

Sustainable industrial building design & optimization

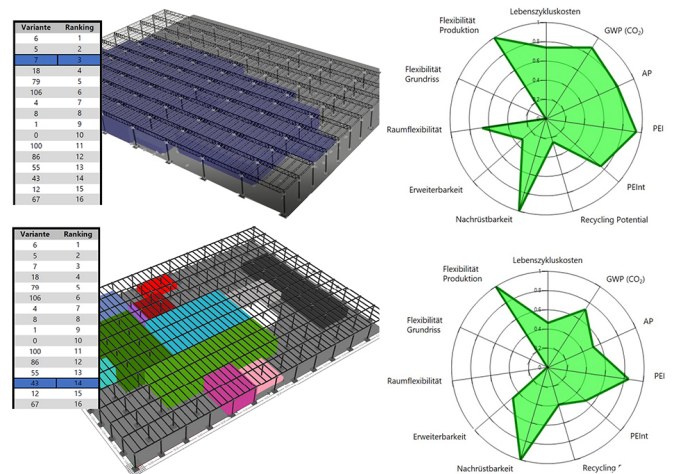
Software for preliminary decisions in early design stages of factories, warehouses and logistics facilities

Industry 4.0 and innovative manufacturing technologies are driving growth so that we see a dramatic rise in production diversity. Due to rapid fluctuations in demand, frequent changes to production processes and logistics are increasingly necessary. Building structures need to meet those changing requirements. Most existing industrial buildings are not flexible enough to adapt for further use. The result is often either renovation, or demolition and new construction, which lead to significant new investment and increased resource consumption. At the same time, building structure has a significant impact on the amount and type of building materials used, and thus on the environmental footprint of industrial facilities.

Building and production planning currently run separately in two varying development processes and software environments. **That will have to change.** Planning flexible and sustainable building structures requires the early collaboration and **involvement of all planning partners involved.** Our tool integrates the design of an industrial building with the planning of production layouts so that these tasks can be completed and optimized simultaneously.

Objective

The goal was to develop a software platform that enables holistic planning and optimization of sustainable industrial buildings. This software is intended to support the realization of buildings with increased adaptability in terms of flexible production layouts. It is intended to reduce planning time, resource consumption and construction costs. The respective players in industrial building and their expertise ought to be networked within a digital tool and their specialist equipment, simulations and working methods integrated. Another goal was to provide those involved in planning with an efficient visualization of decision options in order to promote close collaboration. These objectives were realized by the Integrated Planning and Industrial Building Research Unit of the TU Wien.



The planning tool generates and optimizes building plans over the building's whole life cycle, and provides decision-making support through automatically generated variant studies

Solution

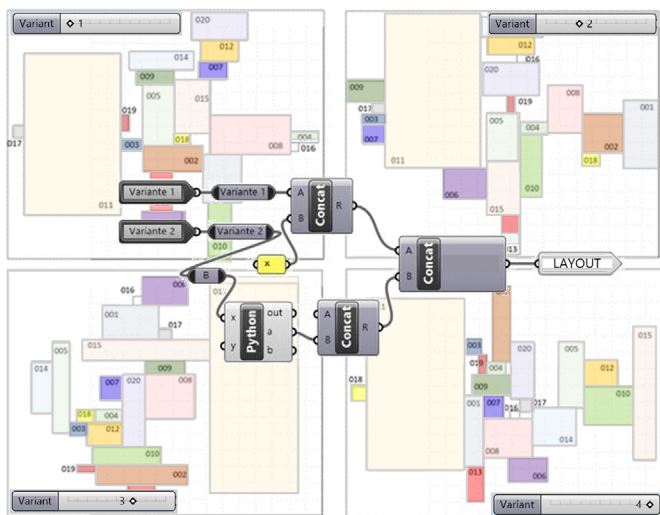
TU Wien researchers developed planning software for automated structural and layout analyses of buildings and production systems. Based on generative design and evidence-based decision-making methods, this software creates an automated design process. Users get real-time feedback regarding costs, life cycle assessment (LCA), and flexibility. This allows decisions to be made in an informed, transparent and rapid manner.

A multi-user virtual reality (VR) platform allows users to explore the building and production layouts generated directly in a 3D digital environment, providing real-time feedback.

Results

The new software platform offers the following three planning improvements:

- Automates planning and optimization of **production layout variants.**



The software automatically generates variants of the production layout that allow for the greatest possible flexibility and sustainability of the structure

- **Comprehensive scenario generation for production, storage and logistics buildings** regarding materials and structural systems as well as their analysis and optimization in terms of: material consumption, flexibility, life cycle costs and LCA (criteria such as Global Warming Potential (GWP) aka CO2 emissions).
- **Integrated development** of production layout and building planning according to the principle of optimizing for the greatest possible structural flexibility and sustainability.

The software optimizes building design using automatically generated production layouts based on predicted production scenarios. It also automatically provides recommendations in real-time for building material, structural design and production layout options. The multi-user VR platform enables users to interactively review and modify design decisions in a 3D environment.

Your Benefits

The new software platform

- efficiently supports building owners and industrial companies' management in making priority decisions in preliminary design planning. In industrial pilot projects conducted with structural engineers and production planners, **software use reduced planning time by 90% (from about 4 weeks to 2 days) and found variants that saved 10% of costs.** When used in construction companies, it was shown that the automated creation and calculation of bid variants **reduced the time required to prepare a bid for an industrial production hall by 80%**; at the same time, the software quickly and efficiently determined the most economical variant.
- facilitates the planning and realization of flexible, cost- and resource-saving and thus sustainable industrial buildings for building owners, architects, structural and production planners as well as project developers and construction companies.
- helps to anticipate and facilitate subsequent planning steps and rescheduling, which are currently often unavoidable, in a highly effective manner.

The software platform and our experienced development team are now available for further industrial building planning projects.

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