



ALLPLAN in practice | Structural Engineering

AIRSHIP HANGAR MÜLHEIM: AN AWARD-WINNING MASTERPIECE OF MODERN TIMBER CONSTRUCTION

The Mülheim airship hangar combines innovation, sustainability, and a pioneering spirit to create a breathtaking piece of modern architecture.

Airships were once the kings of the sky, ruling the air with colossal dimensions and majestic grace. Over time, they were replaced by airplanes, which were more practical in many respects. However, these floating giants never disappeared completely. In Mülheim an der Ruhr, for example, entrepreneur Theodor Wüllenkemper helped bring about their renaissance as flying billboards in the early 1970s. His company, Westdeutsche Luftwerbung (WDL), had previously flown advertising banners through the air in up to 80 small aircraft. When this was no longer possible due to stricter noise

protection regulations, he reinvented his company with airships. Until a few years ago, these blimps were maintained and stored for the winter break in a textile-covered lightweight hangar at Essen-Mülheim Airport, which had also been used for their construction in the past. In 2022, this popular and highly visible landmark made of steel and fabric was demolished to make way for a new replacement building – a move that was not universally welcomed in Mülheim. However, the architectural and engineering masterpiece that has since replaced the hangar quickly silenced all criticism.



The airship hangar's 100% wooden supporting structure consists of 15 two-hinged arches, each 26 meters high.



A total of 557 tons of spruce wood from local forests was used. This saved approx. 156 tons of CO₂.

The engineering firm Ripkens Wiesenkämper, together with Marx Krontal Partner, was responsible for the structural design (LPH 1-6), which played a key role in this success.

Old shape, innovative design

The biggest challenge of the project was the construction requirements. The approval for a new replacement building stipulated that the footprint and volume had to match the existing building. One architect had previously failed in his attempt to obtain approval for a rectangular hall. This meant that the familiar vaulted shape of the old hangar had to be constructively reinvented, so to speak. It was precisely for this purpose that client representative and project manager Lars Römmling brought Ripkens and Wiesenkämper on board, who are known for their innovative timber constructions. Together with the architectural firm Smyk Fischer, the engineers worked on a timber construction solution.

For Tobias Wiesenkämper, it was clear from the outset that only arches could be considered for the curved supporting structure. His office initially suggested solid timber trusses for this. However, Smyk Fischer opted for trussed girders, as this emphasized the impression of industrial architecture and at the same time conveyed a sense of lightness. This idea also proved to make sense in terms of material efficiency, which was all the more important given the sharp rise in building material prices. Together with Marx Krontal Partner, the engineers ultimately developed an all-timber truss that does not require any steel at all thanks to almost 600 innovative timber nodes and trusses.

