

CONCRETE CONNECTIONS

2/2013

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PEIKKO'S COMPOSITE FRAME SOLUTION

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ON THE COVER:

Dixi, the new railway station centre is built using Peikko's composite frame solution at Vantaa, Finland. The first phase of the large construction will be ready in 2014.

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HISTORY CAN EXPLAIN THE FUTURE

In early 2013 we worked on a fun project at Peikko – we participated in the making of a movie called the “Story of Peikko”. This short movie was prepared for our employees, customers and partners. Film is usually a powerful visual tool to tell a story, and we thought this could work well also at Peikko.

The process of making the movie was exciting: browsing through old brochures, pictures and films. It was amazing to realize that the issues that were important to us decades ago have remained nearly unchanged. Innovation, speedy decision making, customer relationships... all these have, and continue to be among our priorities.

It was also nice to get to interview so many people and to remind ourselves how long careers many of our team members have made at Peikko. In the movie you can see,

for example, two of our former Managing Directors, both of whom are still working for Peikko, albeit in new roles. And last but not least, the film also introduces to its viewers one of our most devoted employees – he started his career at Peikko in 1965 as a 15-year-old boy, and he is still working at our Finland factory.

Peikko is today a nearly 50-year-old company. Our ripe age, of course, does not protect us against challenges of the corporate world - these days even well-known companies are announced bankrupt

every week. We have to change ourselves continuously, to keep apace with global markets and the industry, and to adapt better to our customers’ expectations. Throughout its history, Peikko has focused on continuous change, and that is the approach that will keep the company alive also in the future.

Please fetch yourselves a can of Coke and cone of popcorn and join us to watch the Story of Peikko. The film is available on our YouTube channel at: www.peikko.com/youtube

At your service,

Topi Paananen
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DIXI RAILWAY STATION CENTRE REACHING FOR THE SKY WITH PEIKKO'S COMPOSITE FRAME SOLUTION

Text: Arto Rautio
Pictures: Arto Rautio and Peikko

The new ring railroad to Helsinki Airport will connect to Finland's main rail line at Tikkurila in Vantaa. Where these two railroads meet, there will also be a bus terminal, a large shopping centre, an office tower, and a car park. This place will be known as Dixi, Tikkurila. Peikko has supplied the composite frame for the building, which was a more demanding task than most.

Tikkurila is the administrative heart of the City of Vantaa and one of its regional centers. It is home to the third busiest station on the main rail line. There are frequent bus connections from Tikkurila to Helsinki Airport. After completion of the new ring railroad, there will also be a frequent rail service. An impressive new group of buildings is emerging in the area around Tikkurila station. They will be known as "Dixi", a name chosen by public vote. The principal architect is **Rainer Mahlamäki** from Lahdelma & Mahlamäki Architects.

Dixi's first phase, which will be completed in 2014, includes a shopping centre, an office tower, a bus terminal, and

a car park. Most of the permitted building area will be in a structure with a gross floor area of 33,200 m², due to be completed in the fall of 2014. The project will continue in 2015 with phases 2 and 3 as buildings stretch out toward Hotel Vantaa. The station's ticket office and bus terminal will move to the new building and the current structure will be demolished to make way for new buildings. The second phase includes a gross floor area of 16,000 m² and the third phase includes 6,800 m².

"The shopping centre will occupy three floors. Floors 4–11 will be occupied by offices. A decision was made to build the shopping centre and office space using a steel-framed

composite structure. A five-story building, cast in situ above the bus terminal, will be occupied by station facilities, commercial premises, and a car park with space for 500 vehicles. It will have a green roof covering 6,000 m²," says **Jyrki Haka**, Site Manager for YIT Rakennus Oy, the construction company in charge of the turnkey project.

COMPOSITE FRAME SPEEDS UP WORK

Tenders were requested for the frame of the office building, which will form the southern part of the section currently under construction. The tenders were based on a



composite structure of steel columns, WQ beams, and hollow-core slabs. The frame of the north section consists of reinforced concrete columns and post-tensioned beam-and-slab systems, both of which were cast in situ. The connecting area between the northern and southern sections contains long, variable spans. In this area, the frame consists of hollow steel section columns, steel truss structures or steel beams with hollow-core slabs, and post-tensioned reinforced concrete slabs cast in situ.

"The composite structure is going up quickly. The steel frame and hollow-core slabs will be ready within six months. The schedule calls for the walls and roof to be in place before Christmas 2013, which is a good thing from the point of view of minimizing moisture in the building," states Jyrki Haka.

"We held an extensive tendering competition. Peikko Finland's tender, based on its Deltabeam technology, proved

competitive. As beams account for 60 percent of the office building's frame, ensuring that they could be reliably supplied played an important role in securing this contract. We chose KPA-Rakentajat Oy as our erector and they had positive things to say about the choice of Deltabeams, which also worked in Peikko's favor," says **Tommi Gröhn**, who was responsible for purchases at YIT.

"Peikko fabricated the composite columns and trusses for the frame according to Finnmap's designs in accordance with Euronorms, and the Deltabeams according to its own workshop designs. We worked in conjunction with Finnmap and took responsibility for changing the designs to enable Deltabeams to be used instead of WQ beams. This meant that there were no extra costs for the customer," says **Harri Onikki**, Peikko's Project Manager.

"We prepared the entire design using Tekla Structures. It was a great help to us in our work. Small tolerances and

collision avoidance have been managed well. Column reinforcements were also a part of the model. We provided a model in AutoCAD format to Peikko. When the contract was made, we utilized Peikko's Tekla custom components to update the designs rapidly. The choice of Deltabeams also affected the connecting structures," says **Tomi Eloranta**, Principal Designer of steel structures at Finnmap Consulting Oy.

"The model was invaluable for planning the installation schedule and order. We have one member of staff who focuses entirely on utilizing the model and developing it for use on the construction site. The Site Managers have lightweight versions for day-to-day viewing. The model has been particularly useful for visualizing truss structures," Jyrki Haka says.

"Understanding the order in which suspended structures should be installed would have been very hard without layout diagrams," adds Tommi Gröhn.

Tomi Eloranta, Harri Onikki, Tommi Gröhn, and Jyrki Haka at the Tikkurila construction site.



