

Timber and Technology

Urban timber construction



Timbatec
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Modern timber construction and new living concepts are taking over urban areas. This contributes towards climate protection and also helps to counteract the limited availability of affordable living space. In this issue, we explore this topic in more detail with the help of specific construction projects.



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Photos:
1 UTO Real Estate Management AG
2 Timbatec/Nils Sandmeier
3 Detlev Christian Schmidt
4 burkart.lu fotografie

Cover:
Liv Suites, Luzern
burkart.lu fotografie

Editorial

Dear partners, customers and timber enthusiasts

Modern timber construction is conquering the construction industry. Around the world, investors are planning high-rise buildings in timber that will reach over 100 metres in height. Residential buildings with 300 units have already become reality in Switzerland. Until recently, concrete and steel were obviously the first choice for the majority of urban construction projects. Today, an increasing number of private customers, municipalities, cantons and even the Federal Government are coming to the conclusion that timber is the better option. There are many good reasons for this decision. You can find an overview of the benefits of timber construction on the last page of this magazine.

Conventional construction has had an image problem ever since attention has shifted to environmental issues, with cement plants alone responsible for some 9% of global CO₂ emissions. If Switzerland wants to play its part towards reaching the climate goals defined in the Paris Agreement, it must find alternatives to coal, oil, gas, petrol and diesel. In the construction industry, this means minimising the use of particularly energy-intensive building materials such as steel and concrete. As a result, new and innovative methods have to be explored. This is where timber construction comes into play – it is not only climate-friendly in production as a home-grown building material, it even stores one tonne of CO₂

per cubic metre of wood. When used in building structures, the CO₂ remains stored there.

In this magazine, we will use four building projects to demonstrate that timber is also suitable as a building material in towns and cities.

We will also take a look behind the scenes at Timbgroup, the parent company of Timbatec. New technologies and developments are necessary in order for entire towns and cities to be built from timber in the near future. Three start-ups at Timbgroup are closing these gaps. Scrimber is a new technology for manufacturing efficient building products in timber where virtually the entire tree is used. This is a response to the great demand for products in timber construction. Timbase provides solutions for basements and floor-level timber components – an important step for further increasing the share of timber used in buildings.

We are looking forward to working together with you on building entire towns and cities in timber. The technologies needed for this are already reality.



Stefan Rüegg
Timber construction engineer and board member
Zurich branch

Timbatec offers the all-round package

A building is more efficient and economical if it is understood as a whole. When it comes to planning timber constructions, the best idea is to consult a timber construction engineer who has skills that go beyond mere structural design. We offer an all-round package in planning and will support you through to execution. We will also gladly develop solutions for your project where none yet exist. Our core competencies:



Structural analysis and design



Fire protection



Building physics



Product development



Construction management

High-quality living in small spaces

In urban centres, affordable living spaces are at a premium and the number of single-person households is increasing. New living concepts are needed to meet these trends. Thanks to moveable cupboards and revolving walls, the small apartments on Stampfenbachstrasse in Zurich appear spacious and versatile – despite just 54 square metres of living space.



Photo: Edelmar Mosayebi Interbitzin Architekt

In order to take up less space, new concepts for high-quality living in smaller spaces are required. Various ideas have been put forward here. One approach that has been increasingly used in recent years is the trend towards more communal areas. Another possibility is floor plans that can be adapted flexibly – a bedroom is not needed during the day, nor is a living room at night. The Performatives Haus on Stampfenbachstrasse in Zurich is a prime example of this method. Cleverly positioned revolving walls, moveable cupboards and platforms with large drawers and trapdoors allow almost infinite possibilities when adapting the living space. In this way, rooms can be organised, divided or connected together.