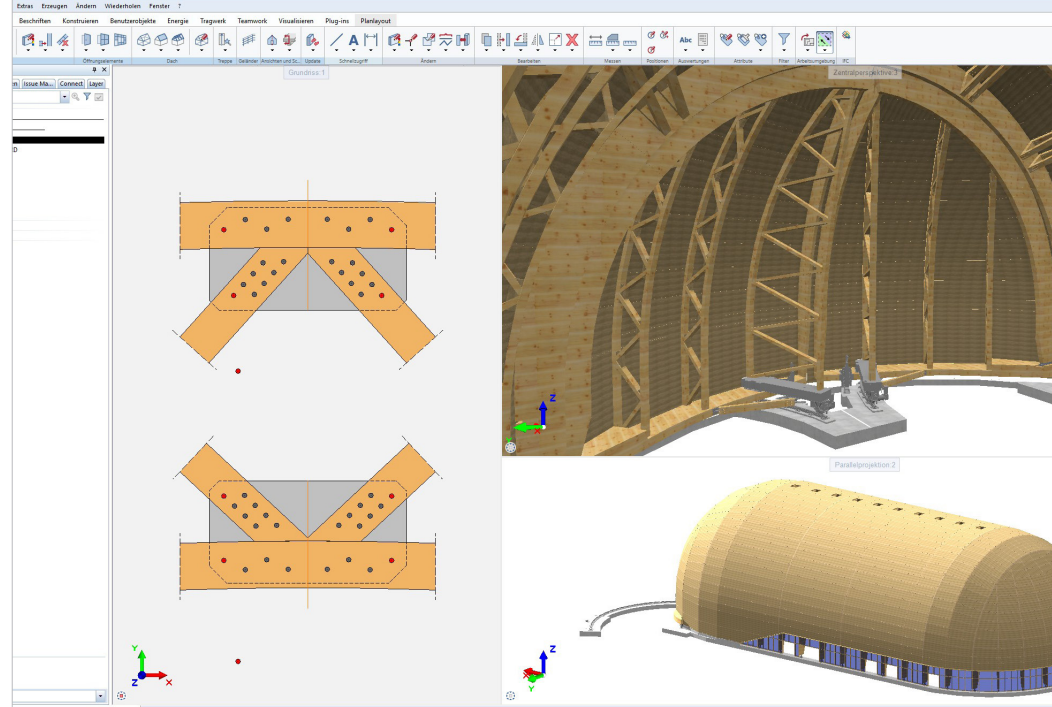
PROJECT INFORMATION AT A GLANCE

- > **Focus:** Structural engineering
- > **Software:** ALLPLAN AEC
- > **Client:** WDL Luftschiffgesellschaft mbH
- > **Execution planning & site management:** Gronau Plan GbR
- > **Structural design:** Ripkens Wiesenkämper Beratende Ingenieure; MARX Krontal Partner (MKP GmbH)
- > **Project duration:** 2022-2023

The unique supporting structure of the new 92-meter-long and 42-meter-wide airship hangar is made of fifteen 26-meter-high double-hinged arches. Truss and upper chord diagonals are fixed into the cross-laminated timber roof shell. An aluminum standing seam profile forms the protective outer skin.

The hangar only reaches its full length when its double-leaf door is closed, which presented its own challenges. On the one hand, these included the enormous weight of 72 tons per door, particularly with regard to the hinges and wind resistance. Secondly, when open, the leaves had to be considered and stabilized as stand-alone structures, while the closed hall formed a structural unit with them. And last but not least, everything had to fit together precisely despite the enormous moving dimensions.

The expertise of Dr. Schippke + Partner was crucial in finding a solution for the gate. The specialist engineering firm drew on all of its experience with large



Thanks to almost 600 innovative wooden nodes and trusses, the supporting structure does not require any steel at all.

Ripkens Wiesenkämper used ALLPLAN for the structural design (including reinforcement planning) of this unique project. Each component is stored in a material passport on the Madaster platform.

moving components from the field of hydraulic steel construction. Thanks to this specialist expertise, an excellent solution was ultimately developed: a combination of pivot points via solid hinges and a rail that serves as a track. The gate leaves are guided over the latter by means of running wheels, driven by four 80 HP electric motors.

Prime example of sustainable building

The new Mülheim airship hangar is not only a masterpiece of modern timber construction, it is also a prime example of sustainable building. Thanks to the continuous timber construction made from a total of 557 tons of spruce wood from local forests, the equivalent of around 156 tons of CO₂ was saved. At the same time, the entire life cycle of the building was taken into account when planning the material resources. When the time comes, the hangar should come to a glorious end, as the materials used in it can still be used as building materials afterwards. Both the entire timber structure and the aluminum shell are completely recyclable. The components can therefore be easily reused or recycled. To ensure that future generations know what is used where in the hangar, all components of the building are recorded in a building resource passport and stored in the Madaster digital material register. Incidentally, part of the hangar is already a recycled product: three foundations from the former airship hangar that were broken up on site were used as the substructure. The new floor, in turn, consists of the old concrete slabs from a former Mülheim logistics center.