HIGH DEMANDS

Dixi is a tall building located between a railroad and a street. Part of the building is above a bus terminal. Therefore, the steel frame was subject to execution classification EXC3, which is more demanding than the standard EXC2 classification. The concrete structures required first-class implementation. The structures were designed to resist impact loads from trains and road traffic. The office building frame also needed to be designed to eliminate the risk of progressive collapse. This means that the structure will not begin to collapse, even if one of the columns is destroyed by the impact of a bus or a train," says Tommi Eloranta.



To prevent progressive collapse, every floor and roof in the frame has been fixed with peripheral ties and perpendicular internal ties between them. All of the columns and walls are also fitted with continuous ties from the foundations to the roof. A rigid plate 100 mm wide by 30 mm thick has been fitted on top of the hollow cores. In the unlikely event that a column fails, the intention is for the structure to remain suspended from these plates. Some areas do not have columns beneath them due to local traffic arrangements. These are equipped with Y supports, enabling the spans to be increased by using suspended trusses. Basic slab modules are 9.6 meters and basic column modules are 5–8 meters. The longest beams are 11 meters and trusses can have a span up to 30 meters. A truss as high as an entire floor bears the load of several floors.

It was necessary to reduce the number of columns supporting the first floor to accommodate the bus terminal and a roundabout, meaning that a more robust structure was required. Harri Onikki states that the lower columns have a diameter of 1,016 mm, mainly so that they meet the demands in terms of resisting impact loads. Fire resistance class R120 was required, so Deltabeams were a good choice for this project. Deltabeams do not require additional fire protection made on construction site as they are designed and manufactured at Peikko's factory in accordance with the fire resistance requirements. According to Tomi Eloranta, the requirement has also affected the connections between columns and beams.

In practice, this problem has been solved by cast-in-situ slabs through the beam and the corbel.

"This was the first EXC3-class frame delivered by us at Peikko. We had to take the requirements into account in our own designs as well as in the various inspections. Our work was also affected by the requirement related to progressive collapse," says Harri Onikki of Peikko.

"I've been involved in purchasing lots of composite frames, but never this robust," adds Tommi Gröhn.

"The column with Y-supports weighed over ten tons. It was quite a job to make it. The plates were 15–30 mm thick and there were a lot of welds," says Harri Onikki.

PART OF PEIKKO'S EVERYDAY BUSINESS

"When we began working on implementing European standard EN 1090 and the CE marking into our products, we decided straight away to work towards the EXC3 standard. This has turned out to be far-sighted as the demand for complex structures appears to be increasing constantly. EXC3 requires welding class B, whereas EXC2 only demands class C. Furthermore, NDT inspections, which are carried out while work is still under way, are different for the EXC3 standard, as are the requirements for documentation," says **Veikko Mattila**, Peikko's Quality Manager.

"Execution class EXC3 requires welding coordinators to be qualified welding engineers. We had everything in order in this regard. Production control helps

us to ensure that structures designed to meet more demanding standards are made correctly. The production lines handle structures for several projects, which could easily become confusing. It is important to remember that EXC3 is not a luxury class. EXC3 is applied whenever justified by the nature of the project. Designers should also keep in mind that the classification should not be raised without good reason because stricter requirements always come with extra costs," Mattila says.

"Finnmap's designs were good, which made the job of the workshop easier," says Harri Onikki. YIT's Haka says the same about the installation. "The frame, which weighed about 900 tons, slotted seamlessly into place, which would not have been possible without excellent teamwork," says Gröhn. He is grateful for the work performed by both the frame supplier and the erector.

FLEXIBILITY BY SAVING SPACE

YIT's initial aim was to create new, flexible, and long-lasting space with low lifecycle costs. The floor area in the shopping centre can be divided into units of 20–2,000 m² and each 700 m² floor within the office tower can also be divided between different users. The Deltabeams provided slim floors, meaning that the height of each floor could be reduced. This makes the space more flexible and also reduces the volume to be heated.

"Steel is a great material for creating frame structures that take up little space and offer good flexibility. With the exception of the glass walls, the façades mainly consist of lightweight thermal elements and liner trays supported by H-purlins. The thermal elements can be easily combined with modular windows, which also makes the space more adaptable," Jyrki Haka says.

Environmental factors have played a major part in the project, with solutions being created for both the construction and use phases.

"Dixi is an YIT Energy Genius building. It meets, and in some cases exceeds, the LEED Gold Standard requirements. Caverion Finland's solutions for building services play an important role in energy efficiency. The low air leakage from the structures and good U-value of the windows are also important," states **Janna Nieminen**, YIT Rakennus's Project Manager.



PEIKKO'S CONNECTIONS IN CONCRETE

Dixi is also a demanding project in concrete structure point of view and required first class implementation with stricter requirements. The requirements were known in the planning phase, so Betset Ltd, which supplied all of the precast concrete elements, and the other contractors were able to take them into account in their deliveries and manufacturing. Peikko delivered a large amount of connection items to Betset to be used in the project.

"Dixi contains some rather big structures. This has been a very challenging job for the designers. We've had to think hard about how each section will fit into place. The car park is made mostly of post-tensioned beams and slabs with reinforced concrete columns. The lower shafts in the office section and the car park were cast-in-situ. The shafts in the upper sections above the fourth floor were made from precast concrete elements, as were floors 3–6 of the car park," says **Juha Kutvonen**, the Designer responsible for concrete structures at Finnmap Consulting.

"This first-class structure can be seen in tolerances and inspections made on massive post-tensioned concrete structures. Supervisors at the precast factory must be highly qualified. However, the hollow-core slabs and precast concrete elements are usually first-class in any event, so the stricter requirements do not have any practical effect on them. The structural class affected the partial safety factors, but it was the mass of the structures rather than the structural class that determined the need for special steel parts. In some cases, there were simply no sufficient standard parts available, so items such as fastening plates had to be ordered," Kutvonen adds.

The building containing the shopping centre, offices, bus terminal, and car park is 300 meters long and quite narrow. As the building is beside a railroad, the structures facing the railroad had to be dimensioned so that they could withstand a train collision. In addition to this, it was necessary to take notice of the risk of buses and other vehicles colliding with the building and to arrange the columns in the bus terminal so as to allow traffic to circulate. The columns around the edges of the building are aligned for the entire height of the building, but the central columns in the bus terminal are approximately five meters away from the columns on the upper 3–6 floors.

"This meant that it was necessary to create concrete spans 2,800 mm high and 2,000 mm wide to transfer the loads

of the upper floors onto the bus terminal columns," Kutvonen says.

