

Isenburg Karree Mainz | ProfessorPfeiferundPartner, Engineering Firm, Darmstadt

From Prison Cell to Office

This construction project had two challenges which needed to be overcome: the conversion of a prison into a generously structured office and commercial building, and the handling of the fabric of an old building in Wilhelminian style, which threw up a few surprises. For the structural design for the Isenburg Karree Mainz project in the heart of Mainz city center, Darmstadt-based engineering firm ProfessorPfeiferundPartner conducted an exemplary work process in 3D using Allplan Engineering.

Current surveys have shown that more than half the future building volume in Germany will be generated in the area of conversion and restoration. Fewer and fewer new buildings are currently being planned. In contrast, the number of existing buildings requiring restoration is constantly increasing. Experts agree that demand for conversion work will continue to increase, a development that affects engineers and architects equally. Ute Pfeifer, who heads the engineering firm ProfessorPfeiferundPartner jointly with Professor Matthias Pfeifer says: "Designing and building in the existing fabric is highly relevant for our practice. The transition from new building to restoration or the extension of buildings means a change in the focus of activities for many architectural and engineering companies. The work processes thus need to be optimized. In our experience, working in 3D helps to master the tasks we face quickly, accurately and cost-effectively."

The restoration and conversion of a listed former prison from 1908 to an administrative building – right in the city center – is not an everyday task. The Isenburg Karree Mainz project also involved demolishing and rebuilding some structures found in the courtyard. The engineering firm ProfessorPfeiferundPartner, with 70 employees at a number of German and international branches, specializes in the preservation, modernization, restoration, upgrading and extension of historical and listed buildings. The Darmstadt-based office, founded in 1989, was therefore a competent partner for the building client, LBB Landesbetrieb Liegenschafts- und Baubetreuung, Koblenz branch, for this demanding task.

Complete execution planning in 3D

For execution planning, the firm used the Allplan CAD software from Nemetschek Allplan: "The program enables a complex, three-dimensional formwork to be applied after as-built capture for the reinforcement, even for non-right-angle components. As a result, reinforcement sections for large-area installation can be determined, even for widely varying room dimensions. Designers retain an overview of whether reinforcement was

planned for all components, and whether collisions have been avoided if there are several reinforcement layers. Fixtures such as lugs, sound insulation elements or screw connections can be integrated and geometrically checked," says project manager Meike Töllner. Another advantage of Allplan: design professionals' drawings for openings based on all conventional CAD systems could be easily transferred to the engineering firm's own plans.

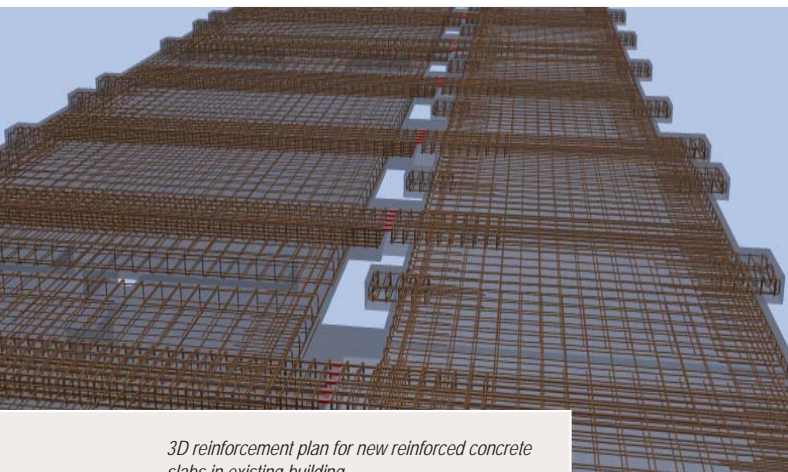
The main task was to adapt the small-scale room structure of the prison cells to the requirements of an administrative building. For this, the existing floor and ceiling slabs, which did not offer sufficient load-bearing strength, were replaced by new reinforced concrete slabs, and retaining structures for the more generous room structure and access shafts were included. This provided barrier-free connection with the ground-level entrance hall, which extends over one-and-a-half stories and the elevator shafts. An underground car park and adjacent extension were built in the inner courtyard.

