

More Sustainable Construction

Sustainable construction is a topic that both dominates the present and will shape the future. But what does it actually take to build more sustainably? At TU Graz, the construction process, the construction industry, architecture and, of course, materials science are all being scrutinized, and only recently has a research network of its own – the Graz Center of Sustainable Construction – been established.

Birgit Baustädter

Aglaée Degros works in an airy old building office with a door on each side and high ceilings. Her office thus forms the centre of the institute, so to speak. No wonder, because the professor and head of the Institute of Urbanism at TU Graz works with communally used spaces in urban areas and on ways to make cities more sustainable, greener and more liveable through specific planning. She asks questions about how cities can be organized, how nature, water and green mobility can be integrated and how community spaces can be designed. “Cities can be planned not only based on buildings, but also based on green spaces and shared areas,” explains Degros. “Currently, shared areas are primarily dedicated to mobility, but there is a lot of potential for other uses.”

With this approach, the lives of the residents can be sustainably improved and their well-being enhanced. But not only that. Aglaée Degros is also considering how, for example, the narrow gaps between buildings can be designed so that the naturally occurring air flow contributes to cooling the city during the summer months. Or think about the so-called 15-minute cities, in which cities are organized as neighbourhoods, where all facilities important for daily life can be reached within 15 minutes. “We could clearly see during the Covid pandemic that occupational traffic levels dropped. But people still used their cars because they didn’t have any more shopping options on foot.”

She and her team are also working to counteract the extensive vacancy rate in many small rural towns and the associated need for new buildings in more urban areas to which people are migrating. For example, by developing concepts together with the residents to make small towns more attractive. Or to think about transport connections in a new and sustainable way. “Also in the wake of the pandemic, people longed for more greenery and more open spaces. At the same time, the need to work from home meant that they had to pay less attention to the distance between home and work and could work from more remote, rural areas.” According to the researcher this trend will continue in the future. “If I only have to go to my office in Graz twice a week and have good connections with sustainable, public transport, then I can simply also live and work in Eisenerz, for example.” >



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**Alexander Passer
Professor of Sustainable Construction**

Lunghammer – TU Graz

BUILDING FOR 2050

When it comes to planning itself, a visionary look into the future is important, as Alexander Passer, Professor of Sustainable Construction at TU Graz, explains: “When I build something today, I have to develop the building to be ready for the state of the art of 2050.” This is because it is necessary for planners to anticipate what demands will be placed on the building over a useful life of decades. Passer is referring, for example, to changes in the climate, rising temperatures in summer, stronger weather events and sudden changes in weather. It is also important to consider what changes in use could be made to the building and how it can already be prepared for them.

The focus of the research is on the method of life cycle assessment – but also including the ecological costs in the total costs of a building, i.e. taking into account all costs and environmental impacts incurred during the life cycle of a building. “Not only must the operation of a building be possible in an emission-neutral way, but also its construction and maintenance. That’s why we have to start thinking about building projects in a completely new way and place value on efficiency, consistency and sufficiency,” says Passer, who has already been heading the Working Group for Sustainable Construction at TU Graz for several years.

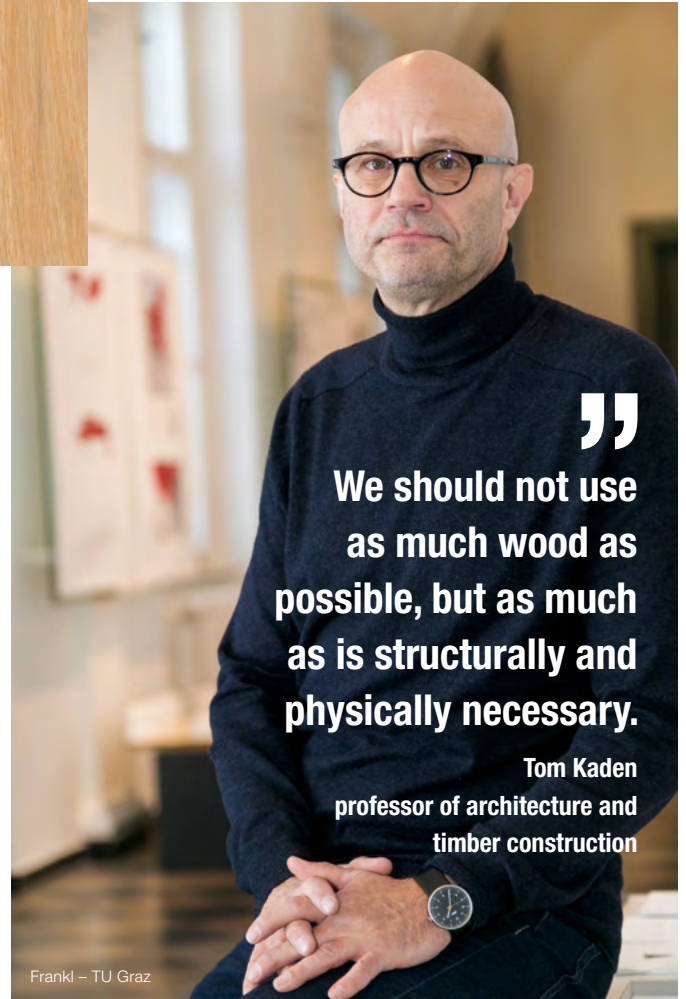
Institute of Timber Engineering
and Wood Technology