The high section of the building, which accommodates the shopping centre and offices, is connected by a floor joint to the lower section, where is the bus terminal and car park. The steel frame supporting the higher section has been stiffened into the structure's concrete shafts. Mast column stiffening was used in the lower section, in cross direction. In the longitudinal direction, loads are transferred to the foundations by braces. Special steel parts were used to connect the braces to the columns and foundations.

DELIVERIES ON TIME

Peikko has also delivered many products related to concrete structures to the Dixi construction site. These have included standard anchor bolts, fastening plates, hollow-core slab hangers, floor joints, special anchoring plates for braces to be connected to the foundations and round columns, rebar couplers required by the long spans, etc. The round columns cast in situ were equipped with Peikko's braces, which were tailor-made for this project.

"I've utilized Peikko Designer® for dimensioning and to check whether the planned solutions would be suitable. I visit Peikko's website almost every day to check some information. Our designs are often made universal. However, when the need or desire arises, we can utilize Peikko's design components to include specific Peikko products in the designs as requested by the

precast element suppliers," Juha Kutvonen says.

Purchasing related to YIT's concrete structures were treated separately from the other purchases. **Matti Sarikkola**, the Site Manager of YIT Rakennus Oy, says that YIT has ordered a large volume of products from Peikko for concrete structures. The orders were based on an annual agreement. Special parts are sometimes put out to tender, but often they are ordered directly from Peikko in accordance with pre-agreed principles.

"We have used a large number of different steel parts. We have purchased steel products related to concrete structures from Peikko. These have been used by the frame installer, KPA-Rakentajat Oy, the concrete contractor for the car park, Kontek Oy, and the company that completed the concrete work in the office and shopping centre section, Jerodos Oy. Workers at the construction site are used to utilizing Peikko's services and our Site Engineers order them together with contractors to an agreed schedule. Peikko is good at delivering products as standard parts are always in stock and also custom parts can be delivered quickly. The construction site does not need to stop and wait for Peikko," Matti Sarikkola says about the long-term working relationship.

"Standard parts have proven suitable in many places but a project as demanding as this could not be completed without special parts. Although these take longer to deliver than standard parts, there was no need to change the construction schedule," Sarikkola adds.

"The annual agreement with Peikko has turned out to be a good practice. It means that purchasing products is not too time consuming and costs remain under control," says Matti Sarikkola in a nutshell.

"We have also found Peikko's products and services good – both the standard and special parts. Peikko has also assisted us with the design of the special parts they have supplied, which has helped us to find the right solutions," Juha Kutvonen says. ■



LONG SPAN AT HIGH LOADS WITH PEIKKO'S COMPOSITE FRAME SOLUTION

Text: Jürgen Lehmann, Sascha Schaaf
Translation: Wolfram Wagner

The Schlossplatz Center in downtown Hildburghausen in central Germany will be built on the former fortification that is located adjacent to the castle park named Schlosspark. Long spans with only a few supports and slim floors are possible due to Peikko's composite frame solution and pre-stressed concrete hollow-core slabs. The elimination of expensive formwork and the prefabrication of columns and supports brought about a significant reduction of the construction time.

A new shopping center will be erected between the Schlosspark and the city center of Hildburghausen. Extensive commercial business premises are accommodated on two floors. On the upper floor, energy efficient homes for rent will be established with planted roof terraces. The position is particularly attractive because it provides easy access to the city center as access road between the Schlosspark and the market. Completion is scheduled for the fall of 2013.

A WELL-THOUGHT SOLUTION

A special challenge was that the tenants defined a column grid of 12.0 m x 12.0 m with variable loads of up to $q_k = 10.0 \text{ kN/m}^2$. In



Composite Columns by Peikko are available as prefabricated products with the necessary connections and can be erected, assembled and aligned without temporary bracing.

a feasibility study Peikko's engineers proposed various methods of slab construction and tested the respective cross-sectional dimensions and costs.

It quickly became apparent that a composite structure with the Deltabeam integrated into the slab represents the most sensible and economic solution. Peikko's Deltabeam has accomplished a composite effect between the steel and infill concrete to minimize the height of the support structure.

Shear, pressure and tensile resistant connectors for a concrete wall above the Deltabeam are provided by MODIX Rebar Couplers. MODIX weld-on couplers are welded to the top plate of the beams to avoid time consuming rebar threading into the beam cross section and the entire system was assembled very quickly and reliable.

Peikko's design components were accurately matched with and the elements of the other suppliers.

The Deltabeams, details and connections of the structure are designed so that the construction company can erect the structure on site in a simple sequence without any previous knowledge of the process of assembly.

A SYSTEM FOR SPEEDY CONSTRUCTION

Special design such as downstands to create different slab elevation or main and supporting beam connections are also pre-fabricated, so that no additional assembly or welding is required on site. This necessitates a high degree of technical preparation and detailed planning by Peikko's technical support office, including consultations with all the stakeholders. As a result, Peikko achieved a fully viable assembly solution of the entire structure through the interaction of composite steel columns and Deltabeam



Construction site in a historical setting: In the basement, the slim Peikko Composite Columns are secured to the individual foundations so they can be loaded immediately after installation. Peikko Anchor Bolts establish the connection to the Deltabeam.





The perfect match of the connections means that the prefabricated Deltabeams can be installed in a short amount of time on composite columns that can bear loads already in assembly state.

with pre-stressed hollow-cores, slabs and double walls.

Consequently, only a few areas need to be cast-in-situ so that the construction process is accelerated substantially.

The low expenditure for in situ concrete structures was one of the decision criteria for choosing Peikko's Composite Frame Solution since most of the construction period was timed to fall into winter. The situation was further complicated by the surrounding buildings, which meant that significant loads due to earth pressure had to be considered. Resulting horizontal loads were transferred via concrete floor slabs to the Deltabeams and via beams into the stiffening walls. This posed an additional challenge to the design process.



FIRE PROTECTION INCLUDED

Important aspects for the decision to utilize the system of composite steel columns and the Deltabeam were the height of the structure and economy as well as the fact that these components offered solutions that meet the highest fire protection requirements. Peikko components already offer R90 fire resistance properties – without extra cladding. This not only reduces costs but also saves valuable time and not to mention construction height or section width respectively.

The necessary fire protection reinforcement is part of the Deltabeam and is installed inside the beam already in the factory. This means that the product that arrives on site is ready for assembly and can be installed by the construction company without additional expenses.

