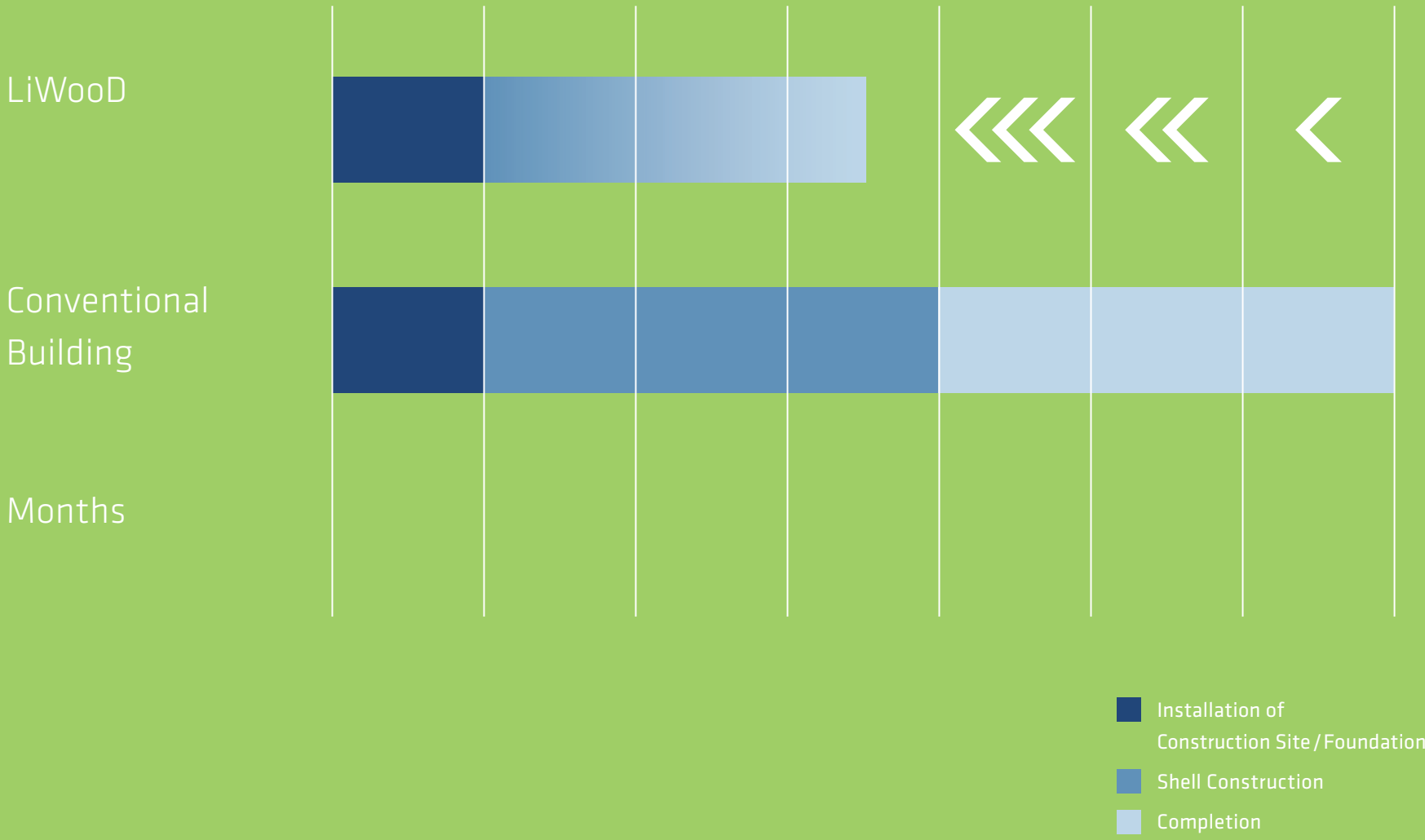
STUDENT LIVING
HEIDELBERG

LiWooD
Living in Wood

Building time



STUDENT LIVING HEIDELBERG

LiWooD develops, designs and builds modular constructed, multi-storey buildings from solid cross-laminated timber for projects as diverse as student apartments, retirement homes, apartment hotels and residential buildings.

LiWooD's first buildings, which at that time still used a post and beam framework, were erected in Constance (a five storey student residence with 170 bed spaces in single and two-roomed apartments) and Tubingen (a hostel for juvenile offenders with 50 bed spaces). Each building was completed within a construction period of approximately six months in 2006/2007.

After LiWooD won a EU-wide tender to construct three student apartment buildings, which was organised by the Student Union in Heidelberg, they erected three buildings for 265 students within 7 months.

The decisive factors besides the extremely short construction period, were the sustainability of the building based on the materials used and, above all, the unrivalled low ongoing energy costs. The installation of combi air water heat pumps combined with a high performance photovoltaic system reduces the cost of heating and hot water to virtually zero.

The LiWooD concept is capable of realising an ecological and economic model construction; sustainability which is so vital today is being turned into reality.

