Rendering produced by Lundgaard & Tranberg Arkitekter

MALMÖ UNIVERSITY EXPANDED USING PEIKKO'S COMPOSITE FRAME

Text & Photos: Arto Rautio

I have high hopes for Niagara. Both the physical environment and the building's location right in downtown Malmö are important. Consolidating our activities into one location will help us to develop our identity and will boost cooperation within the university. The location provides us with all the perquisites for further improving interaction with other city communities, says Ingrid Dackert, Dean of the Faculty of Culture and Society at Malmö University, of the significance of the new portal building. The buildings, collectively known as Niagara, are supported by Peikko's DELTAEBAMs and Composite Columns – the Peikko Composite Frame.

The university's activities are currently dispersed across several locations in Malmö. In the fall of 2014 they will be brought together into Niagara, a new collection of buildings under construction right next to downtown Malmö. As land has become available right next to downtown Malmö, due in part to a shift in the operations of the dock industry, new areas are being developed with a combination of bold, new work and modernization of old buildings, complementing them with new ones. Niagara, which will provide 25.000 m^2 of floor space close to Malmö Central Station, will make an impressive partner on Malmö's skyline to the Turning Torso, a well-known modern building in Malmö's Västra Hamnen district.

"As a building, Niagara is completely in tune with the university's vision. It shows what Malmö University is new, fresh, and modern, and also Sweden's largest university. The building allows us to stand out impressively and, with its modern facilities, it is a symbol of the university's activities. When we can bring two faculties under the same roof, cooperation between the faculties will improve," believes **Naser Eftekharian**, who previously worked in the Faculty of Technology and Society and is now an advisor to the Vice-Chancellor.

"The building is a composition of three entities with five, seven and eleven floors, connected to each other by an undulating horizontal design language combined with strong sculptural imagery.

Between the three parts of the building is the central lobby, which functions as the building's heart. The building stands tall as the focal point of the Universitetsholmen campus zone," say designers Lindgaard & Tranberg Arkitekter of their work's under lying principles.

The name, Niagara, comes from the building's location. The lot has long been known as Niagara and the project's developers did not see any reason to change it.

THE UNIVERSITY IS LOOKING FOR THE BEST

The project to construct a new teaching and research building began on Malmö University's initiative. The aim was to consolidate the activities that were dispersed across the city onto the same campus and construct a clear portal for the university and a landmark in the city. When project planning began, the future users of the building were responsible for steering the project. The university arranged an architecture competition and Lundgaard & Tranberg Arkitekter of Copenhagen won the commission.

"In Sweden, universities cannot own real estate. For this reason, the university put the project out to tender. The university used the tendering process to look for the best possible solution. We won the competition and set about looking for planning and implementation partners," says **Jan Andersson**, Project Manager from Akademiska Hus, the real-estate owner.

Akademiska Hus is a state-owned real-estate investment company that focuses on university real-estate. This specialization and the consequent strong position on the debt markets explains why their offer was the most attractive to the university, according to Andersson.

"The university has spaces for research, education, and administration in the new building. The building has wings of five, seven and eleven floors and a large, well-lit atrium between them. The teaching areas are on the lower floors and the upper floors house office-type working areas. A new aspect here is that even professors do not have their own offices: all of the offices are open-plan. Of course, there are also areas where professors can speak to students in private," Andersson says of the project.

"Although the facilities are being made for the university on a long-term lease, the building has been designed to allow for other uses too," says Andersson.

GREEN ROOF EXTENDS THE ATRIUM TO THE OUTSIDE

The architects have also brought a modern look to the building's external surfaces. The façades are metal and glass, and the roof of the lowest wing complements the atrium, serving as a lounge and meeting space for Niagara's users.

"The rounded corners created extra work on the metal structures during the construction phase. The design and the architect's strong vision, combined with the functional requirements of the structure, have led to demands that seldom arise. I would say that the architects have played an unusually large role in the project, but I consider this a positive thing: it is an operating model that could be used even more. Modeling has naturally been an important part of the planning and it has helped a lot across the various phases. We have also been pleasantly surprised by how much can be done with glass that was impossible only three or four years ago. There are several curved glass surfaces and the glass affects the way in which sound is carried from place to place. This is one thing that we had to bear in mind during implementation," Andersson says.

The atrium structure opens out onto the street between each wing. The idea was to use three entrances to keep the space open and easy to access from every direction. There are restaurants and large lecture theaters

Christoff Hagelin (left), Jan Andersson and Magnus Claesson.