Structural design with ALLPLAN

Ripkens Wiesenkämper relied on ALLPLAN for the complex structural design. "With ALLPLAN, projects can be realized faster because it offers seamless integration of design, planning, and execution," explains Tobias Wiesenkämper. "Particularly noteworthy are the high level of accuracy and the extensive planning functions, which promote error-free implementation and easy team collaboration." As a basis for the entire planning process, a complete 3D model of the structure was first created in the planning software. Detailed points were also modeled in order to precisely depict complex connections such as the timber nodes and other critical areas. The engineers also carried out regular collision checks on the model in order to identify and avoid any conflicts between components as early as possible. Determining quantities directly from the model enabled precise material and cost estimates. In addition to the structural model of the hall, a detailed reinforcement model was also created for the steel reinforcement of the foundation. This ensured an exact representation of the reinforcement layout as well as a direct derivation of the formwork and reinforcement plans.

Cloud-based planning in real time proved to be extremely practical. This allowed several designers to work on the project simultaneously in ALLPLAN. At times, up to four engineers were working on the same model at the same time. Tobias Wiesenkämper cites the strong support of the BIM methodology as another reason for using



When it is not needed for the accommodation and maintenance of airships, the hall also serves as an event location for up to 1,500 people.

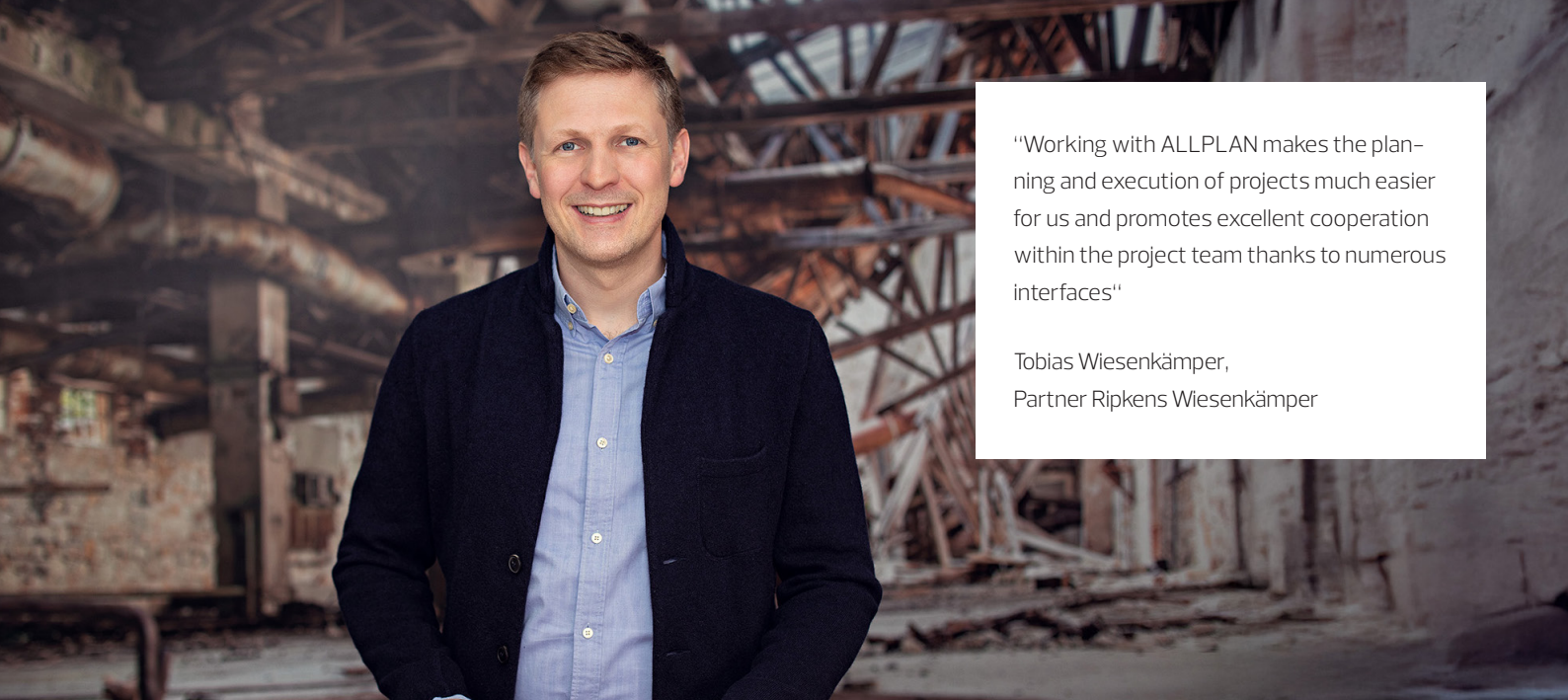
ALLPLAN in the office. "With these advantages, ALLPLAN is an excellent choice for anyone striving for innovative and high-quality planning processes," says the engineer. Due to a very tight schedule, the BIM workflow was implemented downstream at the Mülheim airship hangar. On the one hand, this served the purpose of quality assurance by allowing the planning to be checked again in a structured manner and the construction processes to be sustainably optimized. On the other hand, BIM was used to create a digital twin of the building. Based on this, the airship hangar could be provided with a material passport and stored on the