These apartments offer an intimate bedroom, a comfortable kitchen with dining area or a spacious living room for welcoming guests. “This is all possible thanks to a revolving wall and moveable components. This apartment

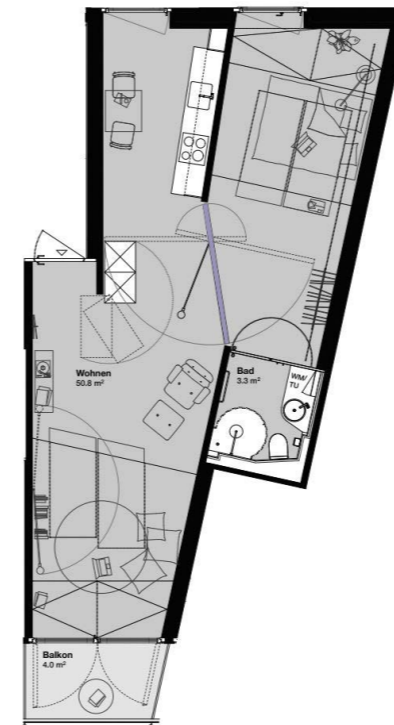
meets any demand”, comments Simon Hess. He spent one week living in a scale mock-up of an apartment during the testing phase and thus helped to develop the new living concept. This mock-up covered 54 square metres and was set up at ETH Zurich in order to research how the innovative apartments with moveable elements are used.

Lightweight timber construction

Building in the city means adapting to the existing buildings. In many cases, the new structures in urban areas are replacement buildings. In order to keep the ecological footprint as small as possible, functional parts of the building are reused. In this example, the Performatives Haus is built on the basement of the previous building. Part of the former car park was even converted into apartments. In order to save weight, the upper floors were constructed in timber – including the stairwell and lift shaft. The structure consists primarily

of cross-laminated timber panels painted white and grey, which remain visible in the rooms. The result is a comfortable and modern living space.

Simon Hess not only lived in the apartment mock-up at ETH Zurich. As a building physicist at Timbatec, he also helped in developing the structures and was responsible for building acoustics. The load-bearing cross-laminated timber walls guide the heavy loads from the upper floors to the floors below. “In order to prevent the wood from being crushed in the area around the ceiling support, the loads were guided through beech dowels measuring 6 cm in diameter”, explains Hess. This simple connection makes the cross-laminated timber supporting structure more economical as sound insulation bearings can be dispensed with.



Sound measurements on the mock-up

The construction method using beech dowels for guiding loads is new, meaning there were no empirical values to fall back on. “Using the 1:1 scale mock-up, we were able to check the acoustic behaviour and determine to what extent sound inside the building is transferred from one apartment to the other”, comments Hess. The test demonstrated that the legally prescribed sound insulation requirements between apartments have been met.

In the heart of the city, yet quiet

Building in urban areas often also means having to meet strict soundproofing standards. The apartments should be quiet, despite the traffic noise from the busy Stampfenbachstrasse outside. “These demands were met thanks to an acoustically decoupled building façade”, explains Hess.

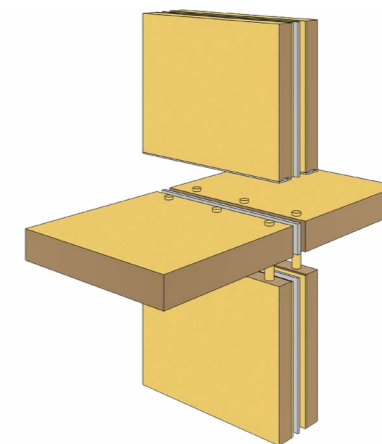


“We ensured peace and quiet in the heart of the city with innovative engineering solutions.”

Simon Hess
Building physicist at Timbatec and resident of the mock-up apartment



Sound measurements on the 1:1 scale mock-up ensured that the selected construction method was suitable before the start of building.



Beech dowels guide the loads from one wall to the next.

Architecture, site management

Edelmar Mosayebi Interbitzin, Zurich

Building owner

Moyreal Immobilien, Zurich

Timber engineering, building physics

Timbatec Holzbauingenieure, Zurich

Civil engineer

wlw Bauingenieure AG, Zurich

Timber construction

Häring AG, Eiken

Semiramis – unique and ambitious

The Tech Cluster Zug is home to an elegant 22.5-metre-high timber structure called Semiramis – a nod to the famous Hanging Gardens of Babylon.



