

Solving problems and reducing risks

Spectacular stages at Lowlands Festival

The safe way to build steel structures overseas

Investigating a cracked crane runway beam





Newsletter of TCS / December 2018

Determination

In one of the stories we tell in this newsletter, a highly experienced engineer-entrepreneur says he felt a touch of panic surfacing at a key moment during a steel construction project. Pressed by an exacting entertainment industry, his team had designed a spectacular mobile stage with an audacious steel cross vault, but two months before the delivery deadline they were still struggling with the details. For him this felt like he was going through hell. But a spark of engineering ingenuity came to the rescue and the venue was delivered right on time.

Panic? Hell? He used those words in retrospect, but I'm sure he wasn't really panicking or going through hell at the time. Entrepreneurs of his kind don't let themselves be paralyzed by anxiety over the outcome of a project. They believe that problem-solving is almost the essence of life, and that's how we think here at TCS too. Problem solving is fun, and the bigger the challenge the more compelling the job.

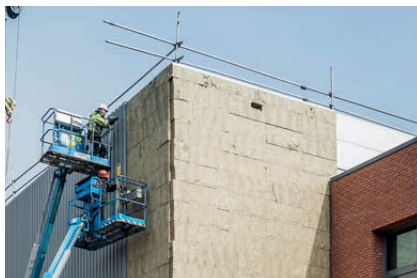
That doesn't mean we have a weak spot for taking risks. On the contrary, countless projects illustrate our primary concern for reducing risks as much as we can. Look at how we run steel construction projects overseas. Check out how we organized the renovations at Vandersanden to be certain that production could proceed safely. Or the cracked crane runway beam issue we resolved at a non-ferrous metals production plant.

Determination to solve problems and reduce risks is an integral part of our commitment to customers. It makes our people proud. It makes me proud. Proud to be working with you.



Bert Zimmermann
CEO

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Don't forget the nodes

EPBD requirements for industrial newbuilds

While the European Union's Energy Performance of Buildings Directive primarily aims to improve energy efficiency in residential and commercial buildings, the legislative framework also includes directives designed to reduce energy consumption in new industrial buildings. "The requirements are less strict, but it's still a good idea to engage EPBD-assessors early in industrial development projects."

KEY FACTS

- The European Union's Energy Performance of Buildings Directive includes provisions to reduce energy consumption in new industrial buildings.
- The requirements are less strict than those for residential and non-residential buildings.
- Details such as floor insulation and the proper design of nodes should not be overlooked.

The Energy Performance of Buildings Directive (EPBD) is among the EU's main legislative instruments promoting improved energy performance in buildings. The Directive, and the subsequent implementing legislation introduced by individual member states, set strict targets for energy performance in new buildings. Compliance must be analysed and validated by an independent EPBD assessor, who uses validated calculation models and specific software for the purpose. Legislation in the Flemish part of Belgium, for example, defines so-called E levels for a building's energy performance, and S levels for the energy efficiency of its envelope. These levels are calculated based on a wide range of characteristics, including the amount of thermal insulation, the building's compactness, its orientation, and the type of heating, ventilation and cooling equipment deployed, among other things.

“Floors are also subject to specific insulation requirements, especially in smaller industrial buildings”

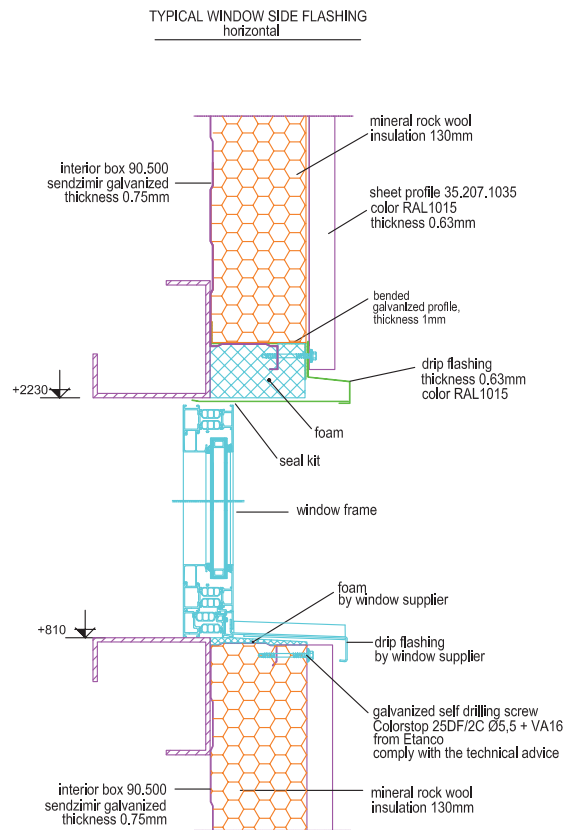
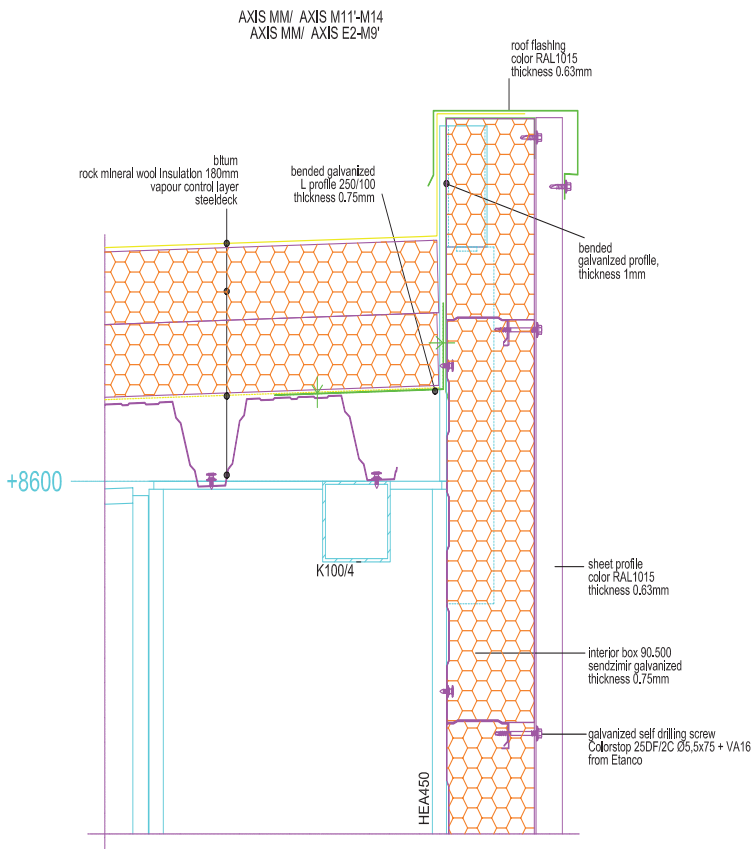
Industrial buildings are easier

“It is well known that the performance requirements for residential and commercial buildings are increasingly strict,” says Enerdo Energy Consultant Jorn Van Herck. “Current Flemish legislation, for example, requires that residential buildings achieve an E40 energy performance level and an S31 energy efficiency level. This will gradually evolve towards E30 and S28 levels in 2021, meaning that all new dwellings will have to be nearly zero-energy buildings. Non-residential buildings are also subject to strict requirements, and the calculations are even more complex.”

