



Centre Pompidou-Metz,
Metz, France

Allplan in practice

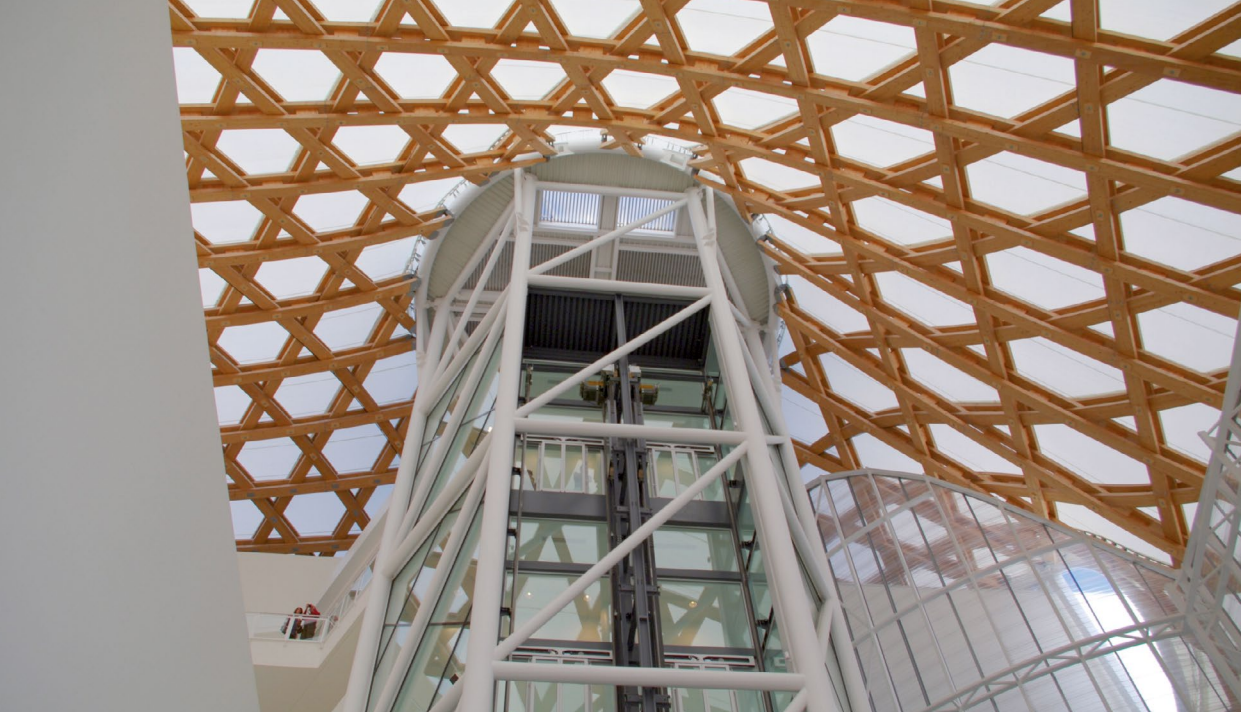
ART UNDER A STRAW HAT

A building which houses modern and contemporary art must, itself also, satisfy certain artistic demands.

And this is certainly the case at the Pompidou Art Center in Metz: The architects were inspired by the straw hats of Japanese rice farmers. This new home for art represents a milestone in the field of architecture and faced structural engineers with a number of challenges. They were solved with Allplan Engineering.

Not only is the Pompidou Center in Metz the centerpiece of an extensive redevelopment project in the capital of the Lorraine region but, it is the first decentralization project carried out by a French

cultural institute. It also marks a completely new trend in this previously very centralized country. With its own exhibitions and events, the new art center will give a wide ranging audience the chance to see things previously only available at the main Pompidou Center. Established in 1977 in Paris, with around 59,000 exhibits, it is the largest interdisciplinary collection of modern and contemporary art in Europe. The aim of the Pompidou Center in Metz is to establish itself as a point of cultural influence throughout eastern France, to enable it to develop into one of the main cultural institutes in Europe.



A TENT FULL OF SURPRISES

The architects Shigeru Ban (Tokyo), Jean de Gastines (Paris) and Philip Gumuchdjian (London) won the international architectural competition in 2003, with a floating design of concrete, steel and wood. The client Metz Métropole selected the Demathieu & Bard construction group to establish the supporting general arrangement, with the CTE engineering agency in Mulhouse and thus its Freiburg branch, CHP GmbH, being assigned the task of structural design. The groundbreaking nature of the building, which was inspired by the image of a rice farmer's straw hat, made the structural design a particular challenge: Firstly, the three materials – metal, wood and concrete had to be combined and their static interdependently taken into account. And secondly, the architectural design was very complex due to the optically individual, yet statically overlapping interwoven elements.