Not art for art's sake, but instead a structure linking art and nature: Semiramis shows the direction that urban timber construction could take in future.



Using 3D modelling software, the planning team defined the shape and positioning of the shells according to prescribed specifications.



“Conventional processes were completely rethought when designing Semiramis. The design was suggested by artificial intelligence.”

Beat Weiss
Tech Cluster Zug AG

The goal was to design a structure that reflects the innovative and entrepreneurial spirit of the Tech Cluster. The result was a natural work of art with wooden shells holding plants and trees across five floors. Semiramis demonstrates the urgently needed ecological transformation in urban construction. The timber structure offers urban habitats for insects, birds and small animals across five storeys. At the same time, Semiramis also shows the direction that architectural design can take when artificial intelligence is used, with the interaction between man and machine becoming established in the creation of building structures.

First blueprints using modelling software
Using 3D modelling software, the planning team defined the shape and positioning of the

shells according to prescribed specifications, such as protection from sun and rain, the available area for planting and the structural conditions. The software then drafted the complex design of the five plant shells and the 363 geometrically unique timber panels that were to be used for creating the shells.

Manufacturing using robots and TS3
Robots positioned the cross-laminated timber panels together precisely leaving a joint of 3 mm, where an engineer then connected the panels by injecting TS3 casting resin. With TS3 connections, the angle of the fibres on the panel joints plays an important role. The modelling software optimised the positioning of the panels so that the fibres run as parallel as possible to each other.

Human touch still essential
Despite the use of intelligent software, engineers and architects will still be needed in future. These specialists feed the models with data and check the plausibility of the results using further calculation methods. In doing so, they ensure that Semiramis can also survive a storm if the plant shells are subjected to heavy winds.

Robots positioned the panels, which were then connected together to form shells using TS3 joints.



Building owner
Urban Assets Zug AG, Zug

Draft
Gramazio Kohler Research, ETH Zurich in collaboration with Müller Illien Landschaftsarchitekten GmbH and Timbatec Holzbauingenieure, Zurich

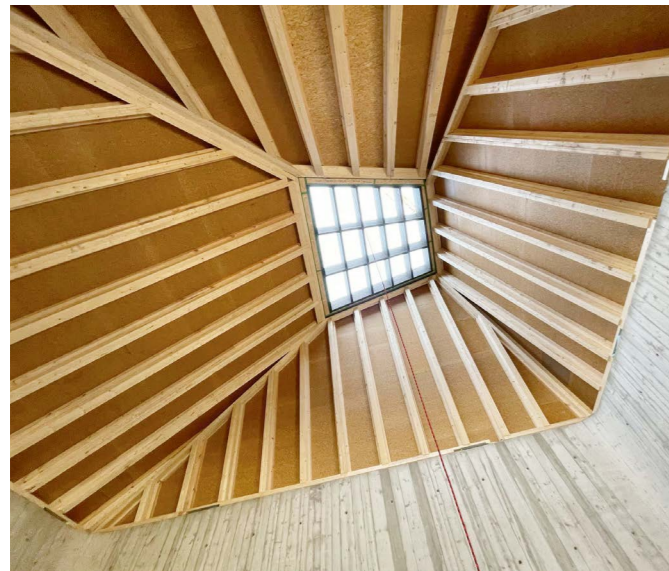
General contractors
Erne AG Holzbau, Laufenburg

Joining
Timber Structures 3.0 AG, Thun

Experts
Chair for Timber Structures, ETH Zurich; Computational Robotics Lab, ETH Zurich; Swiss Data Science Center; Intrinsic