LiWooD – Living in Wood – As simple as it is ingenious

Munich, April 2014
Christian A. Czerny

Christian A Czerny,
CEO of LiwooD AG
with Daniel Friedrichson,
"Meister" (Carpenter)

A BESPOKE CONCEPT

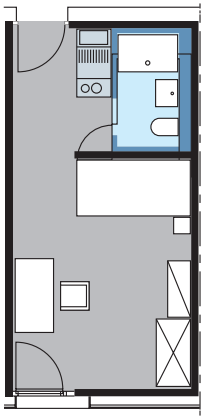
The buildings are designed to be energy efficient as well as sustainable. After taking into consideration the needs of the client, the location and the individual requirements of the residents, they are industrially prefabricated before being finally fully assembled on site.

Due to their modular design and versatility – each house can be individually made, fitted out and furnished, regardless of sizing standards – the buildings reflect the specific requirements of our clients and contractors.

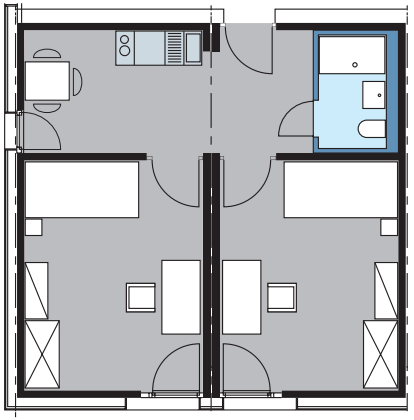
The single apartment (basic module) functions as a self-contained residential accommodation unit with 20 square metres of floor space. It consists of a living area fitted with a solid wood bed (100 x200 cm) and bedside table, a combined wardrobe and shelving unit, a separate study area with a desk and office chair, a bathroom with a floor-level shower, toilet, washbasin with storage shelves, an illuminated mirror and a kitchenette with a ceramic hob, sink and refrigerator with freezer compartment.

The two room apartment has double the floor area of the single apartment and consists of two identical but separate living areas, as well as a third communal area. This consists of a spacious kitchen/dining room and a shared bathroom, which is larger than the bathrooms in the single units. In addition to the basic equipment, the kitchen is fitted with a larger work surface with an integrated cooker and more kitchen cabinets.

The overall structure of the three room apartments resembles the double apartments but with the addition of a considerably larger communal area. The apartment consists of three living areas, identical in size, and a spacious, fully equipped kitchen and dining area with a table and chairs and optional wall shelves and seating. The bathroom matches the bathroom in the double apartments.