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on the ground floor. Around the edge are stairwells and elevator towers, as well as a separate staircase leading to the atrium's upper floors. At the center of the atrium, which narrows as it goes up, is a lightwell with a glass roof. The upper floors of each wing house open-place office space. The tallest wing naturally has the most space. "It was only possible to build a green roof on the lowest wing due to the wind conditions," Jan Andersson says.

The atrium is the height of six normal floors, rising as high as the top floor in the lowest wing. Niagara's teaching facilities are on floors 00 and 0M. Office space, meeting rooms, and other similar facilities are on floor 1. The green roof is on level 5, as is the atrium's glass roof.

TOP EXPERTS WERE SOUGHT

Akademiska Hus looked for partners by inviting expert designers and construction companies to enter a tendering competition. For the building phase, it requested tenders from Sweden's largest national companies as well as a significant local operator, Thage Anderssons Byggnads Ab, which won the commission. The work is mainly being done using the client's designs, which were produced by WSP. Peikko has also provided dimensioning and planning data related to its own products.

"Thage Anderssons has been responsible for implementation in collaboration with its subcontractors. We have put the concrete work and steel work out to tender separately. Östra Vrams Smide Ab, who won the commission for the frame, assembled its own package of deliverables and chose Peikko's composite structures," says Niagara's Site Manager, **Magnus Claesson** from Thage Anderssons Bydggnad Ab.

"We will deliver a surface-treated frame that is ready for installation, meaning that the Composite Columns and DELTABEAMs will be lifted from the trucks right onto the building. Furthermore, the precast concrete supplier, Starka Betongelement Ab, has purchased a large number of Fastening Plates, Anchor Bolts, Wall Shoes, and Connection Loops from Peikko. A large proportion of the deliverables are custom-made for the site," adds **Christoff Hagelin**, Peikko's on-site Project Manager for Niagara.

The rounded corners were a distinctive element of the architect's design. There are no right angles in the building. This has naturally posed its own set of interesting challenges for the structural designers. The division of space also required much thought, particularly in the atrium's structures. The planning and placement of the stiffened stairwells and elevator shafts, as well as that of the columns, had to be carefully considered so as to allow sufficient space for students and university staff to circulate, as it was not possible to reduce the amount of concrete used. DELTABEAMs are always made straight from their load-bearing cores. For this reason, the columns of the external wall line are always located on both sides of the rounded corners. The building's forms are managed using customized flange solutions for the beams.

The precast element designer, **Anders Palenryd**, says that interesting and unusual solutions arose frequently. It took a long time even to group the precast concrete elements for the intermediate floors. The most exciting thing for Palenryd was stabilizing the stiffened wall structures using cabling. The wall elements of the stairwells and elevator shafts, which stiffen the entire building, have been fixed to the building's foundations using cables. These wells and shafts transfer all of the horizontal loads, including wind loads, from the hollow-core

Rendering produced by Lundgaard & Tranberg Arkitekter

slab levels to the building's foundations. The composite frame bears the building's vertical loads.

"Steel helped us because it was possible to make beams and precast elements of similar thickness. That also pleases the builders," Palenryd says.

COMPOSITE STRUCTURE CHOSEN AT AN EARLY STAGE

Jan Andersson from Akademiska Hus says that the thought process behind the implementation of the building developed as the project progressed, but the composite structure was in mind from the outset. The architects and the university had already decided on it before Akademiska Hus won the project.

As the building was constructed from scratch on soft coastal land that is difficult to manage in terms of moisture, the foundations and load management have been highly demanding. The foundations do not only have to withstand the weight of the buildings. They must also prevent strong winds from causing the structure to tilt, particularly in the case of the taller parts of the building. Niagara is standing on very long piles with a diameter greater than anywhere else in Sweden. The amount of water was an extra challenge for the foundations: there was much more than initially assumed.

"It would have caused us many a headache along the way if it had not been possible to use a composite structure. Thanks to the composite structure, floor heights are well-managed and it has been easy to install services. Keeping the buildings' overall heights down has had a positive effect on managing wind loads," Jan Andersson says of the chosen solution.

"The building's fire protection is also provided by the composite structure. The structures have been measured to have a 60-minute fire resistance classification," Claesson adds.

The difficult starting conditions have reflected on the entire project, affecting Peikko's original delivery schedules. However, work has been progressing in accordance with the university's requirements. Construction work began in summer 2012 and work on the frame began in June of that year. The building will be ready for the fall semester of 2015. In practice, however, the university can only move to new premises between semesters. The lower parts of the building's façade were sealed in time for Christmas 2013. The facade will be sealed on the taller parts in April 2014.

