



Helsinki Music Centre, Helsinki, Finland | Vahanen Engineering Company, Helsinki

Setting the tone with Allplan

When the Vahanen Engineering firm, located in Helsinki, took on the contract for the Helsinki Music Centre, the client had only one condition: project realization should be achieved on the basis of building information modeling. This would ensure that the building met requirements with regard to its design, its function, the costs and deadlines. Insofar as cost planning and, most importantly, design and structural planning are involved, the BIM method successfully demonstrated its efficiency in conjunction with Allplan software.

Finland, a country which has given the world many famous musicians and composers, is known as the land of music. However, the Finlandia Hall in Helsinki, designed by Alvar Aalto in the 1970's, exhibits some serious acoustic drawbacks. This situation should soon be remedied. The Helsinki Music Centre – a new concert hall with sophisticated acoustics – has now opened in the Finnish capital. Upon its completion, the building has a large concert hall with 1,700 seats and five smaller halls, each with up to 400 seats. The building also became the new home of the world-famous Sibelius Academy, as well as several coffee shops and a restaurant.

BIM-based project realization

To plan the building with its total usable area of around 36,000 square meters, the city, acting as the construction client imposed a fundamental condition. It stipulated that the project use BIM to ensure that the building would meet requirements with regard to form, function, costs and deadlines. Building information modeling (BIM) uses a virtual building model across all phases and disciplines of design, construction and management to significantly increase efficiency. The benefits of the BIM method were clearly demonstrated during construction of the Helsinki Music Centre: during cost planning, for example, but primarily during design and structural planning made by Vahanen, the Finnish engineering firm. The Allplan software from Nemetschek also proved to be an efficient tool here.

Several factors make the design and structural planning of the Helsinki Music Centre particularly difficult. The new concert building is up to 14 meters below the surface to avoid obstructing existing city vistas. At the same time, the groundwater level is very high here at the edge of Töölö Bay, so the underground section of the building had to be designed as a waterproof concrete basin. This meant even more demanding structural and design requirements. The entire design also had to take specific acoustic requirements into account – with the added difficulty that the

building is located very close to a busy street. To counteract this, additional measures were required to dampen tremors and vibrations.

Complex designs

The shape of the building itself presents another difficulty. The architects at LPR Arkkitehdit designed the Helsinki Music Centre using the “box in a box” principle, where all five

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Tero Aaltonen, Technical Director at Vahanen Helsinki

smaller halls and the central component of the large concert hall are, so to speak, “suspended” with the aid of vibration dampers as a separate space within the surrounding building. This makes the interior building design especially challenging. At the same time, the building shell is extremely complex. On the one hand due to the extensive glass façade and the 40-meter span of the roof, which is extremely heavy due to the acoustic requirements and the suspended panels of glass. The building also has an extremely comprehensive ventilation system that must match the entire design perfectly.

All in all, a complex and difficult project that the engineers at Vahanen managed to complete with particular efficiency, thanks to Allplan. The engineering company with branch offices in Finland, Russia, Estonia, Romania and Switzerland decided in favor of the Nemetschek software because



it provided “the best options for general arrangement and reinforcement design of particularly complex structures”, says Tero Aaltonen, Technical Director at Vahanen, Helsinki. As an integrated software solution, Allplan is also virtually predestined for BIM-based design – a quality that is important to Vahanen, not only for the concert hall project, but also generally. This is because the interdisciplinary design firm with around 400 employees relies heavily on optimized project communication – something that Allplan improves on a sustainable basis.