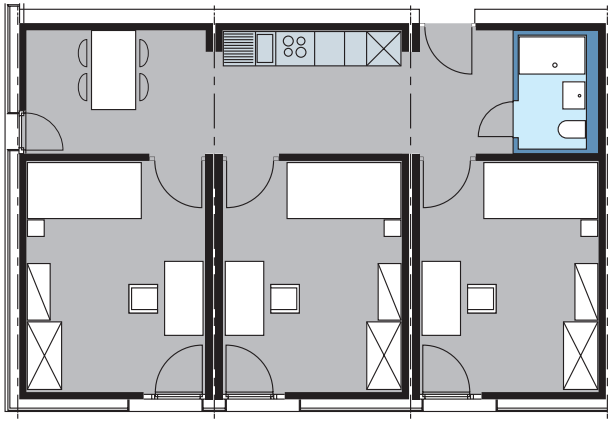


Single apartment



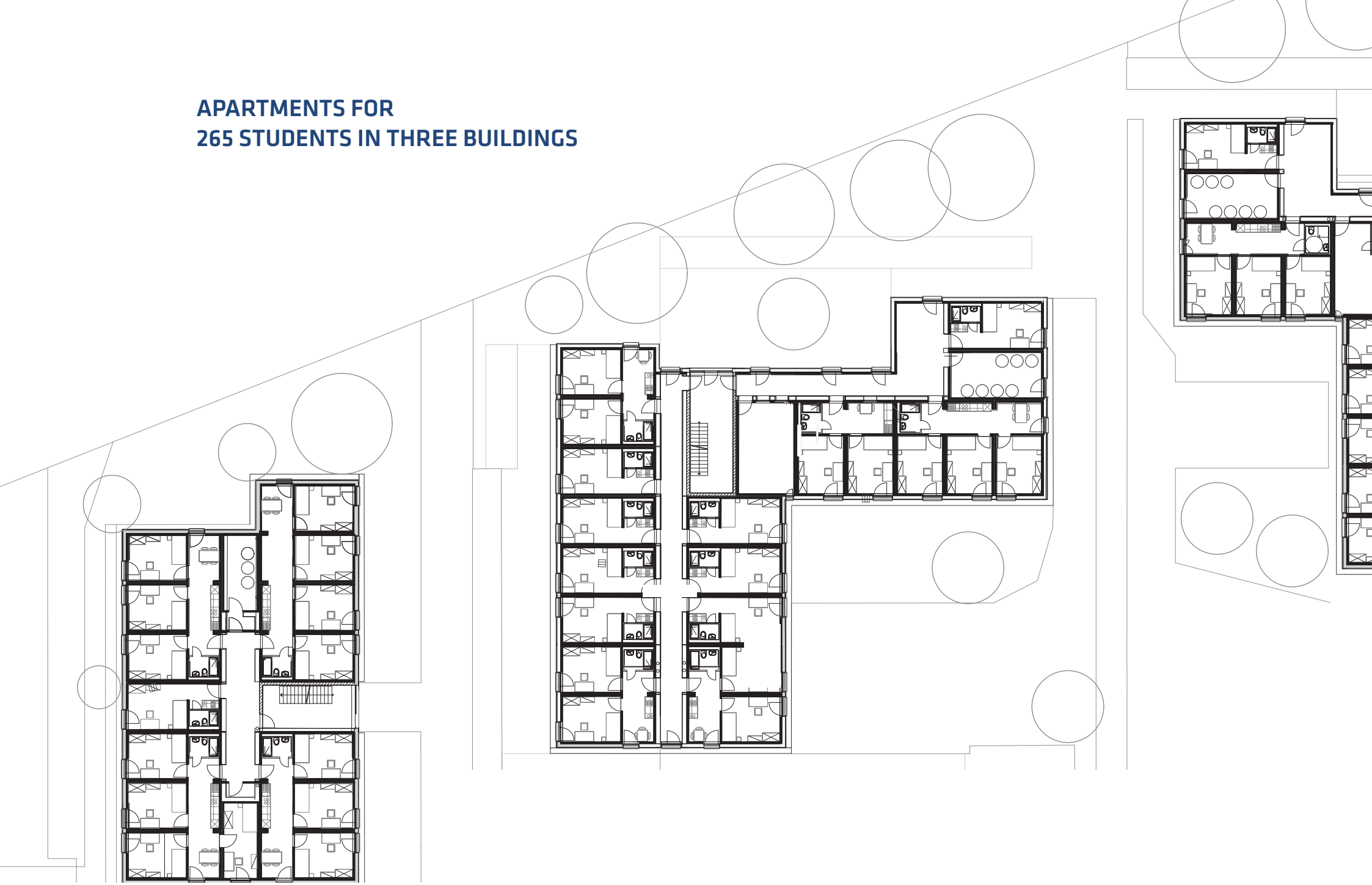
Two room apartment

The new apartment buildings for students in Heidelberg: the exterior facades are clad with fibre cement panels in various tones of grey, combined with a different primary colour for each building. The layout of the alternating window axes emphasises the visual aesthetic of the five storey building.



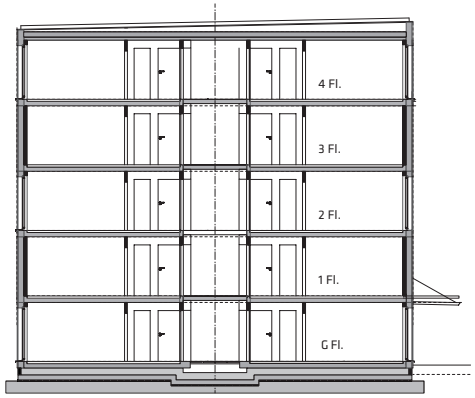
Three room apartment

APARTMENTS FOR
265 STUDENTS IN THREE BUILDINGS



The Student Union's three new five storey apartment buildings "Am Klausenpfad" on campus "Im Neuenheimer Feld" can accommodate 265 students in a green landscaped residential development for approximately 1.600 tenants. The range of services offered by the Student Union include car parking spaces and covered bicycle racks as well as a central launderette and barbecue facilities.

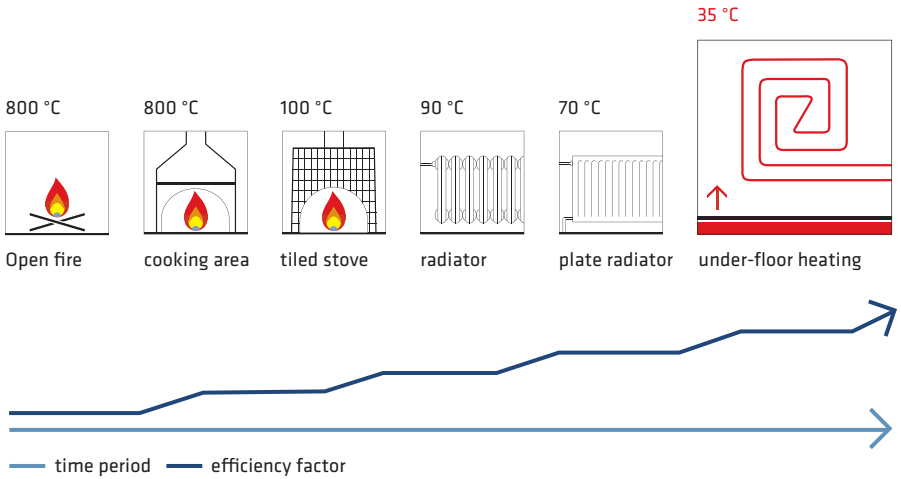
The site plan illustrates the flexibility of the ground plan and the range of possible variations depending on the individual characteristics of the building. Single apartments can easily be combined with common rooms and two to four room modules for families or flat-sharers. The West building is an "I"-shape which for the other two buildings has been extended into an "L"-shape (which in turn could be extended into an "U"-shape). In this way the "ILU-concept" which LiWooD has developed allows optimum use of the land and potentially further future development.



