purchase a copy of the Timber Design Guide, visit www.nztif.co.nz

Glulam can be used as the primary structure for almost any type of building, bridge or other structure. Construction options in glulam vary according to the structural needs and the use of the building.

BEAMS AND COLUMNS

Simple straight beams are used for many structures from small domestic lintels, rafters or ridges spanning only 3m, to large industrial structures or bridges over 30m span. Simple span beams can be individually cambered to assist in achieving the most cost effective section where deflection governs the design. Many manufacturers carry a range of stock laminated beams with a standard pre-camber of 1/400.

CURVED BEAMS

Curved laminated beams can provide solutions that are either aesthetic or functional. The elegance and flexibility of glulam beams are well recognised from curved roof forms to spiral stair stringers. The ability to curve large span industrial roof members also means a low pitch gable roof can be economically provided using a slow curved “cranked” or “pitch-tapered” beam (minimum radius 10 m). These beams follow the roof pitch on their top edge while the underside forms a radius curve. In this way laminated beams conveniently taper from maximum depth at the apex to a minimum end section. Curved beams of any shape are possible in glulam.

PORTAL FRAMES

These fall generally into three categories that relate to the way in which the moment resisting knee areas are provided.

(a) Gusset portal frames

Gusset portals typically consist of rafter members and two columns. The rafter may be a continuous cranked member, or two straight beams with a gusset apex. The knee joint between the column and rafter is achieved by nailing a moment-resisting gusset to both sides of the joint. The most economic method uses specially designed plywood gussets. Some situations require the use of predrilled steel plates which are usually more expensive than plywood. Composite ply-steel joints have also been used to handle the large stresses in spans up to 40 m while allowing the convenience of nail gun fixing. Because of their lower labour content they are a more cost efficient solution than drilled steel plates. All nailed gusset joints should be individually designed with special care given to nail spacings and alignments. Gusset portal frames have been proven cost competitive in spans from 12 to 40 metres.

(b) Angle knee portals

Angle knee portal frames have interlocking glued knee joints combining the best in appearance with economic erection. The build-up of interlocking rafter and column panels means that the column section is wider than the rafter. Tapering members provide cost efficient design and attractive appearance. Supplied to the site in two halves these frames require only pinned base and apex connections to complete the erection. With a sanded and stained finish these portals enhance the appearance of any community building, or with a utility finish they are economic in industrial structures. Limitations of transport involving over width loads can make these portal sections more costly than the gusset portals.

(c) Curved knee portal frames.

Curved portals achieve effects that uniquely express the versatility of glulam. They represent the top of the line in portal construction. The laminations run continuously from base to apex and give a clean sweeping appearance. Open-knee curved portals are the most economic allowing the curved knee section to follow parallel lines between tangent points. The open-knee portal design has been found to provide cost efficient structures even for industrial and utility buildings. Solid-knee curved portals have a radiused internal knee section while the outer faces are straight. Reverse curved portals produce an elegant "swan neck" sweep with individual laminations curving in two directions. This most attractive portal has been used in churches and halls. Particular attention needs to be paid to the radius of curvature chosen for the knee area. The use of ex 25 mm laminations allows a radius of 2.8 m-3.8 m to be used. Smaller radii can be used but they will involve thinner laminations and therefore greater costs.

ARCHES

Glulam arches can be radial, elliptical or parabolic. The arch form has long been recognised as proving the most economical support structure for uniformly distributed loads. Glulam arches are a low cost, highly efficient structural form. They are well suited to achieve large, unobstructed, clear span enclosures, and can be used for a variety of buildings such as aircraft hangars, sports stadiums, and storage buildings.

FLOORING

Glulam timber decking for floors and ceilings serves as a structural component and at the same time forms an attractive exposed surface when viewed from above or below. Laminated timber flooring panels are available in several appearance grades. As a structural floor they are able to carry normal loads up to 8 metres without support, depending on the thickness and span. Decking panels are made up in sections approximately 300 mm wide and in lengths to suit building dimensions. The underside usually has chamfered edges, producing a "V"-ed appearance at the joins, for a completed ceiling. Glulam flooring has an intrinsic fire resistance rating with no extra protection, as shown in Table 1. Refer to NZS 3603:1993 Section 9 for detailed fire resistance requirements. Glulam flooring is particularly suited to mezzanine floors in factories, offices, hotels, sports halls and domestic dwellings. This is especially so where height restrictions limit available space. It is important to keep this material dry at all times during construction. Dimensional instability can occur if the flooring is allowed to absorb moisture in which case shrinking and splitting may result once the area has been fully enclosed.

Table 1: Fire resistance of glulam flooring, computed from Section 9 of NZS 3603:1993

Thickness (mm)	Fire resistance (hours)
65	0.5
90	1
115	1.5
135	2

BRIDGES

Glulam bridges can be manufactured in many sizes and shapes including straight beams and curved arches. Glulam bridges have been used extensively for both pedestrian and vehicle traffic. Advantages of glulam bridges are light weight, easy assembly, corrosion resistance and low maintenance.

SCAFFOLD PLANKS

Glulam scaffold planks essentially consist of thin glulam beams used on the flat. Glulam scaffold planks are light and durable, and have reliable strength under impact and long term loads.