The situation with composite steel columns is identical. Again, the reinforcement cage of the column is part of the component and therefore includes to the delivery. The prefabricated steel columns that have been fitted with a top and a base plate are also ready for assembly. Immediately after delivery these can be connected into foundation with Peikko's Anchor Bolts and can thus be erected without braces. After pouring low-shrinkage mortar into the joint and concreting the tube profiles, columns with the desired load capacity can be produced quickly.

Connections and points of support have already been provided on the Deltabeam for quick and easy connection.



Downstands are included to Deltabeams to support pre-stressed hollow-core and filigran slabs in different elevations. Composite beams are integrated into the slab. The composite columns of the upper floor are attached to the Peikko anchor bolts of the composite columns on the ground floor.

SLIM COMPONENTS - MORE SPACE

Architects and builders prefer slim components and structures from the view point of the design and economic aspects. The construction area and height was significantly reduced by using components with the slimmest dimensions possible. Consequently precious parking, residential and retail space as well as room height is gained, which is characteristic of the most prestigious office space. The cable routing for whole building services below the slab was simplified a great deal.

"In a conventional design, the main beam of the slabs would have been up to 1.50 meters high" said the Construction

Supervisor.

After optimization of the structure, a construction with a slab thickness of 40 cm pre-stressed hollow-core slabs, or of floor slabs with in-situ concrete casting could be implemented. In order to optimize costs and cross sections, all options of the structural implementation were considered and alternatives were investigated. Here continuous Deltabeams with Gerber connections were repeatedly used on the one hand to manage the deflection behavior under control and on the other hand for economic reasons, since this form of construction could save a significant portion of the cost involved in comparison to conventional single-span beams. Of course, all options were used, such as the downstands of single-span

beams in order to achieve optimal results in respect of economy even in this structural approach.

THE OPTIMUM SOLUTION FOR EVERY PURPOSE

The use of the Deltabeams in combination with composite columns and pre-stressed concrete hollow-core slabs permitted the implementation of the ideas of the client in terms of long span, high traffic loads and building height.

This concept was only implemented to the satisfaction of the client owing to the close cooperation between all stakeholders, including crucial input from Peikko's project engineers. ■



Utilization
Developer
Architecture
Project Control

Shopping center, apartments
Hildburghausen-Project-Management GmbH
Dr. Lickert Projektbau GmbH, Karlsruhe
Engineering & Planning Office Dipl.-Ing. Rainer Rittmeier, Duderstadt

Structural Engineering
Building Contractor
Total usable area
Storeys
Construction period

Engineering offices DNK Damm-Nachtwey-Kopp Duderstadt
Ehrlich und Bohme
approx. 5,800 m²
3 storeys
2012–2013





ÖBB HEADQUARTERS

SLIM FLOOR CONSTRUCTION

Text: Claudia El-Ahwany and Gatis Počas
Translation: Wolfram Wagner

Heavy-duty slabs with Peikko's PSB Punching Reinforcement in combination with CUBO Column Caps and Fastening Plates. Thin slabs were accomplished by utilizing individually sized connections that were manufactured to the exact requirements of the slab panels.

The new ÖBB Group, the Federal Railway Company of Austria, headquarters is erected immediately adjacent to the newly constructed Central Station in Vienna, Austria. In an architectural competition, the Viennese architectural office Zechner & Zechner won this project for themselves when it was put on tender. The structural design was provided by Thomas Lorenz ZT of Graz. ARGE Habau-Östu Szczecin is responsible for the construction. The developer is the HÖSBA project development and utilization company.

In this project a cast-in-situ slim floor system is used. It results in lower story height optimizing construction and running costs at the same time. Here Peikko has provided CUBO Column Caps, including the structural analyses and Peikko PSB Punching Reinforcement as well as specially customized Fastening Plates to connect columns to slabs. The use of Peikko CUBO Column Caps means that the slab thicknesses could be kept relatively low.

A special requirement for the CUBO's was to design and deliver product corresponding to EXC3 according to



EN 1090-2. Considering high responsibility of column caps Peikko had to define highest quality criteria. All requirements have been met thanks to Peikko's profound production experience and process also included internal and external quality controls such as testing of welds using magnetic particles and ultrasonic testing.

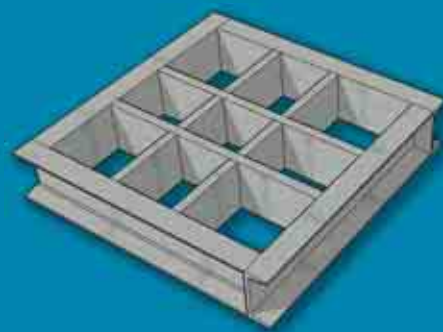
This is first time Peikko has delivered CUBO Column Caps to a precaster. Part of the concrete columns were produced in a precast element factory and delivered with the CUBOs installed. This solution was chosen due to high quality demands defined in the Execution Class 3. Considering also that part of the precast columns were made inclined, this way the contractor could save construction time. Customized Peikko Fastening Plates were used to fix the inclined precast columns to the floor slab.



CUBO COLUMN CAPS

– PUNCHING PREVENTION SYSTEM FOR ULTIMATE LOADS

- CUBO together with PSB is a technically and cost wise efficient solution for high load punching prevention
- Possibility to reduce slab span and optimize slab thickness
- Possibility to use small dimension columns without risk of punching failure
- Possibility to have openings in the slab close to the support also in cases of high punching loads





A NEW SUBURB RISES IN AARHUS

- PEIKKO'S PUNCHING REINFORCEMENT USED FOR THE FIRST TIME IN DENMARK

Text: Reeta Paakkinen
Photos: A. Enggaard A/S

In the summer of 2015 a new, ultramodern suburb will be completed in the heart of Denmark's second largest city, Aarhus. The project is the first time punching shear reinforcement has been used in Denmark.



Ceres City is a new suburb built on the land of Royal Unibrew's former brewery in the heart of Aarhus, western Denmark. Once completed, it will become an important part of Aarhus' city center.

HOMES AND A CAMPUS FOR 6,000 PEOPLE

The suburb will consist of premises for businesses (30,000 m²), education (42,000 m²), shops (3,000 m²) as well as residential areas for students and families (65,000 m²). Approximately 600 ultra-modern flats will provide housing for 1,000 people, whilst the VIA University College dormitory will accommodate 5,000 students.