ENERGY-EFFICIENT AND SUSTAINABLE

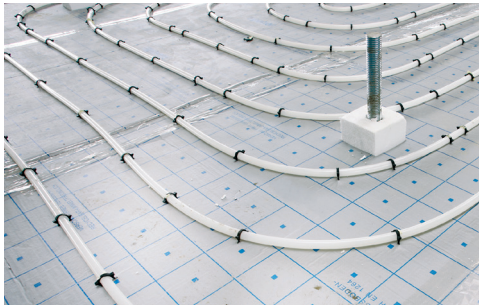
An innovative approach to wood construction facilitates an energy-efficient concept. Due to the relatively low thermal conductivity of wood, low energy standards, even passive or zero energy housing can be achieved when it is combined with insulating materials made from renewable resources. This means, that compared to other building materials, such as cement, steel or brick, timber construction results in considerable energy savings during production and processing. Furthermore, conifers (mainly spruce) are a regionally available, renewable building material and they absorb CO_2.

In contrast to conventional heating systems which have flow temperatures of 70 to 90 °C, energy efficient solutions require significantly lower temperatures (approx. 35 °C flow temperature). Specifically, the excellent insulating properties of the outer shell, resulting in higher surface temperatures of the inner wall surfaces, make it possible for low temperature heating systems to be inserted everywhere without sacrificing comfort. These heat transfer systems in conjunction with heat pumps allow environmental energy to be utilised.

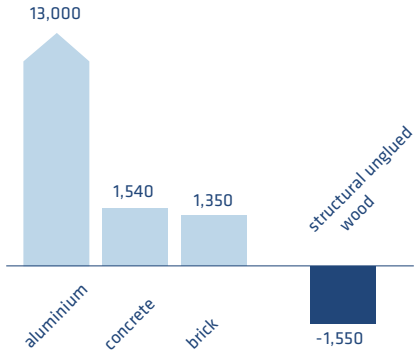


The photovoltaic elements integrated in the flat roof generate the electricity needed to operate the combi air water heat pumps, which in turn provide energy for heating and hot water.

The LiWooD concept is able to produce all the household energy required which is both cost and carbon neutral. Without intruding into the substrata, heating or cooling energy is obtained in an environmentally friendly and economical manner, by installing combi air water heat pumps which feed into the heating and cooling system via the building's own energy center. In addition a suitably sized long life, low maintenance photovoltaic system generates a large proportion of the building's electricity needs.



CO_2 emissions from building materials during production*



* per 1000 kg

Thermal insulation

Base Plate
Screed flooring
Impact sound insulation
Carrier plate
Base plate
Perimeter insulation

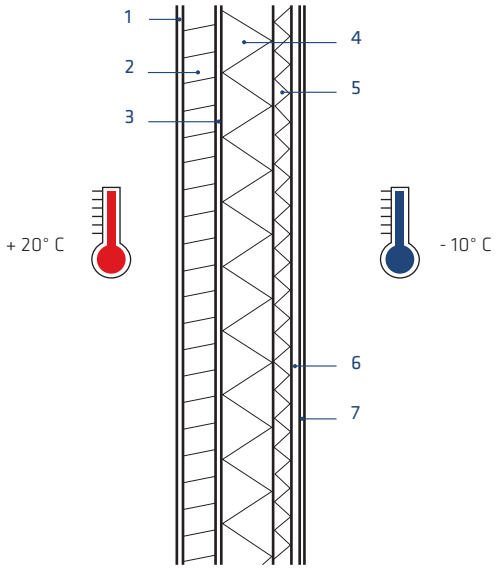
U-value
0.160 W/(m²K)

Flat Roof
Supporting structure
Insulating layer/carrier
Enclosed air cussion
Wood composite panels
Sealing
Substrate

U-value
0.127 W/(m²K)

Exterior wall
1 Gypsum fibreboard
2 Solid wood element
3 Gypsum fibreboard
4 Insulation layer 1 / structural wood
5 Insulation layer 2 / structural wood
6 Rear ventilation
7 Cladding/facade/ external cladding

U-value
0.148 W/(m²K)



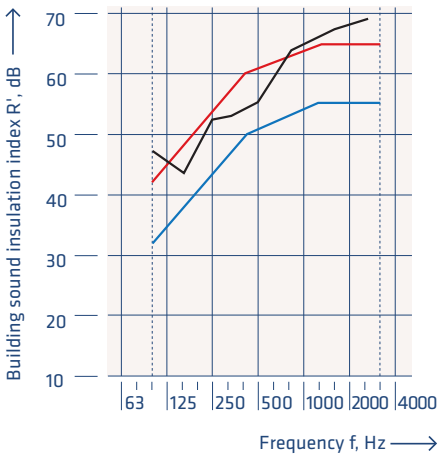
For centuries wood was the most widely used building material in the Alpine region – particularly in Bavaria, Austria and Switzerland. Thanks to modern processing techniques, this building material can easily compete with the large array of materials available today.

