Materials

Timber, as a natural material, is inherently variable, even within a single species. Strength grading of softwood and hardwood overcomes this, by assessing the strength and stiffness of individual pieces intended for structural use and assigning them to a strength grade and/or strength class. Specifiers can then work with known and dependable mechanical properties.

The strength class is based on grade, timber species and where the timber was grown. There are 18 strength classes – groups of species/strength grade combinations with similar properties – 12 for softwoods, prefixed C, and 6 for hardwoods, prefixed D. The most commonly used in the UK are C16/C24. The numbers represent the characteristic bending stress of the timber, a value which is called up in Eurocode 5 (EC5). So far so good.

In the UK, all structural timber, whether hardwood or softwood, should be strength graded in accordance with the umbrella standard BS EN 14081 Timber structures. Strength-graded structural timber with rectangular cross section. A Notified Body should oversee the training and certification of graders and the operation of grading machines. The UK national standards which comply with BS EN 14081 are: BS 4978: 2007 Visual strength grading of softwood - Specification and BS 5756: 2007 Specification for visual strength grading of hardwood.

Another way of meeting BS EN 14081 is to CE mark, which might, but not necessarily, include grading to the British Standards – other European national standards could be called up instead. CE marking is a whole new topic, however, and best left for another day.

Appearance is also a consideration

Correctly strength-graded timber will fulfil its structural purpose, but it may not be pretty. Visual grading of structural timber relies on a correlation between the size of strength-reducing characteristics (defects) as observed on the surface of the piece and its effect on mechanical properties. The characteristics include knots, fissures, wane, resin-bark pockets and insect attack, as well as slope of grain, distortion and even rate of growth, all of which may have to be considered. Note, however, that there are differences in the manner in which defects are measured for softwood, hardwood and scaffold boards.

And some of the rules are open to interpretation, for example on insect damage. The softwood grading standard BS 4978:2007 excludes active infestation and wasp holes, but other insect damage is permitted, provided it "conforms to the requirements of Clause 5", the gist of which is that any piece which contains "abnormal defects" such as compression wood, insect damage or fungal decay that "could cause a decrease in strength properties to an amount which threatens the serviceability of the piece" must be excluded from the grades.

We have run visual strength grading courses for many years and our advice to candidates is not to be led too much by the general appearance of a piece of timber. There is a limit, too, to how much time a grader can spend on an individual board, so graders have to learn to draw from their experience and trust their own judgement to make quick, accurate decisions.

Suppliers should bear this in mind when a customer is challenging a parcel that may not look the best, but has been correctly graded and, above all, will meet the requirements of its designated strength class.
Materials

Knowing what to look for

To ensure that specifiers, inspectors and site staff are able to identify immediately the strength class and moisture content of the timber supplied, the rules dictate that each piece of strength graded timber must be stamped ‘clearly and indelibly’ on one face. Another tricky issue for buyers, however, is that grade stamps can be falsified or applied incorrectly, so they need to know what to look for.

The stamp must include the name or identifying mark of the producer, the strength class (or, if not included, the strength grade and grading standard), the words ‘dry graded’ if appropriate and the Notified Body. In some situations, marking may be omitted for aesthetic reasons, as long as a commercial document can be issued for each batch of a single grade of hardwood/softwood. This document must bear all the information that would otherwise be marked on the product and/or in other accompanying documentation. Buyers therefore need to check the paperwork if a consignment of supposedly strength graded lumber arrives unmarked.

Moisture content has a direct effect on strength; therefore, it is a vital factor in designing and specifying timber for structural use. TRADA Technology recommends that, wherever possible, ‘dry graded’ timber is specified, that is with an average moisture content of 20% or less, with no single reading exceeding 24%. Timber sections over 100mm in thickness can be difficult to dry without degrade, so are normally graded wet, that is at a moisture content above 20%.

Under BS EN 14081, wet graded timber is not required to be marked as such, which is an important clue for the designer or user — assume that the timber has been wet graded unless the stamp says otherwise. Engineers will have applied modification factors if the timber being used is wet, because wet timber is weaker than dry timber. While it would be safe to install dry graded timber instead of wet, the opposite is not necessarily true — wet wood might not be strong enough. If dry graded timber has been specified, but the grading stamp does not clearly state that, then alarm bells should ring. If unsure, the contractor or builder must check the documentation and go back down the supply chain.

Re-machining and re-grading

Just as there are rules governing marking, there are also rules governing re-machining. If graded timber has been re-machined, it will usually have to be re-graded. The limits for strength-reducing characteristics as stated in the rules may at times be open to interpretation, but the rules governing re-machining — which are the same for visually or machine graded timber — are very clear and the limits are quite tight. Take a piece of timber measuring 47mm x 138mm. If more than 10mm is taken off the width, the piece must be re-graded.

If in doubt, keep it dry

Lack of care on site can also affect the grade. Timber, sadly, is often one of the least respected materials on a building site and bad handling or poorly organised storage are major causes of damage and wastage. The grading rules take account of this and clearly state: “Graded timber shall be protected in storage and transport to the extent necessary to minimise downgrading of the timber.” This may be open to interpretation, but commonsense should prevail — if in doubt keep it dry!

Using qualified graders

When TRADA Technology technical consultants have been called in to check the grading of timber, the outcome has varied hugely, from more than half of the consignment being rejected, to the parcel being totally in keeping with the rules. With grading generally, much of it comes down to the grader’s knowledge and experience. Companies that employ qualified graders know how valuable they can be, if the grading of timber coming into the yard or perhaps, more critically, going out comes into question.

Philip O’Leary says graders have to learn to draw from their experience and trust their own judgment to make quick, accurate decisions.