



AHEC Europe
Unit 20.1,
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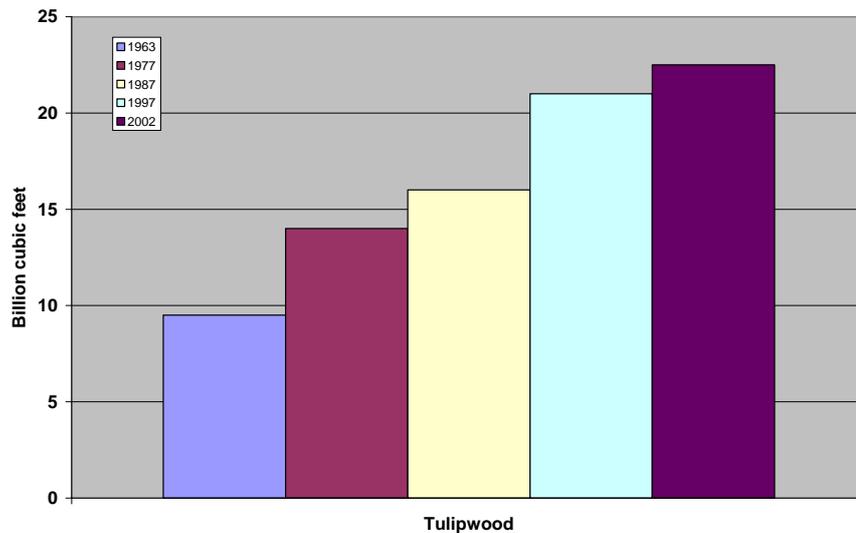
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TULIPWOOD AT THE LONDON DESIGN FESTIVAL

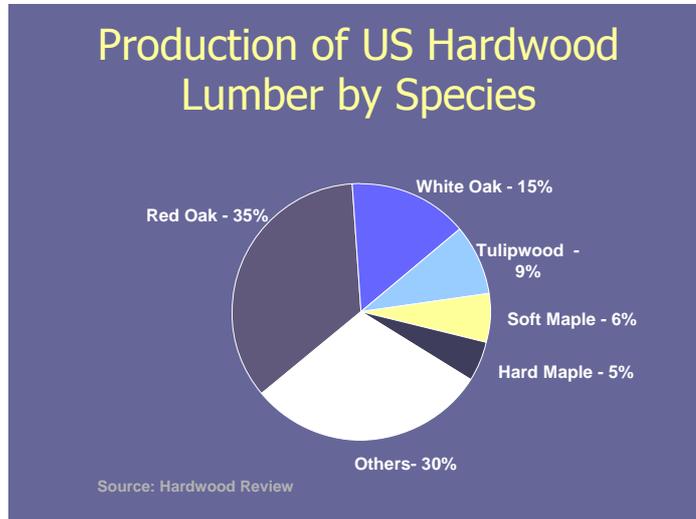
“A high profile project with one of the UK’s leading architects, David Adjaye, has put American tulipwood into the spotlight. Adjaye’s tulipwood pavilion is a major feature of the 2008 London Design Festival, taking its place on London’s South Bank for the duration of the Festival. Named by the architect “Sclera” the pavilion’s design is innovative and, appropriately, eye catching. And Adjaye’s preference for tulipwood is a bold choice, marking the start of what may be a new era for this prolific, strong and versatile timber.”

Tulipwood is an odd species. Odd because it is native to North America and widely distributed, but was eliminated by the last ice age in Europe, evidenced by fossilised pollen. As one of the most prolific seed producers of all temperate hardwoods, tulipwood is as sustainable as any other grown in the USA. An annual seed fall of 741,000 to 1,482,000 per tree or 300,000 to 600,000/acre is not uncommon. (Burns and Honkala: 1990) Thus the growing forest stock has been increasing continuously since 1963 when measurements, required by US federal law, began.



Tulipwood growing stock on Eastern Timberland, 1963 – 2002
Source: J L Bowyer 2004

Tulipwood (*Liriodendron tulipifera* of the Magnoliaceae) is also oddly named. Usually called Yellow Poplar or Tulip Poplar in North America, it is known internationally as tulipwood so as not to confuse it with *Populus* species such as Aspen and European Poplar which are much less hard. It is the fourth single most plentiful species growing in the USA, accounting for 9% of the hardwood lumber production, after the Oaks.