The first part of the city to be built is the university campus, where students will be housed in a building of six floors, which has a parking lot in its basement. The contractor of the project, funded by the Danish state, is A. Enggaard A/S. The engineering firm is Niras and architect Arkitema. Construction of the campus started in June 2012, and it is expected to be completed in the summer of 2015.

FIRST TIME FOR PUNCHING SHEAR REINFORCEMENT IN DENMARK

Peikko is supplying punching shear reinforcement for the campus building.



© CeresByen

There exists two ways of applying PSB; as punching or as shear reinforcement. In this project both applications have been used. For the first stage of the construction work, A. Enggaard ordered several thousands of standard Ø10 - Ø25 PSB studrails and more than 2,000 1-2 meters high Ø32 single studs.

Enggaard A/S also has a MODIX Pressing machine on site so that around 1,000 Ø32x14000 rebars can be connected by MODIX standard A+B couplers and PM position coupler instead of using traditional overlap, which is not geometrically possible to install in the casting mold.

Peikko's PSB is headed stud reinforcement system used as punching and shear reinforcement in all kind of cast-in-situ and precast structural elements like flat slabs, ground slabs and footings, beams and

walls. Such reinforcement has been used in Central Europe already for decades, and it has become a commodity product whenever cast-in-situ structures are built. PSB provides higher resistance, faster and simpler installation and supervision optimizing construction height, construction and running costs in comparison to other conventional reinforcement solutions like stirrups. Most often it is used as punching reinforcement.

A very important benefit of PSB that has been used in Ceres City project is anchorage of transversal reinforcement provided by use of forged heads with diameter of three times rebar diameter.



"When we speak about big spans and heavy loaded concrete elements, the use of forged heads as anchorage of reinforcement can be the best technically feasible and cost efficient solution," **Gatis Pocs**, product manager of punching reinforcement at Peikko Group, said.

To fulfill needs of various kinds of projects Peikko provides PSB with diameter from 10 till 32 mm in length up to 6 m.

PSB SOLVES PROBLEM OF HEAVY LOAD UPSTAIRS

According to **Jan Würtz Knudsen**, project leader at contractor A. Enggaard, due to high shear loads according to design Ø32 stirrups were required in the foundation slabs and in some of the in-situ beams of the building above the parking lot basement. However technically it was not possible to use conventional Ø32 stirrups in the construction of Ceres City campus building because of problems with too big bending radius and anchorage length required for Ø32 rebars. "Our sales team realised normal reinforcement would not solve the problem of heavy load above the basement parking lot. We needed new ideas to carry on," he said. "Using PSB in the top level of the parking basement solved the problem of heavy load upstairs. There simply was not enough space to use traditional reinforcement. Using PSB was the right solution because compared to traditional stirrups, it also speeded up the construction process. We would definitely use it again," Würtz Knudsen added.

Henrik Harder, Sales Consultant at Peikko Denmark, noted the walls in the parking space were not following the walls above the building, which meant that a lot of load had to be transferred along the beams in the walls of the parking space. "Our product manager has supported engineers actively on this project, as it is their first time designing a project by using PSB," he noted.

The running designing during the project has resulted in imitate ordering of the PSB after the final revision of the drawings from the engineers have been finalized. This has created a demand for fast deliveries to avoid expensive waiting time on site.

"So far we have stayed right on schedule and deliveries to the site have been on time," Harder said.

DEMAND FOR THE SOLUTION ON THE MARKET

"We see a great potential in the Danish market for PSB, not only in traditional slabs to avoid punching failure, but also in other applications to transfer shear loads like in wind turbine foundations, bridges and precast elements," states Henrik Harder.

In Denmark the benefit of using PSB is very obvious due to the high salary level. Solutions that enable faster building up of reinforcement structures are warmly welcome. It is fair to say that we expect to see many new PSB projects in the years to come where contractors and engineers can gain from the benefits the system offers. ■





SPANISH DIY GIANT BRICO DÉPÔT

USES PEIKKO'S COLUMN CONNECTIONS IN THE CONSTRUCTION OF A NEW STORE IN MADRID

Text: Reeta Paakkinen

A new sales outlet for the Brico Dépôt home improvement chain opened at the end of October in Majadahonda near Madrid, Spain. Peikko's Column Shoes and Anchor Bolts were used in the construction of the DIY chain's newest store in the country.

Brico Dépôt chain is part of Kingfisher plc, Europe's largest home improvement retail group and the third largest in the world. Kingfisher has over 1,060 stores in nine countries in Europe and Asia. In addition to Brico Dépôt, its main retail brands are Screwfix, B&Q and Castorama. Brico Dépôt opened its first store in Spain some ten years ago and today has 23 retail outlets in the country.

The precast company of the DIY store was Artepref and the building company was Inbisa.





ORDER OF 1,000 UNITS OF COLUMN SHOES AND ANCHOR BOLTS

The new 12,500 square meters Brico Dépôt store in Majadahonda, a dormitory suburb of Madrid, was built by using Peikko's column connection system. There were approximately 200 precast columns in the building all connected to the foundation and to in-situ walls using Peikko bolted system. Artepref's order to Peikko consisted of approximately 1,000 units of different types of Column Shoes and matching Anchor Bolts.

Artepref and Peikko have cooperated in Spain already for nearly a decade. The previous project of the two firms was a data center building in Madrid where big precast columns were connected to the foundation

using big column shoes. Artepref's Managing Director **Iñaki de la Calle** said the firm has several reasons to be loyal to Peikko's product line.

"We used Peikko's column connection system in the new Brico Dépôt store in Madrid because compared to conservative socket foundations, Peikko's products enable us to drastically reduce the thickness of the building's foundation. This means important savings in materials – from concrete to reinforcement and form work – as well as in working hours spent on excavation, concreting and auxiliary works. We prefer Peikko's solutions because they save us money," de la Calle explained.

Artepref also appreciates the construction site safety Peikko's products provide. "Peikko's system offers total safety

during the assembly of the columns because the connection becomes rigid as soon as nuts have been tightened. This means that it is not necessary to brace the structure during the assembly of the columns or during the process of grout mortar sets. We demand high quality and total safety from the systems we use. Peikko's products fill these requirements," de la Calle added.