Engineering Prize, the NRW Architecture Prize, the NRW Timber Construction Prize and, most recently, the crowning glory of the German Engineering Prize (State Prize). But the people of Mülheim have also won: when the airship is not in the hangar, up to 1,500 people can use this unique cathedral of innovative, sustainable architecture as an event venue and experience it firsthand.

Madaster platform, among other things. This ensures that its materials and building components are documented in the long term and can be reused in the future in line with a genuine circular economy.

An ongoing success story

Thanks to excellent planning and coordination, but also the huge commitment of everyone involved in the project, the new airship hangar was built within an extremely short time frame. As the WDL airship must not be exposed to snow, the old hangar was not demolished until mid-April 2022, while the new one had to be completed before the onset of winter. With combined efforts – and probably also the pioneering spirit of Theodor Wülkenkemper – it was completed on time, in November. However, the success story of this iconic building is far from over. In the meantime, the awards for the project are almost piling up, including the Ernst & Sohn



"Working with ALLPLAN makes the planning and execution of projects much easier for us and promotes excellent cooperation within the project team thanks to numerous interfaces"

Tobias Wiesenkämper,
Partner Ripkens Wiesenkämper

The customer

Inspired by the unique style of the Ruhr area, Ripkens Wiesenkämper Consulting Engineers offer innovative engineering services at the highest technical level. The main areas of their wide-ranging service portfolio include structural design and building performance engineering of solid, steel, and timber structures for private, public, and industrial clients. Personal and qualified advice at eye level and the best understanding are the basis for sustainable cooperation. With the support of

our dynamic team, we can work on your projects successfully and creatively. With us, you get new ideas from an innovative team based on all the core competencies of solid engineering. Graduate engineers Stefan Ripkens and Tobias Wiesenkämper are state-approved experts in sound insulation and thermal insulation from Essen.

About ALLPLAN

ALLPLAN is a global provider of AEC software with BIM solutions for architecture, structural engineering, detailing, fabrication and construction. True to our "design to build" claim, we provide tools that enable earlier data-driven design decisions, support digital fabrication and leverage information throughout the entire construction process. Integrated cloud technology further optimizes interdisciplinary collaboration on building and infrastructure projects. Our innovative workflows

empower architects, engineers, and construction professionals to deliver their projects more productively, safely, and eco-consciously.

Around the world, over 700 dedicated employees continue to write the ALLPLAN success story. Headquartered in Munich, Germany, ALLPLAN is part of the Nemetschek Group – a pioneer for digital transformation in the construction sector.

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