As for new industrial buildings, the requirements are less demanding and will not be tightened in the upcoming years. Van Herck: “Industrial buildings are not subject to E or S levels but to the more general K40 standard, which defines just the level of thermal insulation needed in buildings that are heated during cold periods. That makes it much easier to achieve EPBD compliance.”

But look out for the nodes

But where’s the catch? “I admit that most industrial newbuilds are fairly straightforward from an EPBD point of view,” says Van Herck. “They’re usually simple rectangles in shape. If the target occupant is going to heat the space, you just have to make sure to use appropriately insulated wall plates and roof covering material. Floors are also subject to specific insulation requirements, especially in smaller industrial buildings. And remember that the Directive also sets requirements on the detailed design of nodes to avoid air leaks and thermal bridges. This is often forgotten and can lead to inappropriate skirting boards being used. This may require using thicker insulation packets in walls and roofs, which raises the costs. So even when it looks like an easy game, it might be a good idea to involve the EPBD assessor early in the project.” ■



▲ Air leaks and thermal bridges should be avoided, also in industrial buildings.



Turnkey projects

Constructing while production continues 24/7

Vandersanden: renovating a brick production facility

Brick producer Vandersanden installed a new packaging line at its facility in Bilzen, Belgium to further enhance quality and improve customer service, transport efficiency and safety. The project involved carrying out complex renovation work at the production facility, all the more challenging since production activities needed to continue at the same time. "I was pleasantly surprised to find a company delivering flawlessly." ▶

KEY FACTS

- Brick producer Vandersanden have installed a new packaging line to further enhance quality and improve customer service, transport efficiency and safety.
- Production activities needed to continue 24/7 during adaptation and installation works.
- A comprehensive plan was developed and carried out involving a new structure surrounding and above the existing building.



A family business for over 90 years, Vandersanden produces facing bricks, façade solutions and pavers at various production locations in Belgium, the Netherlands and Germany. With a network of sales offices across five European countries, the company has become the largest brick-producing family business in Europe, employing 650 people and producing 500 million bricks per year.

New packaging line calls for renovation

The company's headquarters and prime production facility are both in Spouwen-Bilzen, Belgium, and the facility is continuously updated to meet changing market trends. The most recent adaptation concerns the installation of a new packaging line to improve customer service and transport efficiency and safety. Maikel Duchateau, the site's Technical Manager, explains: "An additional step was introduced in the brick production process involving a finishing treatment to improve quality. With that, a new packaging line was developed to allow bricks to be mixed to homogenize delivery to our customers. It also involved improving

the stability of the packs and the effectiveness of the truck loading procedure, an important safety gain."

Production continuity complicates the project

Installation of the new packaging line required Vandersanden to thoroughly reorganize and renovate its facility. Duchateau elaborates: "It was a rather complicated project for several reasons. The new machine needed to be installed within the existing

"They described exactly how they would build a new structure around and on top of the existing building before dismantling its roof"

The packaging line was installed on a structure above the storage space which is a receiving area for bricks.



building perimeter due to lack of available space at the site. We decided to locate it on a structure above a storage space which is a receiving area for bricks. This meant we had to increase the building's height by approximately two metres while allowing 24/7 production to continue below. Production continuity also made for very limited manoeuvring space around the building, given that trucks must be able to pass by constantly. The presence of several large gates in the building as well as a 10kV high-voltage line and a gas pipeline in close proximity further complicated the project. And construction was scheduled to happen between December and April, with high risk of unfavourable weather conditions."

A workable plan

Duchateau contacted no fewer than seven construction companies for the job and found that only one had a convincing proposal. "Most of the proposals I saw involved too many uncertainties for me. But TCS had developed a comprehensive plan, describing exactly how they would build a new structure around and on top of the existing building before dismantling its roof. They also proposed to install an overhead crane which

during the project would be used for construction activities and later serve as a maintenance crane. Detailed construction scenarios convinced me that it was a workable plan."

And workable it was. "They started just before Christmas and delivered in the first week of April. Consistently I was pleasantly surprised by their proactive attitude, identifying potential issues or difficulties before they became problems. They were flexible too. I remember them even working at temperatures around -10°C. Remarkable." ■

Specifications

- 1340 m² area (46 m x 22.44/31.4 m)
- 15,400 m³
- 90 tonnes of steel
- 2-tonnes single-beam overhead crane



