

Duebendorf / St. Gall / Thun, 7th March 2005

22nd Science Apéro

Wooden houses – living in comfort

Wooden houses still have a reputation for being old fashioned, low value structures that present a fire risk. That these persistent prejudices are completely unjustified was demonstrated by the three speakers at the 22nd Science Apéro at the Empa Duebendorf. Modern wood houses are no different in quality than their conventional counterparts and fully meet all the applicable heating, dampness, fire and noise criteria. The majority of people living in wooden houses feel more comfortable in them than in brick or concrete constructions, and furthermore, wood has many ecological, biological and economic advantages.

Wood – a step ahead

Wood is a modern building material, for several reasons. “Ecologically speaking, wood is a step ahead of other building materials,” according to Klaus Richter, Head of the Empa’s Wood Laboratory. This natural raw material is constantly replenished by growth and is locally produced from indigenous forests. It is also CO₂ neutral, and disposal is not a problem. So, in times when substantial added value is placed on sustainability, wood becomes an attractive alternative to mineral-based construction materials.

A further advantage is that wood lends a comfortable atmosphere indoors, and wooden floors and walls are always warm and dry to the touch. Wood removes humidity from room air when it is damp and returns it when it is dry, so that wooden houses do not suffer from very dry atmospheres when heated in winter. In addition, Richter adds “Wooden houses can be prefabricated and erected very rapidly, leaving their competitors in brick and mortar or concrete way behind. They also play a leading role in the field of energy efficient buildings.”

New wood-based materials – from beam to sheet

As a building material, wood also has its disadvantages. It is by nature inhomogeneous, the grain of the fiber running along the direction of growth of the tree trunk. Dryness and humidity cause wood to shrink and swell respectively, but the magnitude of the effect varies in different directions. The mechanical strength of wood also depends on whether it is loaded across or along the grain.

Today it is possible to produce wood-based materials with predefined properties. This is achieved by first shredding the wood to produce shavings or chips, then reconstituting these using special techniques to

give the required product. “Wood today is not just available in the traditional form of beams and planks. For a long time now it has been available as large area boards,” reported the next speaker, Andrea Deplazes, Professor of Architecture und Construction at the ETH Zurich. The new wood-derived materials are in addition dry, crack-free, and homogeneous, so that they retain their original shape and size. Using solid wood and wood-based products, it is possible today to manufacture multifunctional assemblies on an industrial scale. These are put together to create complete systems, like a sandwich with many-layers of functions. Complete sets of walls can be produced in a factory and transported to the building site, where they are put together using a set of assembly instructions. “Building a wooden house today is like assembling IKEA furniture,” maintains Deplazes, putting his finger on the nub! Advances in production techniques have now made it possible to use completely different construction methods. Whilst in the past houses were constructed primarily using concrete block or timber-framed methods, today prefabricated wooden assemblies are becoming more and more common. Construction using wood-based materials is beginning to establish itself as standard building technique. Whereas in 1990 only 2% of all new houses were of wood, in the year 2000 this figure had climbed to 16%. In addition, in January this year new fire prevention ordinances came into force which permit the construction of multi-storey wooden buildings. This allows wood constructions techniques access for the first time to a large new segment of the building market.

Safety and protection requirements

“In terms of thermal and acoustic insulation, dampness resistance, and from the fire-safety aspect, wood has made noteworthy progress,” explained Stefan Winter, Professor of Wood Construction and Structural Design at the Technical University, Munich. Wood intrinsically has good thermal insulation characteristics, since it is by nature a cellular material. For this reason wooden houses often have the qualities necessary to achieve the “Minergie” label.

Modern wood buildings are also well sealed. Well thought-through design and careful construction ensure that no dampness can penetrate into the wooden structure. This means that the wood used for modern buildings does not need to be chemically treated. “Good design and construction obviates the need for chemical treatment” according to Prof. Winter. The idea too that wooden houses are noisy, with poor acoustic properties, is a thing of the past. Today there is a large range of constructional measures which can be taken to ensure that new buildings meet current acoustic requirements.

Finally, the danger of fire is no longer a justified fear. Wooden houses built with fire retardant components are astonishingly resistant to fire damage. Whereas steel and concrete rapidly lose strength when heated, wood burns through astoundingly slowly. “The risk of a fire is not increased by the use of an inflammable construction material, but through the age and contents of the building and the carelessness of its inhabitants,” emphasizes Winter.

Wood buildings last a long time

The conclusion the three speakers arrived at was that if building concepts and constructional techniques were adapted appropriately, and the quality of manufacture and assembly properly supervised, then it would be possible to erect wooden houses which would have long useful lifetimes – as long, in fact, as brick or concrete buildings. They demonstrated the many different applications available to wooden buildings by the following examples: office buildings, swimming baths, churches, bridges, industrial buildings, inhabited dwellings and even fire stations! In summarizing, Klaus Richter hoped that it would be the owners of a wooden building who had the last laugh – because they had chosen the right construction technique – and not the woodworms!

Author

Dr. Bärbel Zierl, Communication Department, baerbel.zierl@empa.ch

Contact person

Dr. Klaus Richter, Wood Laboratory, Tel. 044 823 41 15, klaus.richter@empa.ch



A wooden house in the Ziegelwies development, in Altendorf, Switzerland. Source: Holzbulletin 62/2003, Lignum

The photograph is available in digital form from remigius.nideroest@empa.ch

125 years of the Empa

The Empa is celebrating its 125th anniversary. Founded in 1880 as a laboratory for testing building materials, today the Empa is a modern research institution. On June 18th 2005, the doors to the Empa site in St. Gall will be open to the public, the theme being “The Healthy Human”. One week later, on June 25th 2005, it is Duebendorf’s turn. Research trails cutting right across the site will offer a fascinating insight into the heart of our Nanotechnology, Adaptive Materials, Technosphere / Atmosphere and Materials for Energy Technologies programs. Further attractions will also be on offer.

Among the official speakers at the official celebration on June 24th will be Federal Councilor Pascal Couchepin and ETH-Council President Alexander Zehnder. The guests will include national and international figures and personalities. School classes will be offered guided tours of the St. Gall site on June 16th (for final year classes) and the Duebendorf site on 23rd June (for all levels).

Everyone who has interest and enthusiasm for research is invited to pay us a visit to get to know the Empa and its work close-up, and to come and talk to our scientists in person. There will be opportunities to do experiments, to see newly developed technology in operation and to learn first hand the astonishing properties of modern materials.