CONSTRUCTION PROCESS TAKES FOUR MONTHS

Construction of the new store started in May 2013, when Peikko's products were delivered to the site and precaster firm Artepref built the structure of the store. The structure was complete in July, after which assembly work took place. The structure of





the building was completed in August and the store opened its doors to customers at the end of October 2013.

Juan Moreno, Technical Director at Artepref, noted that Peikko's deliveries to the construction site arrived swiftly and the construction team was therefore able to keep up with its relatively tight schedule.

PEIKKO'S SYSTEM IS EASY TO ASSEMBLE

Moreno also touched on the more technical aspects of Peikko's products, and noted that using Peikko's short bolt type L makes positioning of bolts into the pile cap easy thanks to the use of the installation templates Peikko recommends.

"In Peikko's products, the interference between bolts and the reinforcement of the pile foundation, which is often very heavy in traditional connection systems for precast columns, is minimal," Moreno said.

"Connections between columns and in-situ wall also have many benefits compared to traditional systems: Peikko's products are easier to install, no braces are needed, and overall, they are safer and faster to assemble. The whole structure is assembled smoothly and efficiently," Moreno added.

Enrique Hernández, Managing Director of Peikko Spain, said he is very satisfied with the project and the positive feedback Peikko has received from its customer. "We gave Artepref a great deal of support during the process and are proud to develop

building methods which speed up the construction process and are extremely safe to assemble. Once connections are tightened the connection becomes completely safe," Hernández said.

Adrián Liste, Sales Engineer at Peikko Spain, said his team visited the construction site several times to support the constructor and precaster of the project.

"We have been working with Artepref in Spain already for a long time. This project was yet again an excellent showcase how smooth cooperation can be when all parties share the same values, priorities and goals from safety to cost-effectiveness. We hope to continue cooperating with Artepref on several projects in the coming years," he concluded. ■





PEIKKO'S PSB PUNCHING PREVENTION SYSTEM ETA APPROVED

PEIKKO'S PSB HAS NOW THE HIGHEST RESISTANCES ON THE MARKET

During spring 2013 Peikko Group has received the European Technical Approval ETA-13/0151 for its PSB Punching Prevention System. The ETA approval defines the regulative framework for the use and design of PSB in EU countries and was basis for CE marking of the product. Even if ETA approvals are not required in all European countries, Peikko finds the approvals vital proof of its skills in supplying reliable and tested solutions the customers and related authorities can trust. The notified body for this approval was the German Deutsches Institut für Bautechnik (DIBt).

The original ETA approval for Peikko PSB was received in April 2013. The application process took a year and included extensive product testing to demonstrate compliance with the criteria defined by CUAP. To prove outstanding performance of Peikko PSB following tests were made in different laboratories in Switzerland, Germany and Slovakia:

- Full scale punching tests for flat slabs and footings reinforced with PSB
- Tensile and fatigue testing of PSB studs (different diameters d10 – d25)
- Robustness test of assembled (welded) PSB rails

All tests were documented and testing reports together with other documentation were provided to approval body of the ETA approval.

During past 5 years a lot of efforts has been used to develop production technology for fatigue proof double headed studs. Success of this project is proved by test results which show good fatigue performance of PSB studs as steel parts, even if they are not casted into concrete.

The biggest highlights of this ETA testing series are full scale footing tests. The experimental research was conducted in cooperation between Peikko Group and the Swiss Federal Institute of Technology (EPFL) on foundation slabs reinforced with Peikko PSB double-headed studs. During testing a punching test record was beaten reaching over 7600 kN applied testing load. Thanks to these tests better punching

performance of footing reinforced with Peikko PSB was shown resulting in amendment of ETA-13/0151 in May 2013. The amended ETA approval now enables to design foundation slabs and footings reinforced with Peikko PSB studs with a resistance that is significantly, close to 10 percent, higher than the resistance provided by similar products available on the market (double-headed studs or other). As it

Peikko Group and EPFL conducted experimental research with PSB double-headed studs.



HOW TO DESIGN PSB

Designing of PSB has been made easy. Peikko's own design software Peikko Designer® is a convenient, fast and cost efficient tool to verify punching resistance of the concrete slabs and perform a design of punching reinforcement if such required.



turned out Peikko was the only company beside competitors with similar product on market that have done such footing tests. Full article about the full scale testing and test results can be found in issue 1/2013 of Concrete Connections magazine.

CE MARKED PRODUCT

The ETA approval was used as a reference standard for CE marking. To fulfill market requirements all Peikko PSB stud rails are marked with CE marking as of 1st of July 2013. Only studs welded to rails can be CE marked, because separate double headed studs are not included to ETA-approval.

DEVELOPMENTS TO GREATER CUSTOMER BENEFITS

Latest testing and evaluation of previous testing reports have showed additional safety for slabs with slenderness $L/d < 30$,

but design model of ETA for slabs with higher slenderness are potentially unsafe.

The primary focus of Peikko Group's R&D activities is to develop solutions that make the building process faster, easier and more reliable. Naturally the products also have to be competitive on the market. In this case, Peikko's investment into research produced evidence that now allows designers of slabs reinforced with PSB to use resistance values superior to current standards. At the same time the use of punching prevention design model with improved safety level is recommended to use to guarantee relevant economy and safety of structures.

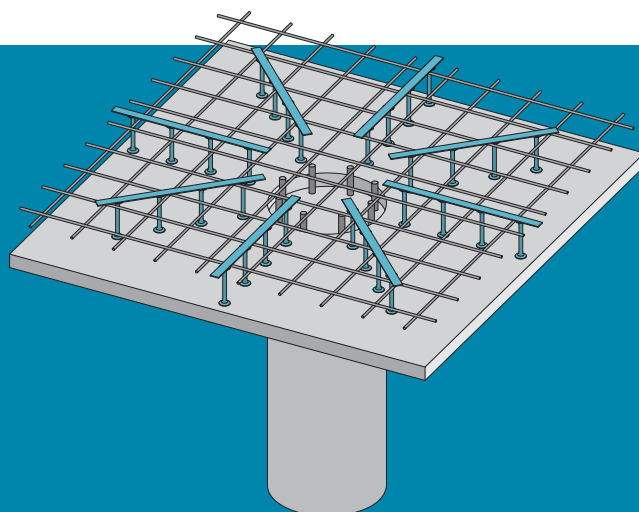
Peikko is continuously developing its own design software Peikko Designer® to give the best support to designers in their daily work. In the near future several new options will be introduced into our Punching Reinforcement module to implement new design standards and to improve functionality of the software:

- Update and new national design standards (already now design according to national requirements of 15 countries available in Peikko Designer®)
- Footing design according ETA-13/0151 (first ever footing design model considering maximum punching capacity provided by Peikko PSB)
- Unique Peikko PSB design model with improved safety (unique design model providing 2 in 1 - safety and economy)
- Updated calculation of β factor
- Automatic calculation of soil pressure
- Update of filigree slab design

Peikko Designer users will be notified about the changes by email Newsletters. In future all major changes will be notified. As the software updates automatically, the improvements are always directly available to users.

