# Researchers recommend new EU standards for machine strength grading of timber

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To ensure that wooden constructions are sufficiently stable, timber must first be graded according to its strength. Machines for this already exist, but they are rarely used in Europe as current EU standards stipulate expensive acceptance requirements. That's why timber is usually classified visually -- which is slower and less accurate. German wood technologists have now identified how the obstacles to machine grading can be overcome. This should make timber a more competitive, safer construction material.

The natural product wood grows in locations with different climate, soil and environmental conditions. These differences influence its properties as construction material: "Scandinavian spruce, for instance, has smaller knots and lower raw densities than spruce coming from central Europe, and this results in different strength and stiffness values," explains Professor Jan-Willem van de Kuilen from the Department of Wood Technology at TUM. That is why, to ensure the stability of wooden structures, timber must be strength graded before it is used. So far, grading is predominantly visual, i.e. according to visible attributes influencing strength, e.g. the proportion of knots, which reduce wood stability, or discolorations indicative of fungi.

Machine strength grading is both more efficient and more reliable: It also includes criteria that are not visible, such as density or elasticity, and it works much faster than expert eyes. Nonetheless, machine grading of engineered wood products has not become established practice yet, because it is subject to stringent EU-wide standards – a machine may

only sort timber of a certain type and from a specified growth area, for which it has been granted specific acceptance. When, for instance, a machine that has been officially accepted for grading German pine, is to be used for Polish pine, EU legislation stipulates that it first go through a lengthy and very costly series of tests measuring 450 samples of this specific timber. However, a sawmill often has to process timber from different growth areas in parallel, making machine strength grading uneconomical.

The Department of Wood Technology at TUM, together with international colleagues, tackled this challenge within the European research project "GRADEWOOD." The researchers set out to establish the following: In how far does timber origin influence strength? Does the existing differentiation in EU norms according to country of origin even make sense? To answer these questions the TUM team spent two years in Germany, France, Belgium and Sweden grading over 6,000 timber specimens of spruce and pine from ten European countries. A great deal of work, considering that for every individual sample they had to use five machines to measure the different timber strength parameters. One approach was to get the timber to vibrate and then measure its natural frequency: the higher the natural frequency, the stronger the timber. After completing the series of tests, the TUM researchers measured the actual strengths of the timber samples. They did this by bending the samples until they broke – the force required, together with the thickness and width of the sample were used to calculate the strength of the timber.

When they compared the compiled data, the wood technologists were in for a surprise: Not all regional differences in timber strength were attributable to the measured parameters. For instance, their extensive experiments showed the density and elasticity of spruce from Poland and Sweden to be the same. Yet, the respective strengths turned out to be to be different. TUM project leader Peter Stapel from the Department of

Wood Technology concludes: "There are parameters influencing timber properties that are yet to be established." And so the search goes on – in a next step the wood researchers hope to find additional measurable parameters that can be used to increase the forecast accuracy of the timber grading machines.

There is, however, one important issue that the TUM researchers can already elucidate on clearly: Together with their international colleagues they successfully demonstrated that there are indeed differences in timber properties according to growth areas, albeit they are so small that it makes no sense to classify timber according to the country of origin. The scientists believe that a classification by three larger regions in which timber displays similar properties would be perfectly sufficient: Northern, Central and Eastern Europe. And this is what the researchers would like to propose to the European Committee for Standardization. This would facilitate machine grading of engineered wood products throughout Europe – and could, in future, translate not only into more reliable, faster and more cost-effective strength grading of timber, but also into higher safety in construction.

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