As a renewable building material, wood has an especially favourable eco-balance: a cubic meter of wood binds 0.9 tons of CO_2. Moreover, as against more conventional building materials wood reduces CO_2 emissions by an average of 1.1 tons. Therefore around 3,000 tons of CO_2 are stored in the new student apartment buildings.

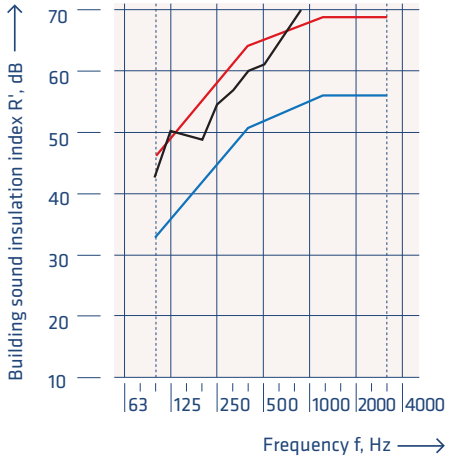
MODEL SOUND INSULATION AND FIRE PROTECTION

The student residence was planned and built with increased sound insulation in compliance with DIN 4109, Supplement 2. The walls between the modules have an airborne sound insulation value of $R'w_R$ = 60 dB and thus substantially exceed the requirement of 55 dB. The ceilings between the modules have an airborne insulation value of $R'w_R$ = 62 dB and thus also exceed the requirement of 55 dB. The impact sound insulation of the ceilings in the residential modules is $L'n_W$ = 44 dB and therefore also below the required 46 dB (when measuring impact sound insulation a lower value indicates a better value).

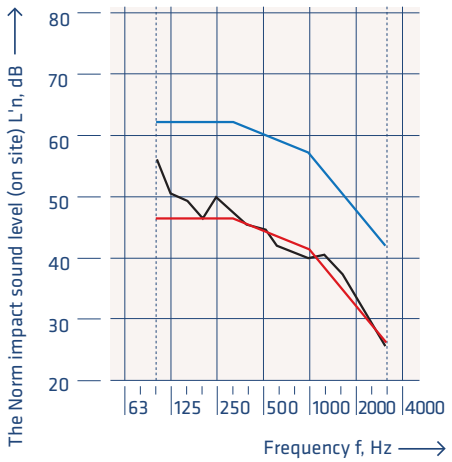
Airborne sound insulation between the corridor and apartment

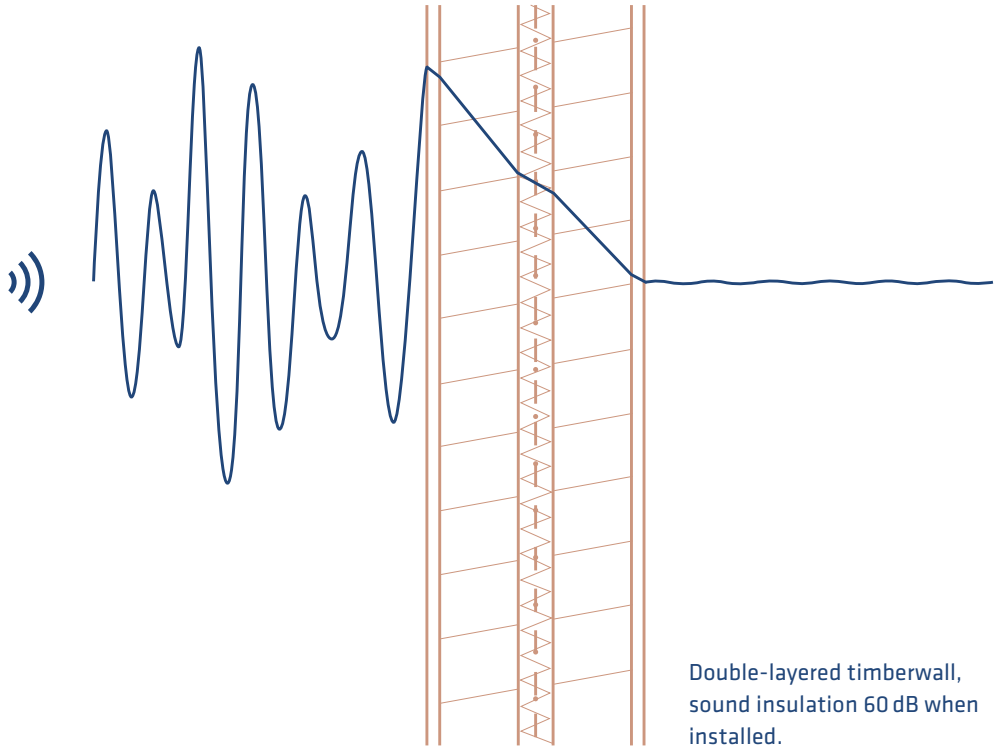


Airborne sound insulation between two apartments



Impact sound insulation between two apartments





Double-layered timberwall, sound insulation 60 dB when installed.