COOPERATION WITH PEIKKO HAS GONE WELL

Jan Linden from Peikko's Swedish unit has acted as all over Project Manager for this very large project. **Gösta Pehrsson** has been responsible for connection item deliveries to the precaster Starka Betongelementer Ab. Christoff Hagelin has been the Project Manager on-site and he has also provided technical support.

"Cooperation with Peikko, in practice with Christoff, worked well. Thanks to his dependable help we were able to get our questions answered. From time to time, it would have been nice to receive information from Peikko even faster, schedules were in this case very demanding. I was familiar with Peikko's products but I hadn't used them in my work before It's important to be able to find up-to-date technical information, as this makes it easy for the Structural Designer to propose which products should be used. My impression is that the majority of Peikko's products are good," says Anders Palenryd.

When asked whether he has been satisfied with Peikko's deliveries, Magnus Claesson from Thage Anderssons has a clear answer.

"No," says Claesson, letting out a cheerful laugh.

"You are going to write what I said, aren't you?", the Site Manager asks, somewhat tongue-in-cheek, before continuing by praising Peikko for its quality deliveries.

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"The frame erection schedule has been planned from the perspective of quality and it allows everybody enough time to do their part well rather than focusing on the highest possible speed. The steel, concrete, and facade subcontractors have worked extremely well together on-site and there have been appropriate tolerances in the deliveries, so it can be said that everything has gone very well," Magnus Claesson elaborates.

The frame subcontractor, Östra Vrams Smide, and the precast element supplier, Starka, also assert their satisfaction with Peikko's deliveries and the progress on-site in general.

"We won this contract by competition and we chose Peikko as our supplier of composite columns and beams in the same manner. Peikko was selected on the basis of its prices and experience. Although we didn't have any experience working with Peikko on joint projects with deliveries as big as these, the choice has proven the right one. We have been satisfied with every aspect of Peikko's activities: handling the project, production, and ensuring accurate deliveries," says Department Manager **Mats Andersson** from Östra Vrams Smide AB, who is working as Project Manager for the Niagara project.

Östrä Vrams Smide was founded in 1968 and has production units in Trollarps and Malmö that employ 24 personnel. Since 2004, the company has been an independent part of the Thage Anderssons Byggnads corporation. Its business includes planning, manufacturing, and erecting metal structures. For the Niagara project, ÖVS is erecting the composite frame – Composite Columns and DELTABEAMs that it has acquired from Peikko.

Ola Svensson, Project Manager from Starka, the company that delivered the concrete parts for the frame and the steel connected to the concrete, describes Peikko's products as excellent. Various Peikko products are being delivered in such a way as to ensure compatibility with Starka's products and operating methods.

"We buy a lot of connection parts from Peikko, both for production and for erection. I think the cooperation has been good, on the Niagara project as in our other deliveries," Ola Svensson summarizes.

NUMEROUS LONG BEAMS IN THE STRUCTURE

"912 tons of steel has been used to make the frame. This is one of our biggest deliveries in Sweden. We have had one person from Sweden dedicated to working on measurements, calculations, and similar jobs for this project. In accordance with our operating principles, the production drawings belong to the production unit," Hagelin says of Peikko's main delivery.

The Niagara project's Composite Columns have come from Peikko's factories in Lithuania and the DELTABEAMs have been delivered by Peikko's factory in Slovakia. Both factories have been responsible for their own strength calculations and production drawings related to the products they have delivered.

The columns have been delivered in one-floor units, with the exception of the atrium space. The tallest columns are 13 meters. The longest beams are 15.5 meters, which is unusually long. DELTABEAMs normally have a maximum length of 13.5 meters, so extension pieces have been used. Due to the building's shape, the composite beams do not have a modular division. Instead, each column span is unique, as is the beam solution designed for it. According to Hagelin, the most common column span is 6–7 meters. The columns are parallel in the vertical plane, so it was not necessary to transfer vertical loads laterally.

"For the columns and beams beneath the green roof, we had to take into account the extra load exerted by the roof. Otherwise, I'd describe the columns and beams as quite normal for any type of product destined for use in office-style premises. Of course, the unusual shapes and spans brought their own little challenges along with them," Christoff Hagelin states.

Sales of composite structures and Peikko's connection products have seen good growth in Sweden, Christoff Hagelin says. Peikko's customers are, as on the Niagara project, construction companies and precasters, whom Peikko worked with on the Niagara project from the quotation phase onwards. The deliveries usually take place according to the customers' plans, as on the Niagara project. ■