FOCUS ON BUILDING MATERIALS

Wood is sustainable and concrete is a real CO₂ guzzler – this is a common opinion about building materials. But the calculation is not that simple, explains Dirk Schlicke, a researcher at the Institute of Structural Concrete: “It’s about selecting the optimal material for the respective application. Bricks and wood, for example, provide a wonderful indoor climate, but find their limits above certain building heights. Steel, with its comparatively high performance, is suitable for filigree structures and long-span railway bridges, provided that sufficient corrosion protection can be guaranteed. Concrete, on the other hand, is very robust and resistant and therefore indispensable in infrastructure construction and for foundations in building construction. However, sustainable construction requires a resource-responsible approach to concrete now and in the future.”

Tom Kaden, Professor of Architecture and Timber Construction at the Institute of Architectural Technology, has a similar view: “Wood is a great building material it grows back and has great physical properties. But we primarily work with hybrid construction methods and combine the building materials in a sensible way. I always say that we should not use as much wood as possible, but only as much as is structurally and physically necessary.”

Resource efficiency, longer life and intelligent use are the focus for all building materials, as diverse research at TU Graz also shows. At the Institute of Technology and Testing of Construction Materials, waste materials from industry – such as blast furnace slag produced in steel production – are used to replace particularly CO₂-emission-intensive materials in concrete mixtures. Among other things, the Institute of Structural Design is



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Frankl – TU Graz

trying to realize ingenious component geometries that save concrete and are stable at the same time. A long-standing research project is dedicated to 3D concrete printing, which can make precisely such complex geometries possible. At the Institute of Steel Structures, the focus is on the service life of different steels and protection against corrosion.

Timber construction professor Tom Kaden sees above all an opening of the timber construction market: “We still deal mainly with residential buildings, but there are now also projects with multi-storey public buildings, such as universities or theatres, that are designed using timber construction.” With his students, he is now mainly involved in urban construction, interested in the combination of living and working space and involved in projects of large cities that want to convert and redensify different >

At the **Institute of Buildings and Energy**, researchers look at the holistic energy performance of buildings up to and including urban systems. Not only the operating phase of a building is scrutinized, but also production, construction and disposal. In addition to the energy demand, the quality achieved with regard to the intended use is also considered and evaluated at the same time. The BEEP method (Building Energy and Environmental Performance) developed by the Institute's director Brian Cody was the first evaluation method worldwide to make it possible to objectively compare several building designs from this point of view.

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areas. Like the city of Sindelfingen, for example, as part of the IBA 2027, which wants to convert a large hospital site, deconstruct it and densify it at certain points. “Our students did a great job and came up with very interesting architectural-constructive ideas using wood as a material.”

In addition, TU Graz is also experimenting with alternative building materials. For example, with clay as a building material (Institute of Structural Design). Paper materials as a raw material for structural interior systems or with Velcro joints as connection systems (both Institute of Architectural Technology).

OPTIMIZING PROCESSES

An important factor in the quest for greater environmental sustainability is also the construction industry itself. Far too often, many specialized companies are still working on a building at different times, without a common, consistent planning in the background.



Digital simulations of the entire construction project can reveal and harness optimization potential and collaboration opportunities in advance. At TU Graz, scientists at the Institute of Construction Management and Economics, the Institute of Building Physics, Services and Construction, the Institute of Structural Concrete and the Professorship of Sustainable Construction, among others, incorporate the forward-looking BIM (Building Information Modelling) methodology into their research projects. BIM unites the data belonging to a construction project in a digital model and maps the construction process in its entirety.

LOOKING FORWARD TOGETHER

In order to bundle this traditional and broad spectrum of research at TU Graz and to work with combined forces for a more sustainable (construction) future, the interdisciplinary research network Graz Center of Sustainable Construction was created at TU Graz in 2022. “We deal specifically and across all faculties with the built environment – in other words, all areas where people change and shape their environment in a structural way,” explains Michael Monsberger, researcher at the Institute of Building Physics, Services and Construction and co-founder of the new research centre. This refers to all residential or work buildings, as well as infrastructure such as tunnels, dams and roads. The research projects are broadly spread across architecture, construction, the digitalization of the building process and ways to make resource use more sustainable. The Center’s work focuses on cities and regions, design and construction, materials and resources, digital processes and assessment methods.

Forward-looking projects have already emerged from the research centre. For example, the City Remixed project, a collaboration between the Institute of Architectural Technology and the Institute of Technology and Testing of Construction Materials at TU Graz. In a forward-looking research project, scientists investigated how the building condition of the city of Graz will develop in the future and where buildings will be demolished. These buildings are then examined for possible re-use of individual components or different raw materials in order to make planned recycling for new construction projects possible. The aim is to develop a prototypical model for actionable circular economy. ■

**Endowed professor
for sustainable building.**