The houses comply with the Standards of Building Class 4 (German Standard). The fire protection concept was developed by an expert independent consultant and monitored throughout the construction period. The cross-laminated timber walls (indigenous conifers) are encapsulated with gypsum fibreboards K_2-30. The wall component, in its entirety, is classified as F60AB. Due to its low combustion rate of 0.7 mm/min., timber retains all its essential structural properties in the event of a fire. Consequently the fire-resistant properties of wood buildings are in no way inferior to that of conventional buildings made of concrete, brick or steel and are able to satisfy even high fire protection ratings.

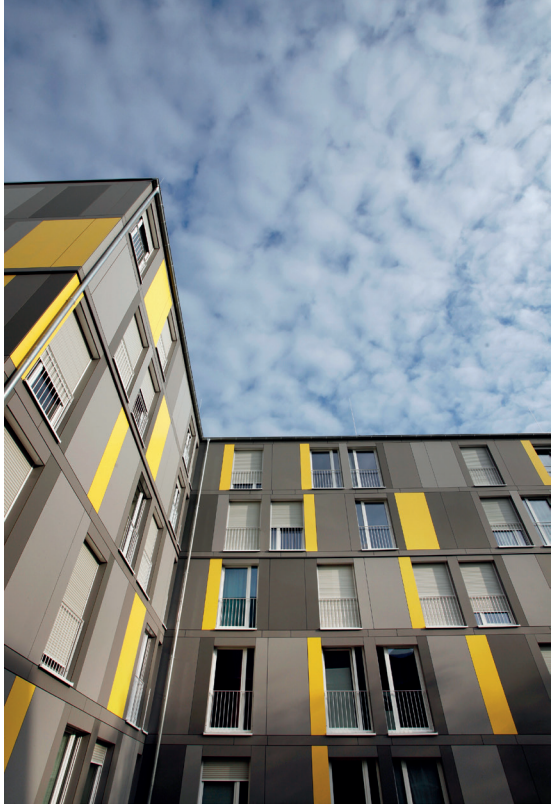
Measurement curve in dB in various frequency ranges (black curve). The blue curve shows the curve of the reference values (ISO 717-1) within the frequency range representing the values of a reference component according to ISO 717-1. The red curve corresponds to the blue curve and is shifted towards the measurement curve in such a way, that it lies always in part below or above the measurement curve.

LIVING IN ASPIRATIONAL ARCHITECTURE

The materials chosen for the residence meet the highest design standards: exposed concrete surfaces give the foyer a high-quality appearance with delicate banisters providing visual accents.

All materials used are durable, low maintenance and sustainable: therefore, the fibre cement panels in the entrance area, in the corridors and on the exterior facades are not only easy to clean but are also overlaid with graffiti resistant coating; the staircases which are made of reinforced concrete are as robust as the fitted linoleum flooring. This eliminates, to a large extent, the need for additional further treatment and/or maintenance work, for example sanding and painting.

In addition, there is a range of options for different colour combinations and designs and also variations of the facade pattern by alternate positioning of the window axes in the individual modules are possible.



The apartments are all furnished; the kitchens and bathrooms are fitted out and finished according to the individual wishes of the client.

In Heidelberg, the residential units are specially adapted to meet the needs of young people and provide enough space for individuality in student life. The study area meets all the criteria for order and functionality; well-thought out furniture and flexible design options allow each student to adapt the space to his or her individual needs. At the same time, the requirements for student accommodation are met at the highest quality level.

The two and three bedroom versions imitate flat-sharing, providing each resident with the same living and study space as in the individual module, but with an additional communal area consisting of a large bathroom, kitchen/ dining room and a lounge area.

CREATION OF A STUDENT RESIDENCE BASED ON A MODULAR FORMAT

1

PREFABRICATION OF COMPONENTS

LiWooD erects residential buildings from single modules with a range of planning options and a high degree of prefabrication. The concept of the buildings is based around industrial prefabrication and efficiency both in energy and raw material usage. They are assembled in a production line directly on construction site (“field-factory”), and the completed modules are aligned next to each other and connected floor by floor. This highly ecological and economic way of construction meets all present day housing and environmental requirements.

This streamlined system of construction results in exceptionally short build times. The materials used by LiWooD are carefully selected according to criteria of sustainability and consist of high quality raw materials: primarily wood, combined with gypsum fibre, glass and reinforced concrete. This helps to create a balanced and healthy living environment.

As with the prefabricated components, the bathrooms are delivered fully equipped as completely functional single units and then installed. This dispenses with the need to employ half a dozen different tradesmen, significantly increases the speed of completion and, also, keeps any construction damage to an absolute minimum.

2

LOGISTICS

Based on the approval of the planning application, LiWooD draws up detailed construction and workplans for every component and all the material and labour supply schedules. Finally, the individual building components, ranging from the concrete floors which have built into them all heating conduits and pipework to bathrooms and cross-laminated timber walls, all of which have been manufactured at nearby production factories, are delivered on a just in time basis to the building site, where they are then assembled in the field factory as the accommodation module.