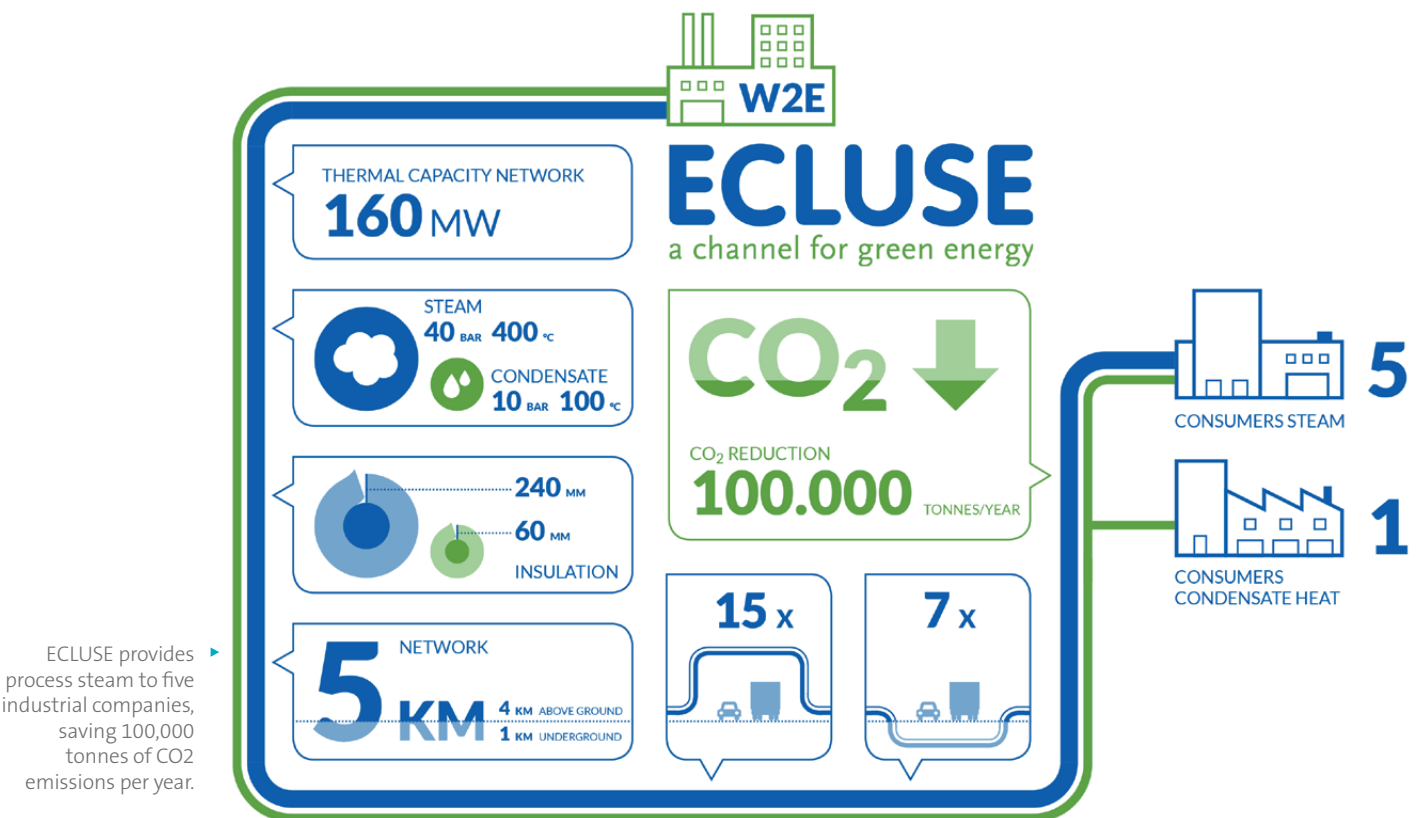
◀ The new packaging line allows bricks to be mixed to homogenize delivery to customers.

Turnkey projects

The largest industrial heat cluster in Europe

ECLUSE: channel for green energy at Waasland Port

An impressive network of steam and condensate pipes is being built in Waasland Port. ECLUSE will be the largest industrial heat cluster in Europe, providing process steam to five industrial companies, saving 100,000 tonnes of CO₂ emissions per year.



The 30-million-euro project is part of a comprehensive decarbonization effort. The steam is produced at the Indaver and Sleco waste processing plant in Waasland Port, which is on the river Scheldt's left bank in the Port of Antwerp. Five neighbouring energy-intensive chemical plants, ADPO, Ashland, Monument Chemical, Ineos Phenol and Lanxess, will use the steam in their production processes. This will allow them to reduce their energy bills by 10 to 20 percent. Containerterminal DP World-Antwerp Gateway will extract the heat from the return condensate duct.

Successful alliance

The 6-km pipeline currently being installed will transport steam at 400°C at a pressure of 40 bar. The 'channel for green energy' pipes are insulated with a 240-mm layer of rockwool and finished with an aluminium protective shield. Most of the pipes are above ground, with the expansion loops being clearly visible from nearby roads. Since half the waste treated in the waste-to-energy facility is bio-organic in nature, this proportion of the heat output can be considered 'green'.

ECLUSE is an alliance between Indaver, SLECO, Fluvius, FINEG, Water-Link and Maatschappij Linkerscheldeover and has the support of the Belgian Federation for Chemistry and Life Science Industries, essenscia. The

project has already won several awards, including the Integration Award at the 2018 CEWEP conference in Bilbao, organized by the European confederation of waste-to-energy plants. ■



◀ The construction of the building housing the network's 60,000-litre buffer vessel was a turnkey project.



▲ 39 pile foundations were constructed in difficult circumstances.

Specifications

TCS designed and constructed the building housing the network's 60,000-litre buffer vessel. "The turnkey project involved constructing pile foundations in difficult circumstances and coordinating several subcontractors to complete the project within the very short time span of two months," says Indaver/SLECO Head of Projects and Modifications Jarne Van Meerbergen.

- 39 pile foundations
- 18 tonnes hot-dip galvanized steel
- 400 m² insulated steel wall panels
- 90 m² steeldeck, insulation and PVC roof
- 30 m² technical space with epoxy floor
- Floors and platforms
- 3 chain hoists 250/500 kg





Steelworks

Infrastructure to help fire up audiences

Spectacular new stages for Lowlands Festival

Things move fast in the summer festival business. Trendsetters like Glastonbury (UK) and Tomorrowland (Belgium) have gone beyond the standard business of putting on concerts, they like to create 'unforgettable experiences in an atmosphere of freedom and global unity'. In this spirit, performance infrastructure is becoming increasingly important to attract and fire up audiences. A prime example is the Lowlands Festival in Biddinghuizen (Netherlands), which wowed crowds in 2017 with two new spectacular main performance stages. ▶



KEY FACTS

- Performance infrastructure is becoming increasingly important to attract summer festival audiences.
- Lowlands in the Netherlands fired up crowds and critics with two spectacular new stages developed by Stageco.
- Both the Alpha and Bravo stages brought out touches of ingenuity from TCS engineers.

The open structure should be able to withstand sidewinds of 25 m/s, making for quite an engineering challenge.

Established in its current form in 1993, Lowlands was one of the first greenfield summer festivals on the European mainland to offer a global experience spread over multiple days. Branded as 'A Campingflight to Lowlands Paradise', the three-day festival presents music and other performing arts on no fewer than ten stages, each offering its own atmosphere and flavour. Tickets must be purchased

for the full programme, so most visitors stay for three days, sleeping in tents on the nearby campground. The concept has been hugely successful over the years, with a 55,000 ticket sell-out. However, ticket sales fell back in 2015, triggering a major festival infrastructure make-over to revitalize the experience and attract new audiences.