PSB PUNCHING PREVENTION SYSTEM

- Punching Shear Reinforcement System
- ETA-13/0151 approval granted by DIBT
- Approval valid in almost 30 countries in Europe
- Tested and CE-marked
- Best performance when used in footings and ground slabs available on market
- Easy to design with Peikko Designer®
- PSB available as 2/3 stud elements and complete elements
- Steel grades of studs: B500B / B550B; B500NC by request
- Available stud size (\emptyset): 10, 12, 14, 16, 20, 25, 28 and 32 mm
- Possible stud length up to 6 m
- Accessories available



DELTABEAM'S SUPERIOR FIRE RESISTANCE PROVED YET AGAIN

The importance of adequate structural behavior under extreme conditions is an critical aspect of structural design and the fire rating of structural steel is one of its more sensitive aspects. One of the main advantages of Peikko's Deltabeam composite beam is its fire resistance which does not require any additional operations on construction site. Proving of this advantage sometimes needs extreme actions like burning some beams and hollow-core slabs. Peikko's Deltabeams have been fire tested again, this time in North America.

Using the positive experiences of previous fire tests carried out in Sweden, Germany and Finland, Peikko just completed the next phase of its Deltabeam worldwide approvals. After several years of preparation with the Underwriters Laboratory, the Deltabeam has again proven its distinctive design and capacity by successfully achieving 1, 2, 3 and 4 hours fire ratings without any additional fire protection.

The fire test consisted of four specimens. The main goal of the test was to collect as much data as possible to obtain the 2 hours rating. Thus, the 4 specimens were designed to respectively achieve 1, 2, 2.5 and 3 hour ratings. Loads were applied on the beams with hydraulics jacks at quarter points for each specimen. The loading was constant throughout

the whole test. Loads were to be removed once the specimens had reached the maximal deflection and rate of deflection. Several measurements were taken during the test. Twenty eight temperature gages were installed inside and outside each Deltabeam to clearly plot temperature distribution through its whole depth.

The four Deltabeam specimens were successful. The first specimen, designed for 60 minutes, failed at 135 minutes. The second specimen, designed for 120 minutes, failed at 264 minutes. The third and fourth specimens, respectively designed for 150 and 180 minutes, reached the maximal allowable furnace time, which is 5 hours. These impressive results prove once again the Deltabeam's ability to provide a safe and efficient slim floor system.



NEW AND UPDATED TOOLS FOR DESIGNERS

Tools for Designers means a Peikko toolbox for structural designers to make their work faster, easier and more reliable. The toolbox includes design software, 3D components for modeling programs and technical manuals of Peikko's products. All of these are developed constantly to be able to support designers' needs. New and updated tools can be downloaded with installation instructions from Peikko's websites.

NEWS ON PEIKKO COMPONENTS FOR TEKLA

Peikko has developed new Tekla components for Deltabeam during last year and can now offer plugins for Deltabeam column connection, Gerber connection and side connection between two Deltabeams. Also a new tool that helps to make holes on Deltabeam web, downstand and formwork is now available. Assembly drawings for Deltabeams can be done efficiently using drawing template and dimensioning tool that automates basic dimensioning. Also Deltabeam profile for Tekla's Profile Catalogue has undergone a technical update which makes the profiles more reliable.

TOOLS FOR DESIGNER

Peikko's components and tools can be downloaded from Peikko websites. In the Software download center you find short introductions about the tools and instructions how to register and receive the tools for download. Simply fill in a form and receive download links in your email.

Peikko wants to make 3D modeling and detailing as easy as possible by developing new tools!

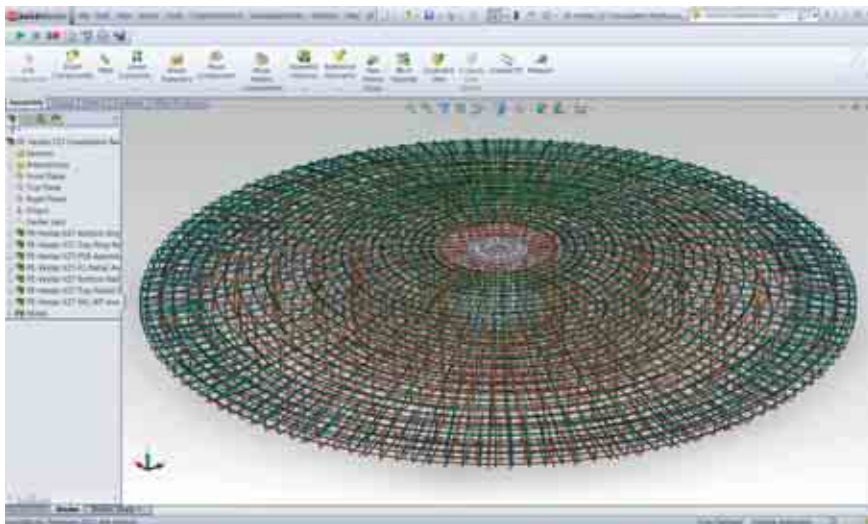


Software download center:

www.peikko.com/software

PEIKKO OFFERS CUSTOMIZED WIND TURBINE FOUNDATION DESIGN WITHIN ONE BUSINESS DAY

Peikko Group has developed an advanced design tool which enters Peikko's design to a new level in onshore wind turbine foundations. With the new design tool and design procedure Peikko is able to better serve wind turbine manufacturers, wind farm developers, investors and engineering offices.



The new design method enables Peikko to evaluate different foundation options and optimize the selected solution for a customer within one business day including pre-design, material and price information.

This wind turbine foundation design innovation is possible because Peikko uses advanced 3D design tools and integrated configurations which again are integrated

into Peikko's products. Peikko Foundation Concept in the field of wind turbine foundations has proved to be a cost-efficient and advanced solution. It has numerous European references in demanding projects for e.g. turbine manufacturers such as Alstom, Hyundai and Vestas.