In this way, the standardisation and industrialisation of the serial production process not only ensures the high precision of components and consistent quality, but through the outsourcing of the manufacturing orders to third party companies, the production becomes scaleable.

3

FIELD FACTORY, MODULE ASSEMBLY

On site, the wall panels which have been clad with gypsum fibreboards and smoothed over are assembled in accordance with the LiWooD specified sequence to form complete accommodation modules. Based on a rate of 70 – 90 minutes per module, the capacity of the field factory is up to 10 modules a day. Assembly in the field factory is not dependent on weather conditions which reduces the construction and logistics costs.

4

POSITIONING

The modules are lined up and stacked using a mobile crane, and then linked through the infrastructure units floor by floor. In this way buildings based on a self-supporting wood structure with up to eight storeys are created. The latest technical equipment, such as keyless entry and billing systems as well as modern communication facilities are already integrated.

5

COMPLETION OF INTERIORS

After the installation of the infrastructure units has been completed, the fibre cement panels, which are almost maintenance free, are attached to the substructure of the interior facade in the corridors and entrance areas and the concrete surfaces are cosmetically treated where necessary.

6

COMPLETION OF FACADES

After the field factory has been dismantled, work on the completion of the facades and the outdoor facilities begins; whilst, at the same time, all the installations are completed inside and the built-in furniture is fitted.

The sealing of the roof and the side walls completes the building envelope. The photovoltaic panels, which are installed on the roof with an East to West orientation, generate the power required to operate the combi air water heat pumps, mainly during the periods in which most energy is needed (morning and late afternoon).

KEY DATA FOR THE APARTMENT BUILDINGS

Client	Student Union Heidelberg
Scope of Project	Turnkey Building
Building Class/Classification (Fire protection)	4
Completion	2013
Ready for Occupancy	5 months after completion of foundation slab
Energy supply	Combi Air Water Heat Pumps, Photovoltaic (PV)
Energy efficiency	KfW40 (German Standard)
Primary energy demand	20.9 kWh / m^2 / a
Final energy demand	16.1 kWh / m^2 / a
Final energy demand whole building	ca. 96,600 kWh / a
Performance PV system	120.96 kWp
Annual yield from PV system	ca. 98,000 kWh
Gross floor area	7.610 m^2
Number of bed spaces	265
1 / 2 / 3 / 4 Room Apartments	93 / 35 / 18 / 12
Study and reading rooms	9
Porter	1
Technical rooms	3
Service rooms	2
Material walls	cross-laminated timber
Material facades (exterior/interior)	fibre cement boards
Material staircase	exposed concrete
Material floors	concrete and cement screed with underfloor heating
Modular Construction	Assembly of prefabricated components, delivered just in time, to the field factory line directly adjacent to the building site. Finally, positioning of the modules on the construction site to complete the building.

LiWooD – LIVING IN WOOD
AS SIMPLE AS IT IS INGENIOUS

LiWooD brings its own factory – this distinguishes us from traditional suppliers of modular building: We set up the field factory adjacent to the site.

The majority of the components required for the construction project are produced according to LiWooD's detailed design and workshop plans in nearby factories and delivered just in time to the building site, where the individual components are fully assembled to create accommodation modules.

Finally, the finished modules are lined up using a mobile crane, stacked and attached floor by floor. This construction method makes it possible to erect self-supported wood buildings with up to eight storeys.

In addition to creating student residences, this innovative and efficient concept can also be adapted perfectly for residential buildings, first time buying buildings, apartment hotels, retirement homes as well as medical/health facilities.

TURNKEY CONSTRUCTION WITH PLANNING IN ACCORDANCE WITH "HOAI" SCOPE OF SERVICE PHASES 1–9
(BASED ON GERMAN ARCHITECT'S AND ENGINEER'S REMUNERATION STANDARDS "HOAI")