Replacing the vintage tent

That's where Stageco came in, world leader in the design, construction and installation of concert tour stage infrastructure for top artists such as Beyoncé, Robbie Williams, The Rolling Stones, Bruce Springsteen, U2, Coldplay and many more. They were asked to develop new Alpha and Bravo stages, which are the main stages at Lowlands. The new Alpha structure had to replace the vintage circus-like tent which had been in use for more than 20 years. Stageco Director International Projects Dirk De Decker recalls the challenge: "The idea was to more than double the existing capacity, allowing 30 or 40,000 people to enjoy the festival headliners at the end of each day, with a clear view from every angle."





A superb view from every angle

“A typical festival tent wouldn’t do,” says De Decker, “so we developed a semi-open structure made up of nine arches, 9.5 metres apart, spanning 65 metres with no additional poles to block people’s views. The structure is open at the rear and at the sides to give a superb view even for those outside the covered area.”

“This was quite a challenge in terms of engineering, as the structure should be able to withstand sidewinds of 25 m/s. The more so because, for flexibility reasons, a lot of the stage equipment is attached to the tent structure. One consequence was that it couldn’t be put up on a mobile slab foundation as is customary in festival tent construction - the significant forces at play meant we needed to make a grid of permanent foundations.” (see also ‘Going through hell for five minutes of glory’). ▶

“The most important aspect is the atmosphere you create inside, with audiences expecting the extraordinary”



▲ The steel cross vault is a spectacular backdrop for the most overwhelming light shows.

◀ A grid of permanent foundations was needed, given the significant forces at play.

Going through hell for five minutes of glory

The Alpha and the Bravo stages presented quite some challenge for Stageco. "With the Alpha stage we set foot in some areas we were not familiar with," explains Dirk De Decker. "Especially the foundations, which required the use of concrete and steel combined, a technique we seldom come across in our projects. But, of course, it was less of a big deal for our construction partner TCS, given their experience with industrial infrastructure."

It was the Bravo project that gave us the biggest worries. "The idea of a double vault seemed straightforward at first sight," says De Decker. "After all, people have been building such structures since the Middle Ages. But this was a mobile structure made from steel, needing to be assembled and disassembled each year. Once we started engineering work, we immediately understood how difficult it was going to be to develop the cross vault with its extremely complex steel joints."

"The entertainment business always pushes you to your limits, so you develop a rather reckless attitude, proposing the boldest of designs. But frankly, at one time I really feared we had overplayed our hand on this project. Two months before the deadline there was a bit of panic in the house. We were like, going through hell. That was until the TCS engineers surprised us once again with their touch of ingenuity. Making for five minutes of glory. Magnificent."



▲ The cross vault of the Bravo structure made for some extremely complex steel joints.

A grandiose scene

The new Bravo stage was just as important for the festival's future. "Historically, this has been the Lowlands stage for dance and hip-hop acts, though it's also staged rock concerts in recent years," elaborates De Decker.

"At Bravo, shows run until 4.30 am, with a big emphasis on visual effects, requiring a mobile venue closed on all sides but with a capacity of 10,000. The most important aspect is the atmosphere you create inside, with audiences expecting the extraordinary. That's what we did. We created a 40-metre double barrel vault of steel, making for a grandiose cross-vaulted interior, a spectacular backdrop for the most overwhelming light shows you've ever seen. It made the traditional opening of Lowlands - a Silent Disco where people dance to music listened to on wireless headphones - crazier than ever. Critics and audiences gave rave reviews on all sides." ■

Specifications

All tent components were designed and manufactured in such a way that they are mutually exchangeable across tent supporting legs. The design is also optimized for minimizing the transport volume.

Alpha tent:

- 68 tonnes of steel
- 927 components
- Study of the foundations using finite elements method

Bravo tent:

- 75 tonnes of steel
- 500 components



Steelworks

Engineered and manufactured in Europe

The safe way to build steel structures overseas

Would it be better for European companies with plans to develop facilities overseas to hire local steel constructors? Practical experience has shown that this is not always the smartest option. The risks involved are often high, and the expertise of a European specialist generally provides more opportunities to reduce them. Though it does require the steel constructor to be organized accordingly. ▶

KEY FACTS

- Hiring local steel constructors is not always the smartest option when developing industrial facilities overseas.
- Risks can be reduced by using a European specialist.
- It requires solid engineering expertise and meticulous organization.

The steel structure is generally the first element to go up when building a new industrial plant. From a budgetary perspective it's often one of the more modest components, representing maybe five percent of the total cost. However, much of the steel structure is critical to project timing, since everything else depends on it. "Process equipment can't be installed without the steel structure being in place," says Dirk Teuwen, Manager of the Steelworks Business Unit at TCS. "It's clearly on the critical path, so companies would be better not to take any chances with it."

"Erecting the steel structure is on the critical path of any industrial project, so companies would be better not to take any chances with it"

Masters of the game

A steel structure can be engineered and manufactured in Europe, ready to be erected in Africa, Central America, the Middle East or Russia. "We've done several projects like that at TCS," confirms Teuwen. "For example, we built the steel structures of some of the largest methanol factories in the world here, in Europe, which were then erected in Trinidad and Tobago. We've done steel construction projects for agro-industrial groups developing facilities in Nigeria. We've engineered and manufactured reformer platforms for Qatar and Cuba. The list goes on with projects in Ghana, Siberia, Egypt and the United States. In these projects, it was local

European expertise

Some risk may be involved in hiring a local steel constructor. Teuwen: "Are they able to meet the required quality standards and deliver on time? This may not be the case, especially when specific engineering challenges are at play. Think of structures subject to patterns of vibrations or other complicating factors. In such cases it might be better to benefit from the engineering expertise and field experience of a European steel constructor."

The shipping cost is only a minor fraction of the entire budget, especially compared to the potential losses a delay could bring.





◀ The steel structures for the methanol factories in Trinidad and Tobago were engineered and manufactured in Belgium.

teams who erected the structure on site, but we are the masters of the game, making sure that deadlines are met, and quality is high.”

Engineered for the purpose

It does require the steel constructor to be well-organized. “Not every European constructor can carry out such projects,” Teuwen admits. “For one thing, they need an engineering office with a solid understanding of non-European standards, including factors such as resistance to earthquakes. Structures should also be engineered in such a way that they can be easily shipped in batches and erected by local teams, using special equipment. It also requires constructors to meticulously plan their work, making sure that offsite parts production is aligned with the onsite project plan. In other words, don’t leave it until the last batch to ship vital structural elements!”