"The new 3D design tool is an important design innovation and a result of continuous

R&D development in Peikko. Customers of Peikko Foundation Concept will get fast and reliable information and this will benefit them greatly in their future projects." states **Mikko Niininen**, Director, Wind Energy of Peikko Group Corporation.

Read more on Peikko's Wind Turbine Foundation Concept on our website at: www.peikko.com/wind

PEIKKO OPENED A NEW DISTRIBUTION AND SERVICE CENTRE IN PHILADELPHIA, USA

Peikko USA Inc. has concentrated its operations to a new distribution and service centre located in Sharon Hill close to Philadelphia, Pennsylvania. The location of the centre is logistically ideal being close to major highways of the East Coast.

The new distribution and service centre houses 2.400 m²/24.000 sqft. warehouse space with a capacity of over 1.000 pallet spaces. In addition to warehousing of precast lifting systems; rebar coupling systems, bolt connections, and punching prevention systems, the centre also focuses on certain customized welding activities as well as customized production of rebar coupling products. Peikko continues its Deltabeam

production in its partner's premises in Philadelphia.

"We see that the North American construction market is picking up. Our new distribution and service centre enables us to serve our precast and other customers in a faster and more flexible way. The centre mainly serves the USA and also our Canadian customers." says **Topi Paananen**, CEO of Peikko Group Corporation.



PEIKKO TO HAVE TWO FACTORIES IN LITHUANIA

Peikko is about to start its steel and composite structures manufacturing in its newly renovated, modern factory premises of more than 8.000 m² in Kaunas, Lithuania. The installations of machinery and equipment are on-going and first production activities will start in during the last quarter of 2013.



The new factory will significantly increase Peikko's capacity, particularly with regard to steel and composite structures supporting Peikko's Deltabeam product range.

Peikko's medium- and long-term outlook requires more capacity in Europe. On the contrary to earlier plans, Peikko will not close its current 3.000 m² factory premises in Kaunas, Lithuania. The current factory will focus on manufacturing various

types of connection items, and have its own production organization. Therefore the overall amount of personnel in Lithuania will grow. The decision to keep a second factory in Lithuania has no effect on any other Peikko factory. The total investments in Lithuanian factories exceed EUR 5 million.

"According to estimates Peikko will this year grow over 10% in volume, and will continue to do so in the coming years.

We need to keep our lead times short and reliable to our customers. The Lithuanian connections factory will help us to reach this goal. I am also excited about the new steel and composite structures factory. With completely renovated facilities, new machinery and improved systems Peikko will be eminently competitive in the market", states **Topi Paananen**, CEO of Peikko Group Corporation.

PEIKKO TO HAVE A NEW LARGER FACTORY IN CHINA

Peikko China moves its operations to new premises in Zhangjiagang, north of Shanghai, during Q4/2013. The new premises are located close to the current 3000 m² premises and comprise 10.000 m² for both production and office use.

Investments have been and will be made into new production lines and machinery. The current operations employ about 100 people, and the amount of employees will grow over time. The output of the factory is planned to be tripled in the coming 1-2 years.

Peikko Group has an active growth strategy in the APAC region. The current operation in China was started in 2011. The unit manufactures various connection

parts, lifting systems, and flooring products for Peikko's units as well as serves as a sales platform for Peikko's products in China and the Asia-Pacific region.

"Peikko has a long-term commitment to create success in China and Asia Pacific. Efficient large-scale production is a key to attract customers in the very competitive market, and secure capacity for the markets" states **Topi Paananen**, CEO of Peikko Group Corporation.

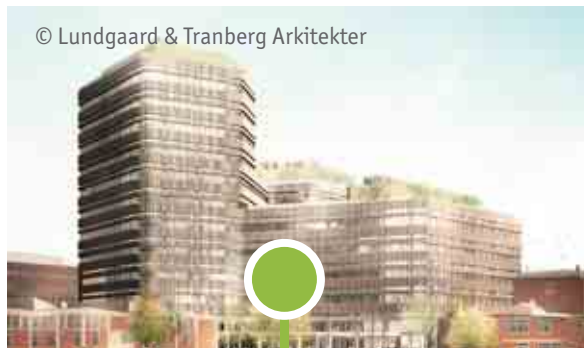


PEIKKO PROJECTS FROM AROUND THE WORLD

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© Lundgaard & Tranberg Arkitekter



Peikko Sweden delivered the composite frame – Deltabeams, Composite Columns and other Steel Structures, to the expansion of the Malmö University in the so called Niagara Quarter.

Peikko Finland delivers during the next two years over 800 tons of different connection products – column shoes, anchor bolts, and fastening products – to be used in the construction of the largest building with a precast frame in Finland. It is a large logistics centre that will be built close to the Finnish capital Helsinki.



© Skanska



Peikko Poland delivers 1.9 kilometres Deltabeams and other connection items to an office project in Cracow. The buildings are made according to Skanska's Green Thinking concept and the project is LEED Gold pre-certified.

Peikko Latvia delivered NIRO Cantilever Balcony Connectors to the Skanstes Mājas high-end apartment buildings located near the Riga city centre.



© Herzog & de Meuron

Peikko delivers well over 3.000 pcs of Hidden Corbels, Beam Shoes, Column Shoes and Anchor Bolts to the pre-cast frame of the new building of Tate Modern museum in London, United Kingdom.

Peikko Germany delivered PSB Punching Prevention Systems to the ADAC's, German Automobile Association, new headquarters in Munich housing offices, conference rooms, restaurants, and exhibition facilities.



Peikko Austria delivered column connections – Column Shoes and Anchor Bolts to be used in the expansion of the industrial plant construction company Kremsmüller's production in Steinhaus near Wels in upper Austria. The design was made according to EC8 (seismic design).

Peikko Finland delivers the composite frame for the new HUSLAB laboratory and office building for clinical analytics of the Hospital District of Helsinki and Uusimaa. Peikko's deliveries consist of 3.3 kilometres of Deltabeams and over 300 tons of other steel structures, mainly composite columns.

© RE-Suunnittelu Oy



Peikko Spain delivered a large amount of column connections to the new IKEA store built in Alfafar village, Valencia. All columns and beams of the structure are connected using Peikko's Column Shoes and Anchor Bolts.



CONCRETE CONNECTIONS



visit

www.peikko.com