3D construction design

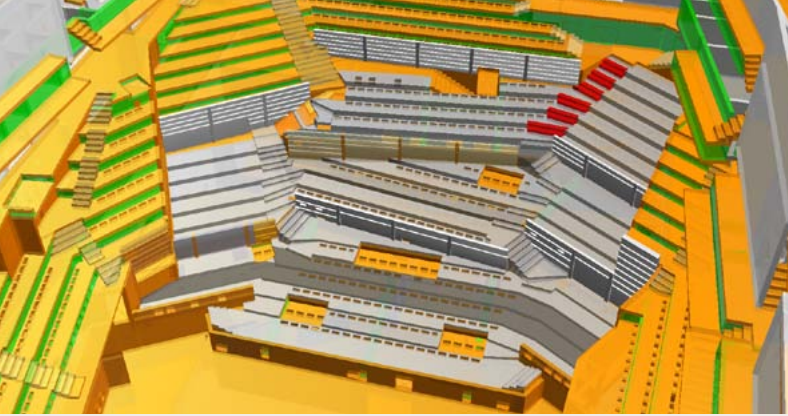
Vahanen has been utilizing Allplan for the last five years. The engineering company now has seven Allplan Architecture licenses and two Allplan Engineering licenses which were used for the building design, as well as general arrangement and reinforcement design for the Music Centre contract. The Music Centre was designed in 3D. This proved to be an ideal method for designing the building without errors, despite its complexity. The 3D design allowed the engineers to better understand the building and maintain an overview in order to recognize and eliminate design mistakes on-screen. In addition, all project data such as floor plans, views and sections were generated automatically. “Allplan helped us to design the Helsinki Music Centre efficiently and without errors, despite the complexity of the building. Construction therefore proceeded smoothly”, says Tero Aaltonen. The 3D design process proved to be

particularly useful for wall and ceiling openings, as these are much easier to design in 3D than in 2D. In addition to providing a better overview, the model display also made it possible to compare the 3D design with data from the TGA designer. The building service provider’s ventilation system was integrated in the complete model for this reason and checked on-screen for collisions using the Solibri Model Checker. It proved possible to identify and eliminate inconsistencies before they could lead to expensive alterations on the construction site. The 3D data was transferred using IFC – a format that caused some initial problems, but was supported by Allplan “almost perfectly”, says Tero Aaltonen. “Other software providers have greater problems with IFC”.

Comprehensive changes

Allplan made general arrangement and reinforcement design particularly efficient. They also determined the structural safety in advance, this being at least partially realized on the basis of 3D data. Elements such as walls, shafts and load-bearing structures in the roof were transferred directly from the model to the SCIA Engineer software and calculated there in order to avoid duplicate entries and possible related errors. The general arrangement and reinforcement design for the concert hall was realized using the traditional 2D method – a technique which Allplan also supports along with 3D reinforcement.

One aspect of Allplan is particularly appreciated by Tero Aaltonen: the flexibility that the system gives to the user. “Regardless of whether you are working with 2D, 3D or BIM – Allplan always allows me to choose how I want to work”. Allplan uses the architecture model to create a structural model that serves as the basis for the general arrangement and reinforcement design. The system recognizes shell outlines automatically – a function that allows for very effective reinforcement as it avoids duplicate entries and the design, general arrangement and reinforcement are sure to match. This method of reinforcement planning is also extremely rapid, with the user only needing to subsequently define



those details which are really necessary. Other user-friendly features include interactive input options and practical placement functions. All in all, the software provides the kind of wide-ranging support that made it possible for Vahanen to design the concert hall “very simply, precisely and quickly”.

Allplan also facilitated the extremely accurate design of over 200 attachments between the acoustic sub-ceiling and the roof of the building – each of them different in position and length. This meant that it was also possible to meet all the building requirements in this area. Thanks to efficient and integrated design processes using Allplan, engineers at Vahanen have ensured that Helsinki will get a concert hall that hits the right note in every respect – both in terms of design and acoustics. It is something for which the people of Helsinki have waited for a long time.

The Project in Brief: The Finnish engineering firm Vahanen employed the BIM method and Allplan software for the design and structural planning of the Helsinki Music Centre. Several aspects made the planning for this building particularly ambitious. For example, the concert building is situated 14 meters below the surface to avoid obstructing existing city vistas. At the same time, the groundwater level is so high, the below ground section of the building had to be designed as a waterproof concrete basin. Special acoustic requirements also needed to be met – with the added difficulty being that the building is located very close to a busy street. The building design itself embodies the “box in a box” principle, with five smaller halls and the central component of the large concert hall being, so to speak, “suspended” with the aid of vibration dampers as a separate space within the surrounding building. The Allplan software provided the engineers with optimum support during their work, thanks to the efficient 3D reinforcement design, smooth data exchange and the automated generation of floor plans, views and sections from the model.