Avoid losses due to delays

And what about the administrative load and additional shipping costs? “They shouldn’t be overestimated,” says Teuwen. “The administrative burden can be high in some countries, but a well-organized company can deal with that. And yes, shipping is an extra cost, but it’s really a minor fraction of the entire budget. For the project developer it is much more important to reduce project risks, because a potential project delay represents a much bigger loss.” ■

A stimulating collaborative effort

Corda Campus: refurbishing a manufacturing facility

Corda Campus in Hasselt, Belgium, is rapidly becoming one of the most coveted workplaces in the Meuse-Rhine Euroregion. The former Philips manufacturing plant and research centre is being converted into a tech campus, fostering innovation, collaboration and co-creation. The process of renovating and furnishing the Corda A and B buildings was itself an energizing collaborative effort.

KEY FACTS

- The former Philips manufacturing plant and research centre in Hasselt is being converted into a tech campus, fostering innovation, collaboration and co-creation.
- The process of renovating and furnishing the Corda A and B buildings was itself an energizing collaborative effort.
- The use of steel and wood as well as exposed ductwork make for a distinctive but warm atmosphere.

The idea for Corda Campus emerged in the years following the closure of the Philips manufacturing and research plant in Hasselt. Once employing thousands of workers, Philips Hasselt closed its doors in 2002 after disruptive evolution in the global electronics market. Procos Group, an Antwerp based company, specialists in space planning and facility management consulting, then put forward a masterplan to convert the site, involving both the renovation of existing Philips buildings and the construction of new offices and labs.

Reminiscent of the industrial past

First, an eye-catching incubator building was erected, housing several technology and service start-ups. More

recently, additional office and laboratory space was created by renovating and refurbishing the 3000 m² Philips production buildings. Procos Group architect Irina Vassileva elaborates on the challenges presented by the project: “We wanted to transform this old facility into an inspiring work environment where collaboration and co-creation are stimulated. Target companies would include small start-ups of a few people right up to larger companies or innovation cells with maybe sixty employees. Space organization needed to be fully optimized for both types of companies. User comfort and energy efficiency had to be top class - no compromises on that - but we also wanted the place to remain reminiscent of its industrial past. And an important practical aspect was timing: the renovation had to be completed inside six months.”

“An important practical aspect was the timing: the renovation had to be completed inside six months”

A warm atmosphere throughout

Procos developed a modular space concept, arranging a series of private dual-level units around a large open space, which functions as a coworking area. Within the open space, open and enclosed boxes with meeting rooms and specific workstations were created. The strict time constraints made the construction of concrete walls and floors impossible, so steel and wood were the

materials of choice. Irina Vassileva: “The use of steel was perfectly in line with our ambition to honour the building’s industrial past. We emphasized this further by exposing cables, ducts and HVAC equipment. Together with the woodwork we were able to create a distinctive but warm atmosphere throughout.”

Allowed to open windows

A high level of user comfort was achieved through a combination of energy efficient techniques. “Spaces are almost entirely heated and cooled by air,” explains Vassileva. “There are only very few radiators in the building. We also managed to achieve a ventilation rate of 60 m³ per person per hour, the highest standard. Even then, people can open windows whenever they feel like it.”

A particular challenge was bringing enough daylight into the coworking space. “The roof was already covered in solar panels, so we couldn’t create new skylight openings. We therefore used tubular skylight systems to redirect and reinforce the light coming in through the existing openings. We really stretched everything to the limit to achieve the required comfort and efficiency.”

Raising the commitment level

LEAN techniques were used to streamline and manage the construction process. But Vassileva above all praises the collaborative atmosphere during the project. “I enjoyed this project like no other. We managed to fully engage all the contractors and subcontractors within the construction team, establishing tight interpersonal relations and raising the commitment level of everyone involved. That really helped us to properly address emerging issues and make sure the deadlines were met.” ■

Specifications

Corda Campus general contractor Kumpfen hired TCS to engineer and manufacture the steel structures of the Corda A building.

- 140 tonnes of steel, most of it R30 fire protected
- Platforms connected to existing structure
- Nine staircases
- Measuring, engineering of joints, and manufacturing
- Entrance 18 tonnes of steel

LEAN techniques were used to streamline and manage the construction process.



▲ The building’s industrial past is honoured by using steel and by exposing cables, ducts and HVAC equipment.





Cranes

Astute investment accelerates delivery

New sheet crane and coil trolley at Aperam Genk



A new overhead crane and an additional coil trolley have been installed in the delivery warehouse at the Aperam stainless-steel mill in Genk, Belgium. The investment significantly increases the delivery flexibility of the plant, confirming the company's strategy of improving overall agility. ▶

KEY FACTS

- Aperam installed a new overhead crane and an additional coil trolley in its delivery warehouse in Genk.
- The sheet-handling crane significantly accelerated the loading of trucks.
- The trolley almost doubled the coil reception capacity to respond to increasing demand.

The delivery warehouse at Aperam Genk comprises five connected 100+-metre buildings where the sheets and coils coming from the different production lines are stored. A specialized overhead crane, RB1, has been in place since the 1960s to load the sheets onto trucks for delivery to steel service centres. Aperam recently decided to replace this crane for various reasons, operational efficiency and safety being the most important. “With RB1 it was difficult to manipulate the sheets, which are two metres wide and up to ten metres long,” explains Internal Logistics Coordinator Jaco Van Oirbeek. “It was a hell of a job trying to position the sheets accurately in the middle of the 2.4-metre wide trucks, because it was a fixed-speed single-hoist crane with no features to improve convenience for the operator.”

“Operators are delighted with the new crane. It’s important to keep our people motivated, isn’t it?”

Gaining time with each truck load

After a field visit to a steel service centre in nearby Bree, Aperam elected to replace RB1 with a dual hoist crane equipped with frequency control, and that made a huge difference. “Stability is much better, especially when handling long sheets. The operators needed to get used to the crane’s behaviour and responsiveness, which is completely different due to the frequency control, but now that they master the thing it works perfectly, allowing us to gain time with each truck load operation. Operators are also delighted with the airconditioned control cabin and the comfortable chair. It’s important to keep our people motivated, isn’t it?”