FIXED PRICE GUARANTEE AND FULL WARRANTY

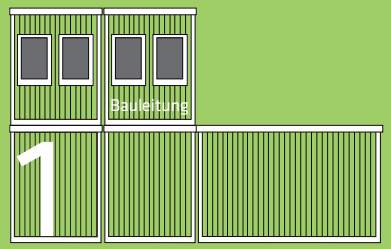
RAPID CONSTRUCTION AND LONG SERVICE LIFE

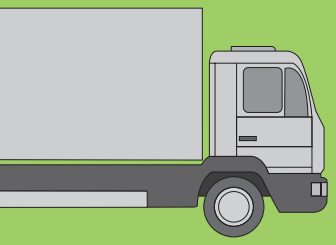
SUSTAINABLE AND VERSATILE

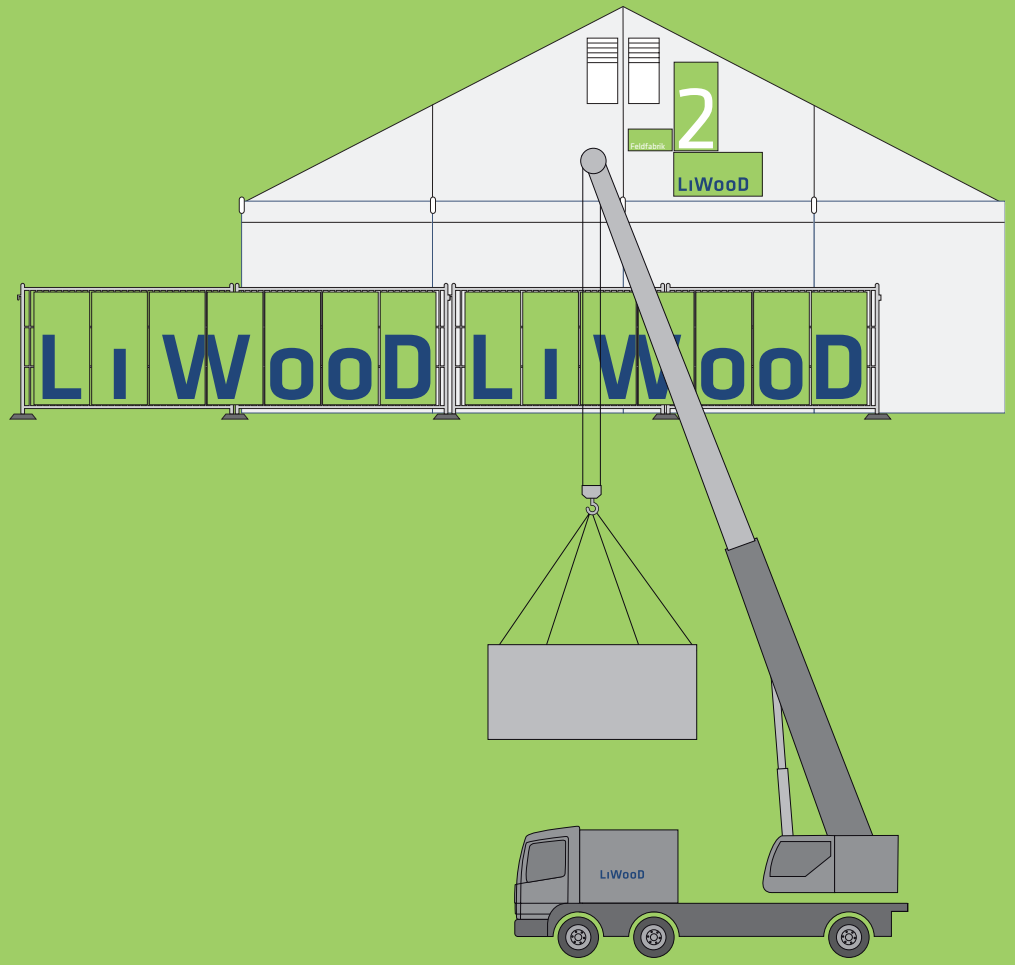
ECOLOGICAL AND ENERGY EFFICIENT

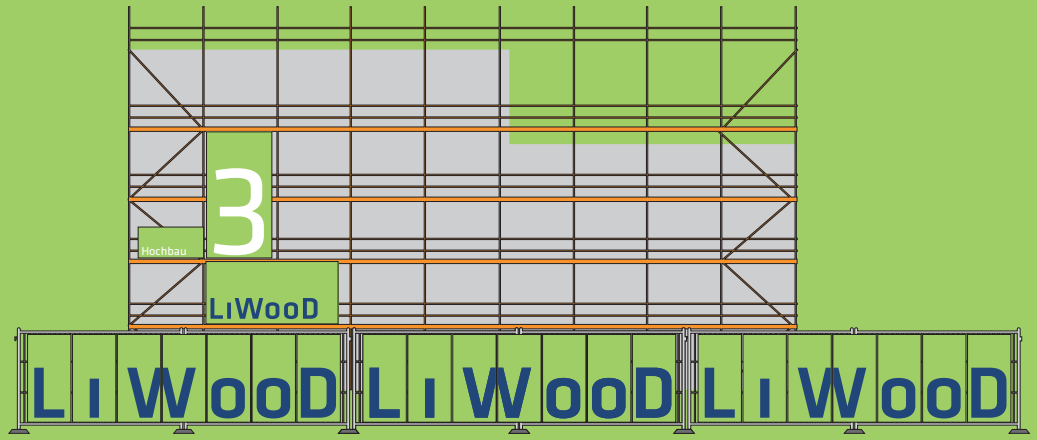
MODULAR CONSTRUCTION FROM WOOD AND CONCRETE

HIGHEST LEVEL OF LIVING COMFORT AND MODEL SOUND INSULATION AND FIRE PROTECTION









 Photos: Sascha Kletzsch except p 1 LiWooD, p 7 b. iStock.com/Sieto, p 7 b.r. iStock.com/ssuni Graphics: LiWooD except p 8 and TSB Tichelmann Design: Büro für Gestaltung Wangler & Abele

LiWooD Management AG

Rueckertstrasse 5
D-80336 Munich
Phone: +49 89 4111 8411 0
Fax: +49 89 548 889 79

Office Eningen
Reutlinger Strasse 21
D-72800 Eningen unter Achalm
Phone: +49 7121 987 80

kontakt@liwood.com
www.liwood.com