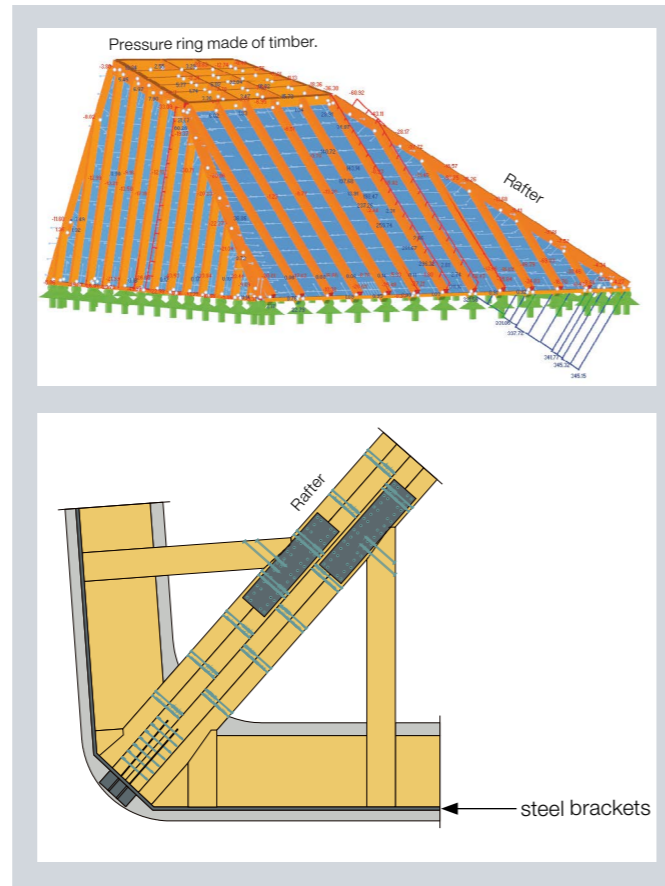
A thatched roof for Berlin

Several parameters were decisive when designing the new conference centre, including its integration in an urban context, optimal lighting, the acoustic qualities of the space and the selection of materials. Timber construction proved the best option for meeting these criteria.



The dome consists of modular wooden elements and is covered with thatch.

After the three-dimensional calculations, construction solutions are dimensioned and drawn for the executing companies.



The goal was to design a cubic area that has been reduced to the minimum. To do this, the specialists from Gogl Architekten sank the ground floor with its polygonal floor plan halfway into the ground. The timber construction with thatched roof was built on top of this. The building is supplied with natural daylight through a single skylight, offering the "ritual room" a very special atmosphere thanks to the clever positioning and pitch of the window in the roof.

Construction site logistics

A well-planned construction site is critical when building timber structures in cities like Berlin. The components must be delivered to the site in the right order and with precise assembly instructions. In addition to planning

the timber construction, Timbatec also created an assembly concept for the Marina Marina conference centre.

Pressure ring as central point

During assembly, the builders first concreted the base wall before mounting steel brackets on all sides. Following prefabrication at the factory, the timber elements with acoustic panels and voice coils for sound insulation were attached to the steel brackets and a pressure ring. Made from cross-laminated timber, this ring is positioned on top of the roof and supports the individual elements.

Building owner

Slow Spree Estate, Berlin

Architecture

Gogl Architektur Ziviltechniker, Lans near Innsbruck

Civil engineer

Hanel Ingenieure – DI Carlo Chiavistrelli, St. Johann in Tirol

Timber construction engineer

Timbatec Holzbauingenieure, Vienna

Timber construction

Eder Holzbau, Bad Feilnbach

One group – one goal

Timbatec is part of Timbagroup, a group of companies with a shared goal – to raise the market share of timber construction in the building sector. Each of the companies is making its own contribution.