Double the coil reception capacity

Aperam also installed an additional coil trolley in the delivery warehouse. “This is a custom-made trolley for transporting coils from the production line into the delivery storage. We call it a ‘metro’, referring to the speed with which it allows us to receive coils. By installing a second one, we could almost double the warehouses’ coil reception capacity, which was needed to respond to increasing demand for stainless steel coils.” ■

The dual hoist crane with frequency control improves stability when handling long sheets.





Crane reception capacity almost
▼ doubled by installing a second 'metro'.



Specifications

Both the overhead crane and the coil trolley were custom-made to allow the reusing at least part of the existing installation.

- DBK class M4/4m overhead crane of 22.5 m with two 8 tonnes hoists on one trolley
- Lifting beam to fit three different tongues
- Frequency controlled movements: hoisting at 16m/min, trolley speed 50m/min, crane speed 120m/min
- Maintenance platforms at both sides of the girder with the trolley being easily accessible
- Safety system for safe crane access at four sides.
- Control cabin and RF control

The coil trolley needed to fit the unconventional existing rail infrastructure.

- 120 tonnes capacity
- 45m/min speed with frequency control

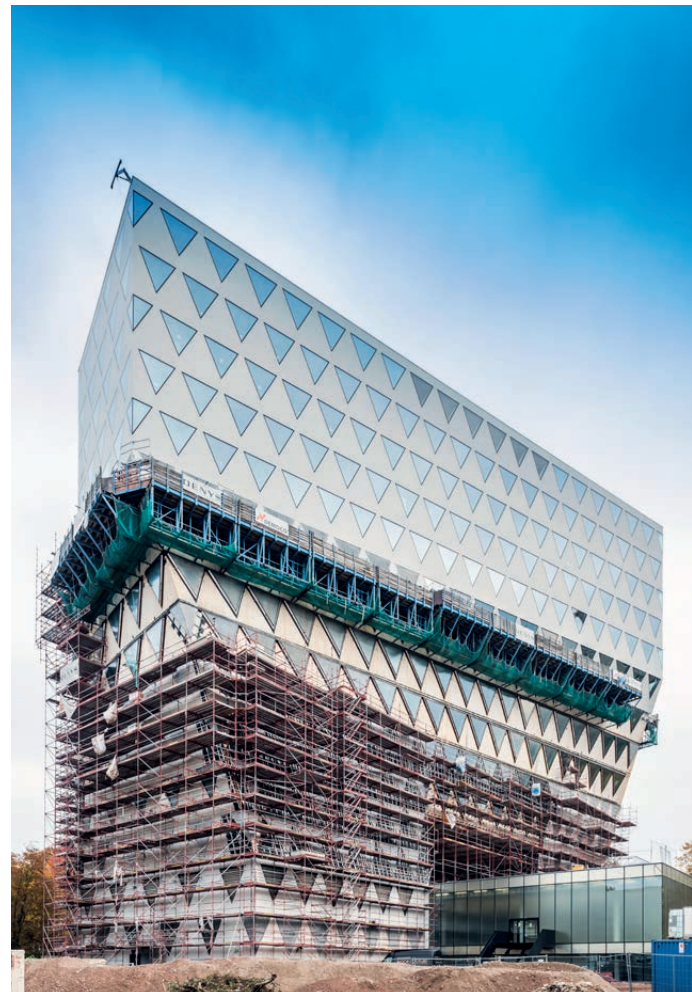
Dealing with peculiar geometries

Construx: complex formwork for spectacular designs

Demand for custom-made precast moulds and flexible formwork systems is on the rise as a result of the increasing complexity of concrete construction projects. This is illustrated by Construx, a leading formwork manufacturer whose moulds and formwork systems are used in projects around the world. "Solid engineering capabilities are needed to meet today's challenges."

KEY FACTS

- With concrete construction projects becoming more complex, demand for custom-made precast moulds and flexible formwork is on the rise.
- Formwork manufacturer Construx developed solid inhouse engineering expertise to meet these challenges.
- A new cleaning and repair shop equipped with TCS crane solutions enhances Construx services to its customers.



▲ The peculiar geometry of the Antwerp Province's new main office presented a tough formwork design challenge.

“Formwork design and functionality can have a significant impact on overall project costs”

Bart Meermans, Plant Manager at Construx Genk, outlines the trend: “The evolution towards ever more spectacular architecture and civil engineering projects has been going on for many years now. Today, oddly shaped creations are not so exceptional anymore, they’ve become almost mainstream. And when it comes to concrete structures, there’s a general rule: the more spectacular the construction, the more complex the formwork.”

Involved early in the project

This is why Construx over the years has developed robust inhouse engineering expertise, in line with their motto ‘Shaping the Future of Concrete’. “We increasingly need to develop complex, custom-made formwork solutions, either for precast plants or for onsite construction work. This means we get involved early in the project to develop the most appropriate ▶



▲ Jib cranes are used to load panels into the cleaning machine.

formwork solution for the project in hand. Bear in mind that formwork design and functionality can have a significant impact on construction speed, the timing of project activities and overall project costs. Construction companies greatly appreciate the fact that we have the right people on board to help them optimize their work.”

Odd geometries presenting challenges

A recent example of a complex architectural shape built using Construx formwork is Antwerp Province’s new main office, a distinctive 14-storey structure with a twisted outline and a remarkable pattern of triangular windows cast *in situ* using white fair-faced concrete. Meermans: “The odd geometry and the very dense reinforcement presented a tough challenge. We designed an adjustable and twistable steel formwork with no tie-bars through the walls, and the inside panels have a stainless steel facing to avoid rust stains. We’ve been working closely with the construction company to optimize the formwork and develop an effective casting procedure.”

Fascinating projects and products

Other fascinating projects using Construx formwork solutions can be seen on the www.construx.be website. Examples include the LUAS light rail line viaduct south of Dublin, Ireland, the A4 Kethel tunnel in the Netherlands city of Delft, quay walls made from prefabricated blocks in Tema Port in Ghana, the new Ghent railway station platforms in Belgium, and standardized bridge arches over the Belgian Infrabel national rail network, among many others. An eyecatcher is the Combicaster multifunctional stair mould developed for a German company, allowing fast *in situ* casting of any type of winding staircase. ■

Specifications

- EBK 6.3-tonnes 16.7-metre overhead crane with frequency control
- Two 630-kg 6-m jib cranes
- Two 500-kg vacuum lifters to be used with the overhead and jib cranes

An adjustable and twistable steel formwork was developed without tie-bars through the walls.