» For us, building in the existing fabric means retaining the original quality, as well as the cultural identity and value of historic buildings. «

Dipl.-Ing. Ute Pfeifer

Knowledge of historical construction methods essential

An extensive survey of the existing fabric of the old building was carried out for the structural engineering check. Here, the engineers from ProfessorPfeiferundPartner were able to apply their knowledge of historical construction methods. The check on the construction materials used was important. As the building's use as a prison required hardly any live load or inte-



3D reinforcement plan for new reinforced concrete slabs in existing building

rior works load, the construction through to the foundation had to be upgraded for a load increase of approximately 40 per cent. Existing floor and ceiling slabs were demolished section by section, or individual parts of the building were completely gutted and all new components integrated taking account of the resulting building sections. The foundation below the existing building was constructed using small-bore piles.

The components in the basement, e.g. new floor slabs and the space below the inner courtyard buildings were in the groundwater zone and had to be connected to the existing fabric in a water-tight manner by means of special structures. Complex steel constructions were measured to protect the interim building phases. Following consultation with the office for the protection of historical monuments, components of historical value were preserved. The existing sandstone stairwells also underwent load tests to ensure that they could withstand the required live load and interior works load. A few typical obstacles that are frequently seen when designing and building in the existing fabric naturally played a role in the Isenburg Karree Mainz project. Because of a lack of space, the reinforcement steel had to be supplied based on the individual progress of the building. Professor Pfeifer und Partner solved the problem by quickly and simply creating steel schema lists in Allplan Engineering that matched the building sections clarified with the construction company.

Changes are automatically transferred to plan sections

Another factor which complicates remodeling projects, is that problems frequently arise only after construction has started. In the Isenburg Karree Mainz project, for example, there were damaged components that were not previously visible. The engineers discovered constructions that differed from the original plans, as a result of previous renovations or war damage. In addition, some individual components such as cornices or pilasters were not sufficiently secure. In all of these cases, the engineers had to provide supplementary structural evidence, take account of conceptual changes at short notice during building execution and clarify these with the testing engineer. The fact that such work was dealt with quickly and smoothly can be attributed primarily to working with Allplan Engineering using the 3D model. "In Allplan, every change in the design is automatically transferred to all derived plan sections. This significantly reduces the number of errors, and we save a huge amount of time," explains Meike Töllner.

Surprise under the construction site

A further challenge was awaiting the team from Professor Pfeifer und Partner in Mainz. Below the construction site, the engineers were surprised to discover a tunnel that caused a last-minute change to the foundation concept. The tunnel was measured, sections were filled, and it was integrated in the





planning changes. Here, too, the engineers benefited from working with Allplan, because the geo-data could be read in easily with Allplan. There was another hurdle in individual sections of the prison's existing fabric: according to the currently valid standards, a suitable verification procedure could not be found. To be able to preserve and further use these historical structures, expert opinions needed to be obtained.

The building that still housed prisoners as recently as 2002, will now be the workplace of 160 employees from the Ministry of Justice of the state of Rhineland-Palatinate by the fall of 2012. Instead of small prison cells, the civil servants will have comfortable offices and conference rooms, as well as a large entrance hall in an accessible building. The building services are state of the art and meet the requirements of a renovated building. Only the attractive Wilhelminian facade evokes memories of the building which was once a prison.

Project in brief: Designing and building in the existing fabric is a constantly growing sector and now makes up more than 50 percent of construction volume in Germany. One interesting example from practice is the restoration of a prison from the Wilhelminian period in the center of Mainz, the Isenburg Karree Mainz. As part of a multi-disciplinary team of experts, engineering firm ProfessorPfeiferundPartner was commissioned to convert the listed building into a representative administrative building. A number of hurdles had to be surmounted, for example the very restricted space, damaged components, or actual structures that deviated from the building plans. Thanks to the engineers' in-depth knowledge of historical construction methods and the use of the Allplan Engineering software from Nemetschek Allplan, the conversion was a success, and the attractive Wilhelminian facade will soon shine in a whole new light.

Focus:
Designing and Building in the Existing Fabric – Engineering

Software used:
Allplan Engineering

Project data:
Client: LBB Landesbetrieb Liegenschafts- und Baubetreuung
Planning: Begun in 2008
Construction: Begun in 2010
Structural completion: Scheduled for end of 2011
GRV: approx. 50,100 m³
Effective area: approx. 11,750 m²
Total building costs (net): approx. EUR 18 million