Timbagroup

Timbagroup Holding AG



Timbagroup is a group of companies working towards the goal of raising the market share of timber construction. Stefan Zöllig is owner of the group and the founder or co-founder of all the companies.



www.timbagroup.com

Timbatec

Timber and Technology



Timbatec is the origin of the group and, as an innovative timber construction engineering company, has been promoting the use of timber as a raw material for over 25 years. We constantly develop new technologies and are thus a driving force in modern urban timber construction.



www.timbatec.com

TS3

Timber Structures 3.0



TS3 technology enables column-panel construction made of timber in a manner that was previously only possible with reinforced concrete. TS3 is opening up new markets for timber construction, and structural engineering will be able to dispense with steel and concrete entirely in the long term.



www.ts3.biz

Timbase

Timber Basements



Timbase

Timber basements are the next logical step when dispensing with steel and concrete. Timbase are specialists in underground timber components and offer general contracting services for the planning, manufacture, delivery, assembly and warranty of timber basements.



www.timbase.com

Scrimber CSC

Carbon Sink Concrete



Scrimber

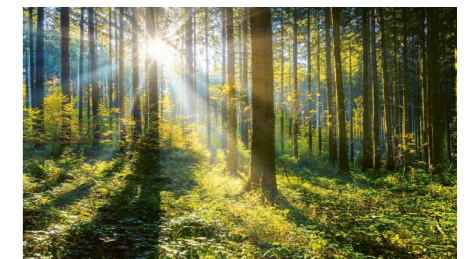
In order to meet the great demand for products in timber construction, more efficient products for the construction industry are needed. Scrimber is a technology used for manufacturing high-quality building materials from lower-quality wood. This makes a contribution to climate protection.



www.scrimber.com

TIMBER FINANCE INITIATIVE

SHAPING THE FUTURE OF THE TIMBER INDUSTRY



Timber Finance Initiative

This initiative allows investment in the forestry and timber industry. The timber industry is growing in importance as an answer to the current timber construction megatrend. With a corresponding index, the initiative increases the exposure of the timber industry in the financial sector.



www.timberfinance.ch

Timber shingles in the city

The Liv Suites in the heart of Lucerne offer a modern living experience. A special feature of the seven-storey timber building is its shingle façade, which brings warm colours and wood as a natural material into the urban environment.

Bricks, glass and stone are predominantly used for façades in an urban context. While these are usually not stipulated in building regulations, architects and building owners have to have some convincing arguments up their sleeve if they want to design a new building with a timber façade in the city centre. Tobias Schaer, owner of the property at Maihofstrasse 8 in Lucerne, was able to convince the city authorities of his plans to build a multi-family home with shingle façade in collaboration with FANGAN Architekten. The façade will soon take on a silver-grey patina and is extremely durable thanks to the natural resins and components used. The façade does not need to be maintained or painted, and has a service life of up to 80 years.

Shingle façade without aprons

The new building on Maihofstrasse has seven storeys and is below the limits set for high-rise buildings. Nonetheless, measures have to be taken for flammable building envelopes of more than three storeys to ensure that fire cannot spread over more than two floors. The question was raised as to whether a continuous shingle façade was possible or whether fire protection aprons or fire blocks were necessary in the structure. Would a fire spread along the building envelope?

Green light following fire tests

There is currently no up-to-date technical documentation on shingle façades. As a result, the measures have to be defined according to established design principles on similar timber façades or from empirical data from fires on buildings with shingles, or from fire tests. Timbatec established a data basis in 2016 with in-house natural fire tests. The starting point for this was the "Appartementshäuser Wolf und Edelweiss" project in Andermatt.

The fire tests here demonstrated that shingle façades are safe against fire when certain conditions are taken into account. By 15 minutes after the initial outbreak, the fire spread over the façade to a height of around



four metres. Once the supporting flame – the artificial fire source used to simulate an apartment fire – was reduced, the fire on the façade did not spread further. Although the façade continued to burn close to the fire plume after the supporting flame was extinguished, it only spread slowly to undamaged areas. As the façade on Maihofstrasse is designed according to the same principles, the fire tests in Andermatt could be used as the basis for the shingle façade in Lucerne.

Architecture
FANGAN Architekten, Zurich

Timber engineering and building physics
Timbatec Holzbauingenieure, Zurich

Civil engineer
PlusStatik GmbH, Emmen

Timber construction
Kost Holzbau, Küssnacht



“Whether in the city or countryside or for the building structure or façade, wood is our preferred building material every time! It has been part of civilisation since the very beginning and has also survived industrialisation.”