New cleaning and repair shop to improve service

In addition to customized solutions, Construx also supplies standard formwork systems including a wide variety of standard precast moulds. The company also offers a steel and aluminium shuttering rental service where sufficient panels must always be in stock to be responsive to customer needs. Returned panels also have to be cleaned, and if necessary repaired, as quickly as possible. To achieve this, Construx recently built a new workshop in Genk with an automated panel cleaning line and a repair area. TCS developed and installed the workshop’s comprehensive array of lifting equipment, which includes an overhead crane, two jib cranes and appropriate vacuum lifters. Meermans praises the collaboration: “They did more than just give us the tools we asked for. For example, they suggested to attach the jib cranes to the building structure instead of delivering standalone jib cranes. This turned out to be much more effective than our original idea.”

Using vintage cranes to handle 18-metre slabs

Prefaco: portal cranes upgraded to work in tandem

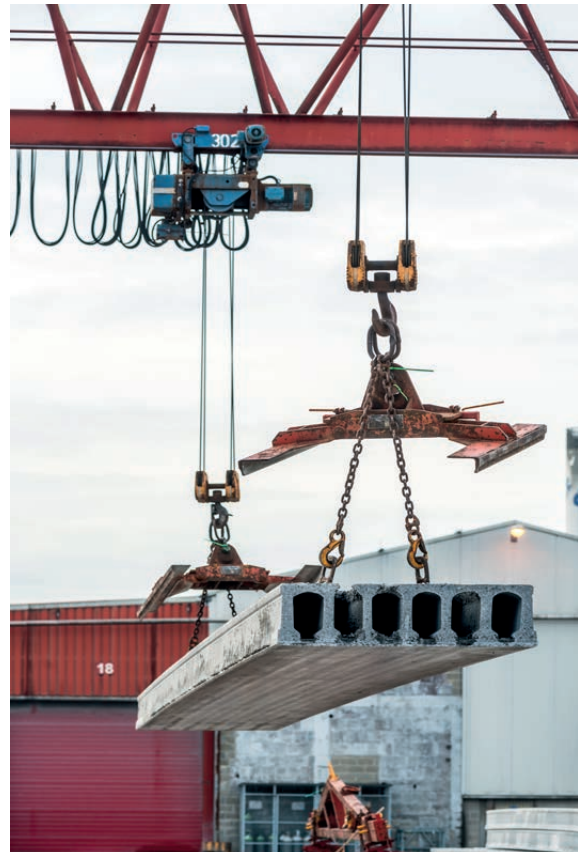
Increasing demand for long hollow-core concrete slabs meant that Prefaco at Houthalen-Helchteren, Belgium, had to modernize its portal crane infrastructure. They invested wisely, renovating two old portal cranes and equipping them with tandem control to allow slabs of up to 18 metres to be manipulated.

KEY FACTS

- Increasing demand for longer hollow-core concrete slabs brought about some logistical challenges at Prefaco
- Two vintage portal cranes were upgraded and equipped with tandem control to allow slabs of up to 18 metres to be manipulated

Business has been on the up in recent years at construction material producer Prefaco after several years of reduced economic activity. Formerly under the Echo banner, their plant in Houthalen-Helchteren produces hollow-core prestressed concrete slabs, always on demand and mainly for use in industrial buildings and warehouses.

“The business was at a low ebb during the crisis years when demand was low and competition fierce,” says the plant’s Technical Team Leader Ben Gysen. “But now we have very busy schedules again, producing 24/7 in a constant rush to deliver on what we promise.” ▶





Longer slabs bring logistical challenges

Business has also changed a bit compared to the pre-crisis years. “There is an increasing demand for longer hollow-core slabs,” explains Gysen. “Back in 2010 we rarely needed to produce slabs of 12 metres or more, but for a few years now we’ve quite often been getting orders for long slabs up to 18 metres with thicknesses up to 40 centimetres.”

This evolution has brought about some logistical challenges. “In fact, we weren’t really equipped for handling these very long slabs. Previously, when we had to deal with such giants, we transported them using our two old portal cranes, but it was rather cumbersome, needing two operators and some special safety arrangements. Good for now and then, but not for every day.”

Operating two cranes as one

So Prefaco looked for specialist advice. “We didn’t want to purchase a new crane - that would have been too big an investment,” says Gysen. “But our existing cranes were more than 25 Years old and we were not sure they could be further used in an effective manner. But TCS confirmed that after installing new control cabinets and remote controls they would serve very well. They also suggested implementing tandem control, which means you can link both cranes and operate them as if they were one machine. A great idea. We let them install it and we’ve been happy with it ever since.” ■



◀ Tandem control allows two cranes to be linked and operated as one machine.



“For a few years we’ve quite often been getting orders for long slabs up to 18 metres with thicknesses up to 40 centimetres”

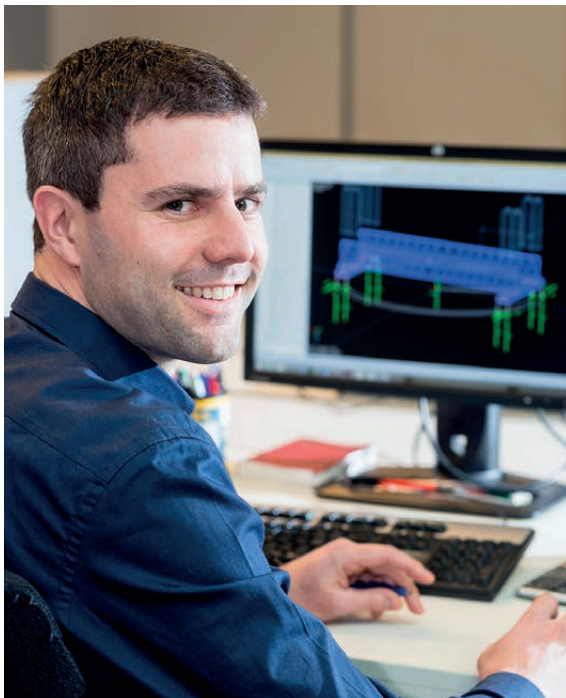
Specifications

Controlling the cranes in tandem can be initiated and carried out by one remote operator. The operator travels the cranes to a certain distance, for example 10 metres, and then activates tandem control, setting one crane in slave mode. From that point, both cranes and their hoists can be controlled simultaneously from the master crane. While in tandem mode, a number of safety signals are being exchanged, including the overload indicator and the end switches for hoist lifting and descending and crane and trolley travelling. This ensures that the tandem system appropriately reacts whenever one of the two cranes sends a safety signal.