US Hardwood production by species
Source: Hardwood Review 2008

Tulipwood offers strong performance credentials where strength, lightness, machinability and long lengths of completely clear lumber are required. Its ability to accept treatment for exterior use is another major advantage. So when it came to the notice of David Adjaye, looking for a suitable material for his “Sclera” pavilion at the 2008 London Design Festival, tulipwood made an interesting choice. “Sclera” is an elliptical 12 x 8m wooden outdoor pavilion located near the Thames on the Southbank Centre Square, open to the public 24 hours a day for the festival.

And here lies another oddity. Italian and British woodworking industries, largely dependent on imported hardwoods, have long used tulipwood in interior joinery and furniture. But European architects generally seem less familiar with this useful and highly competitive species. The American Hardwood Export Council (AHEC) has been trying for many years to change that. It completed treatment testing, initiated in 2000 with BRE, and is now cooperating in ongoing treatment research to meet European standards with specialists Osmose. They have carried out some preliminary trials to determine the potential for using a variety of treatment processes, including some new technologies, to enhance the already strong performance characteristics of tulipwood.

Osmose state that “these trials have clearly demonstrated that tulipwood is both readily treated using modern impregnation techniques and is strongly predictable in its retention of treatment chemicals on processing. Both of these characteristics are important in that they show that this species may be enhanced readily and in a cost effective manner, and that the end product will be consistent in its properties and so more readily adopted by specifiers and users alike for a range of service applications.” Osmose and AHEC will be building on these initial, promising results through a joint product development programme aimed at producing a range of processes which will both add value to tulipwood and enhance its appeal to the wider market. David Adjaye has taken an important lead on this which is well demonstrated by his pavilion. He is said to have been fascinated by the uniqueness of tulipwood’s light colour as well as its flexibility strength and attractive grain. He also appreciated that it is widely available, and bearing in mind that this particular species has been primarily used in the past for indoor applications, he was eager to participate in the experiment to use it for his outdoor project. For reliable weather and timber preservation in this case the tulipwood components were sprayed with a primer - Remmers “Primer GN” and then the surfaces were treated with a Primer Oil, manufactured by OSMOSE, in a dip tank. Longer elements however had to be painted.

Working with BRE, tulipwood was put through structural and strength testing by BRE on behalf of AHEC in 2001, and their data showed that it has tensile strength and stiffness characteristics



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comparable to oak and remarkable strength to weight ratio. Except for density, BRE concluded that tulipwood met strength class D40.

Conclusions

1. It is clearly shown that American Yellow Poplar meets the strength and stiffness requirements of strength class D40. However, the density is well below that required for full compliance with this strength class. This justification has been based on EN408 for testing, BS5756 for visual grading (TH1 visual grade) and EN348 for analysis.

2. This Tulipwood clearly has an excellent strength and stiffness for its weight, this may make the timber of importance for structural applications where self-weight of the structure is critical.

3. This timber cannot make the current EN338 strength classes and therefore EN1912 because of the low density. Therefore engineers wishing to design structurally with tulipwood should refer to the full research published in AHEC's 'Structural Design in American hardwoods' guide. (BRE, 2001).

According to David Venables, European Director of AHEC, "Considering the density of tulipwood, engineers at the contractor fabricating the pavilion, Hess Wohnwerk in Germany, were amazed by it." Tulipwood has an average density of around 449kg/m³ at 6% moisture content (MC) although this can vary according to provenance and growing site conditions. In practical terms, tulipwood supplied to the UK will condition to higher ambient moisture content, probably closer to 10% MC. However this relatively low density compares with Oaks ranging from 670 to 770kg/m³ at 6% MC and thus the excellent strength to weight ratio.

While the length of wood posed practical treatment processing problems for the fabricators in this one-off project, partly due to time constraints, tulipwood's major advantage is its length availability. The tree is one of the tallest growing temperate hardwoods. In forests it stands very straight, tall and clear of lateral branches for a considerable height. On the best sites it can reach 200ft (61m) with 8ft to 12ft (2.4m to 3.7m) diameter at breast height (dbh), although an average height is 100ft to 150ft at maturity. Growth is prolific, culminating at 70 years with annual increment of 5m³ to 11m³ per acre per year. (Natural death occurs usually at 200 or more years.) This produces long lengths of clear sawn lumber in wide boards, free of defects such as knots, which is so important in David Adjaye's pavilion. This weight issue was also a key element for the 910 "hanging boards of the spatial interior design".

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Notes to Editor:

American Hardwood Export Council

AHEC, provider of the tulipwood for this project, is the leading international trade association for the US hardwood industry providing technical research, information and inspiration to architects, designers and construction professionals.