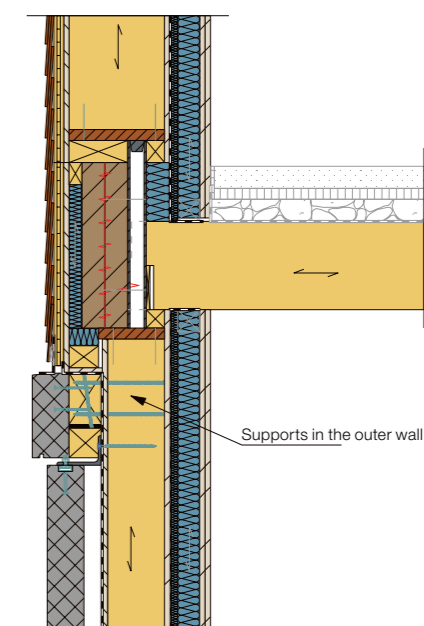
Jürg Burger
Founder and Managing Director, FANGAN Architekten



A quintessential timber construction – the fire walls, floor slabs, staircase and lift shaft are all made from cross-laminated timber panels.

Photos: burkart.lu Fotografie, Lucerne

Following natural fire tests, a continuous larch façade was possible without fire protection aprons or fire blocks interrupting the design.



The advantages of timber construction at a glance

Modern timber construction is conquering the construction industry. It is increasingly shaping the architecture of towns and cities. Thanks to these benefits, an increasing number of public and private building owners are choosing timber construction. Soon, entire cities will be built from wood.



1. Wood is renewable and protects the environment

- Wood stores CO₂: Each cubic metre of wood relieves the atmosphere of around one tonne of CO₂ because trees convert CO₂ into oxygen and carbon in the photosynthesis process as they grow.
- Wood is plentiful: Around 10 million cubic metres of wood grows back in Switzerland each year. Only a small part of this is used in construction, with the majority incinerated. This is something that has to change.
- Wood replaces materials with harmful environmental impacts, such as steel, concrete and brick. Each cubic metre of reinforced concrete creates around half a tonne of CO₂.



4. Wood is cosy

- Wood has a positive impact on well-being and the living and working atmosphere.
- Wood has a higher surface temperature than concrete, steel or glass. As a result, it offers a cosy environment in timber buildings at lower room temperatures.
- Timber structures breathe and regulate the humidity in living spaces.



2. Wood is a regional raw material

- Timber construction promotes the local economy.
- Regional production promotes short, environmentally friendly transportation routes.
- Sustainable forest management protects nature and benefits us all.



5. Wood is lightweight

- Wood is very light compared to other building materials, yet is also extremely strong.
- Wood is therefore ideal for adding storeys or on unstable foundations.
- By weight, wood has higher load-bearing characteristics than steel or concrete.



3. Wood is versatile and the ideal material for ...

- Residential buildings
- Public buildings
- Commercial buildings
- Renovations
- Additional storeys
- Infrastructure buildings
- Basements



6. Timber construction is safe

- Fire protection: Wood has to meet the same fire protection standards as all other building materials. We have also been constructing high-rise buildings, hospitals and hotels in timber since 2015.
- Sound insulation: Modern wooden buildings easily meet sound insulation requirements. The most important element is multi-layer components with good separation of the individual layers.
- Structural engineering: Timber structures meet the same requirements as all other structures. As a result, they are resistant to earthquakes and storms.



7. Timber construction is fast and economical

- Timber construction elements are prefabricated with millimetre precision and transported to the building site. As a result, large buildings shoot up in a matter of days.
- Wood has good insulation properties and saves on heating costs.
- Wood can be processed into high-quality building products with minimal energy consumption.
- As a result, timber structures are more economical than building projects using other materials.



www.timbatec.com

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Timber and Technology

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