Engineering ingenuity making things work

Cracked runway beam illustrates need for analysis

Can we be confident that existing industrial steel structures are safe? A problem that occurred last year with a crane runway beam at a non-ferrous metals plant seemed to be reason for further investigation. Analysis revealed that the beams had been overloaded for decades and needed to be replaced, but some engineering ingenuity was needed to design replacements that would fit the available space.



Last year, TCS was asked to examine a crack in a welded beam from a 165-metre crane runway at a non-ferrous metals production plant. The crack initiated at the junction of two L-shaped flanges, indicating a possible welding issue. A root cause analysis was carried out. “We recalculated the entire runway beam against the actual operating circumstances,” says TCS engineer Peter Neven. “Both static and fatigue calculations were made. The outcome was quite disconcerting. We found out that the beams had been systematically overloaded for more than 40 years.”

End of life was reached

The calculations demonstrated that the beam dimensions were insufficient to withstand the crane loads. “Not only that, the welding was of insufficient quality with surface irregularities that had led to increased stress levels,” says Neven. “We came to the conclusion that the beams had reached end of life. Although we could reduce stress and strain levels by reinforcing the beams, it was clear that this would not eliminate the cumulated fatigue effects. Cracks would continue to emerge, so we strongly advised that all the beams of the 165-metre runway should simply be replaced.”

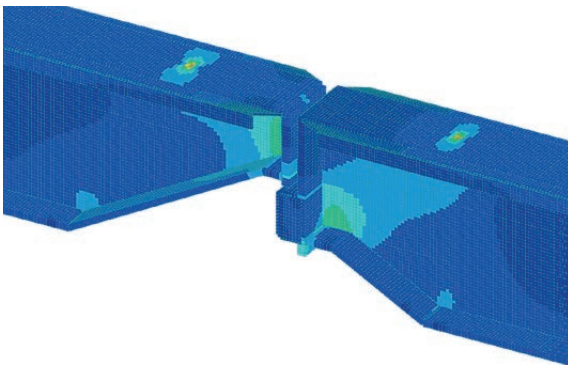
Complex nodes

Replacement wasn't that simple either. Peter Neven: "The new beams needed to be higher to keep stresses and strains down. But they still had to be a perfect fit for the available space, which was obviously limited. So, we devised a special beam design with reduced height at the bearing points, and we also redesigned the two expansion joints to make them fatigue-proof. The design meant we had to develop 3D-models of the complex nodes and calculate them using finite element software. It's engineering ingenuity making things work!" ■

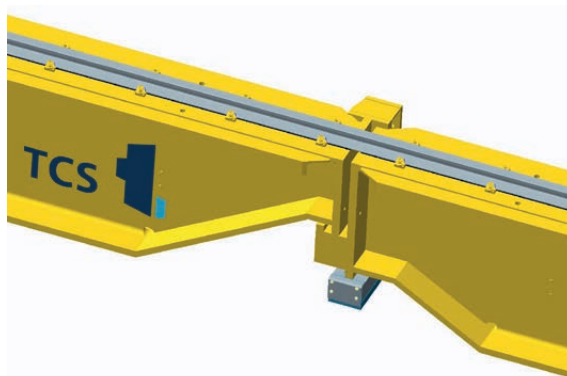
"The new beams needed to be higher but still had to be a perfect fit for the limited space available at the bearing points"



◀ The crack resulted from the runway beams being overloaded for more than 40 years.



▲ Detail of the FE-model of the expansion joint: distribution of Von Mises stress due to 2 concentrated wheel loads



▲ The two expansion joints were redesigned to make them fatigue-proof.

Specifications

- Design according to Eurocode EN-1991-3, EN-1993-6 and EN-1993-1-9 Classification S6
- Existing 15-metre HEA-900 + L150/150/15 + L120/120/12 crane runway beams replaced by HL-1100R + L100/100/15 beams
- Dimensioned for two 11-tonnes 28.6-metre coil manipulator cranes

Embodying the company's commitment

HR Management at TCS

The management of human resources at TCS is firmly oriented towards its company motto: 'The expertise you need, the commitment you deserve.' 'We need to continuously develop our people's skills as well as make sure that each individual embodies the company's commitment to serving our customers' ambitions.'



The company's HR Manager, Elke Cluydts, confirms that soft and hard skills are of equal importance. "We take care that there's no gap between customer expectations and what we can deliver. This implies having on board a sufficient number of highly-skilled personnel. We use competence matrices to follow that up. But let's be clear about that: by competences I don't mean just technical expertise, I also mean soft skills like a positive attitude, team spirit, the ability to learn, and communication skills."

A positive team spirit prevails

Expectations are high, but Cluydts is determined that it isn't asking too much. "We have a very open, non-hierarchical working culture here, where a positive team spirit prevails. People are constantly encouraged to confer with colleagues on how to meet customer expectations. We assess these aspects during job interviews. Is the applicant open-minded and able and willing to learn? Would he or she be able to communicate clearly with customers and subcontractors? Every single TCS employee or worker is considered to be an ambassador for the company, so they need to embody our firm commitment to customer ambitions."

Sensing the company culture

For this reason, TCS increasingly invests in employee growth and development. “Based on our annual performance appraisals, we have significantly increased the number of training sessions in recent years,” confirms Cluydts. “We’re putting the focus firmly on on-the-job-training, which is particularly useful for newcomers, because they can immediately sense our company culture and experience our way of working. On-the-job-training programmes are greatly appreciated because their added value is immediately clear.”

“Each individual can contribute to the process of knowledge-sharing”

Developing staff potential

In addition, a long-term training programme anticipates the ongoing changes in the construction business and their human resource implications. “The world is changing rapidly and that impacts our staff and the skills they need. That’s why we’re gradually retraining them to take on more advanced responsibilities by

teaching design principles and how to calculate structures. Similarly, we’re starting to move our calculation staff up to an even higher level of expertise.”

Sharing experiences

Other aspects being emphasized include knowledge-sharing and experience-feedback. Elke Cluydts: “The process of knowledge-sharing is extremely important, and each individual can contribute to it. For example, we encourage people working in the field to provide feedback to engineers whenever they identify feasibility issues or improvement opportunities. People also need to know that they are encouraged to share experiences, both the positive and the negative ones. That’s how we learn and continuously improve our service.” ■



- ◀ Draughtsmen are being taught design principles and how to calculate structures.



- ◀ All staff is gradually moved up to a higher level of expertise.

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