Three exhibition galleries made of reinforced concrete extend out from a hexagonal tower; a 77 meter high arrow shaped steel tube frame construction. The galleries overlap each other in the form of a parallelepiped and cross each other at 45 degree angles. The over 80 meter long galleries are supported by narrow concrete columns. The main load bearing structure consists of reinforced concrete and covers seven floors. The galleries are complemented by the 1,200 m² nave, a studio for cinema and theater

performances and an auditorium for other events. An information center, a café, a restaurant and a bookshop are located in adjoining rooms.

The straw hat design was realized using a filigree roof structure made of laminated spruce. The glass fiber and Teflon membrane consists of six rectangular modules that cover an area of 8,000 m² and falls from a height of 37 meters from a metal ring. The total exhibition area is 5,020 m². All exhibition areas can be modularized as required, thus contributing an element of surprise to artistic displays. Taken as a whole, the airy building is somewhat reminiscent of a big circus tent with a front yard and some green spaces.

BETWEEN DESIRE AND REALITY

During the planning of the supporting general arrangement, it quickly became apparent that the original architectural concept was associated with serious risks in terms of construction: a wooden roof structure was planned, which was to be fixed to the concrete construction and would therefore be very rigid. In contrast, the galleries were designed to be very flexible. There was therefore a risk of uncontrollable deformations forming between the various construction elements. Together with the french company Demathieu & Bard, and with support from the timber specialist Professor Dominique Calvi, CTE reworked the original design.



The three galleries were constructed as more rigid, monolithic structures upon which the roof rested as a floating spherical form. The horizontal and vertical deformations between the supporting general arrangement of concrete and the surrounding steel and wood structures were thereby disconnected. If one takes a look at some of the key figures, the construction requirements of this project are particularly impressive in terms of the size of the computer model: 45,000 surface elements, 15,000 wire elements, 346 foundation points, 240 load cases and 600 load combinations were also to be taken into account.

A CLEAR VIEW IN THE THIRD DIMENSION

Once the static challenges were resolved, the computational results from CHP's Freiburg office were integrated into the reinforcement design. For this, CHP relied on the solution Allplan Engineering. Two dimensional planning was not sufficient for the challenges of this project, as the complexity of the intersections and the connection points, as well as the high degree of reinforcement required, made 3D tools vital for the reinforcement planning. The interactive functionality of Allplan Engineering provided support in this respect to the CHP planners: depending on requirements, the CAD designers could work with floor plans, isometrics, views and sections in order to create the spatial model. Changes to the reinforcing body were then automatically transferred by the system to all plans and lists.

Particular attention was given to the portrayal of connections between the tower and the galleries, between the gallery ceilings and walls and between the various floors and the main structure of the tower. In addition to the usual planning documents, 3D detail renderings of the reinforcing body were created from the highly complex penetration points and passed on to the building site. These helped the onsite construction teams to better understand the respective situations and to identify the best possible construction solutions.

SEAMLESS COOPERATION

A further advantage of 3D planning with Allplan was that, in contrast to conventional reinforcement planning in 2D, no specific information had to be transferred between users. This allowed all designers, wherever they were based, to work at any time on plans based on a single 3D model. Knowing exactly how another designer had previously worked on the plan was not necessary. This is particularly useful for international, cross-border projects such as the Pompidou Center in Metz.

In terms of cooperation, CHP also benefited from the international nature of Allplan Engineering: this allowed, for example, the general arrangement plans created by CTE in Mulhouse using a French version of Allplan Engineering to be transferred via the Internet to the German design partner. The required



planning data, relating to the construction progress, could thus be extracted from the building model in France, transferred in the original format and imported in the same place in the model by CHP in Germany. On the basis of this, CHP designers were able to create reinforcement plans compliant with French standards while working with their German user interfaces. The reinforcement schedules could also be output in French.

Challenging parts of the reinforcement system were discussed and resolved directly on the reinforcement model with the French partners by means of desktop sharing. By virtue of the com-

mon database and common method of working in Allplan, it was possible to direct the Freiburg-based team from France just as easily as if they had been sitting in the room next door. The partners could therefore always rapidly react to any special issues arising on site in Metz.

The European design team can now look back on another successful project featuring intensive cooperation. Despite the complex tasks, the time pressure and some significant change requests, there were no design or list errors. This can be attributed to the diligent work of the designers as well as the power of Allplan Engineering.

ABOUT ALLPLAN

ALLPLAN is a global provider of BIM design software for the AEC industry. True to our "Design to Build" claim, we cover the entire process from the first concept to final detailed design for the construction site and for prefabrication. Allplan users create deliverables of the highest quality and level of detail thanks to lean workflows. ALLPLAN offers powerful integrated cloud technology to support

interdisciplinary collaboration on building and civil engineering projects. Around the world over 500 dedicated employees continue to write the ALLPLAN success story. Headquartered in Munich, Germany, ALLPLAN is part of the Nemetschek Group which is a pioneer for digital transformation in the construction sector.

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