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Construction of a pallet circuit in France for the manufacture of floor slabs, double walls and core-insulated double walls

In November 2010 the company SPL/Landaul (north of Nantes, France) began production of the first double walls. During the implementation of this pallet circuit alongside the usual plant delivery and installation Vollert also contributed new developments and the transfer of knowledge in the area of precast concrete component manufacture and the operation of a pallet circuit. SPL/Landaul is part of the CADDAC group, which is one of the biggest players in the building materials industry in Brittany. CADDAC is represented on the market under various names. The main branch of the group of companies is comprised of the cement trade (in 2009 Ciment de l'Atlantique was the largest cement importer in France), the manufacture of ready-mixed concrete in 15 Readymix factories (among others Beton de l'Atlantique) and the promotion and sale of sea sand (CETRA). The CADDAC group own presses in multiple locations for the manufacture of concrete storage products, such as hollow blocks.

■ Philippe Marrié,
Vollert Anlagenbau GmbH + Co. KG, Germany ■

In 2008 the plans of CEO Mr. De Sousa Reis of expanding the product range started to take shape. These plans were substantially supported by Mr. Stephane Renaudin, who brought experience with him into the company of the manufacture of precast concrete elements. It was decided to expand the product range of the group and along with stock items to also produce project-dependent large concrete items as well. Mr. Stephane Renaudin undertook the responsibility for the technical aspects and the project management. "We looked for a plant which was capable of making floor slabs and double walls economically and which at the same time was also flexible enough to produce high value products such as core-insulated double walls and architectural concrete items". The plant should be designed so that over time addi-

tional high-value large precast concrete parts can be produced.

"We studied the process very thoroughly and examined different plants and concepts from well-known manufacturers throughout Europe", explained Mr. Renaudin. "Ultimately Vollert and its partners has left the most competent and experienced impression for the pallet circuit, which is why we chose a Vollert plant. The Filzmoser company was commissioned for the steel processing and EDM for the mixing plant".

Latest state of the art

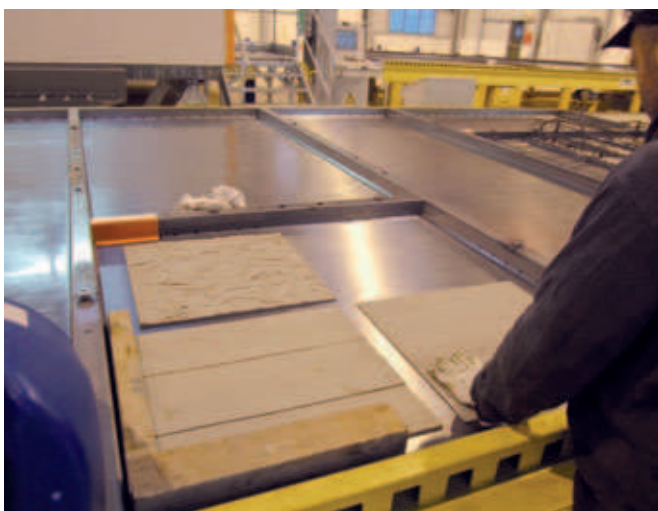
"This project started during an economic phase, in which there were hardly any projects on the market" remembered Frank Schlotter, head of the Machines and Plant division for the building materials industry at Vollert. "We used this time to completely technically rework our machines and to

increase rationalisation by the expansion of our standardised building kit system and to reduce the construction order lead times. Furthermore, the project is one of the first in which all the machines have been completely planned and built with 3D CAD.

The result was a well-organised procedure, virtually error-free production and assembly and a short optimisation period of the machines at the construction site during commissioning. Additionally, it was also possible to reduce the quantity of spare parts. All benefits which customers and suppliers could profit from.

Know-how transfer

The SPL company was founded in 2009. The double wall product was a whole new area for the firm. "The offices were only ready two months before commissioning", explained Jean-Yves Tranvaux, SPL Sales



First architectural double walls, during insertion of the form liners



Double wall with form liners before demoulding

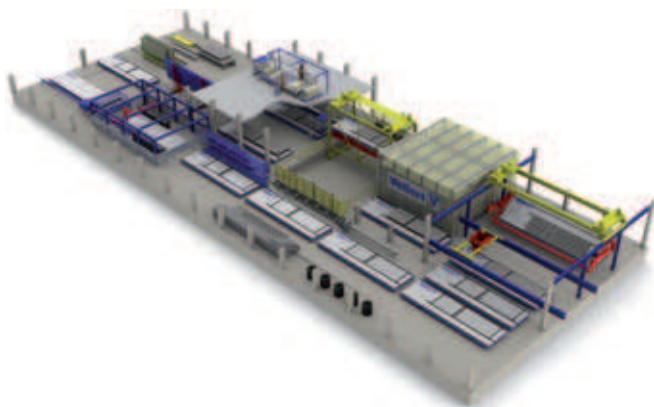


■ Philippe Marrié, born 1969, studied Civil Engineering at the University of Applied Sciences in Konstanz (graduating in Civil Engineering and Industrial Engineering) and has over 10 years of professional experience in the precast concrete part sector. Following positions in technical offices and as production manager in various precast concrete plants, he worked for several years for the Reymann Technik company as a project manager and planner both within and outside Europe. He has been Sales Project Manager at Vollert Anlagebau GmbH + Co. KG since 2009. philippe.marrie@vollert.de

Manager. "We had to start from scratch and needed to make decisions about products, personnel and machines before we really our way around".

In addition to a well-trained team of experienced mechanical engineers, Vollert also has an experienced civil engineer, Philippe Marrié, who places his knowledge in the fields of technical office, production and building site handling, at the customer's disposal in the precast plant. "This was a decisive point in our choice of supplier", explained Stephane Renaudin. "In Vollert we not only found a machine supplier, but also more importantly a team in the area of precast concrete parts, who had the competency to make sure we were in the fast lane from the start. In the last months above all many decisions were made together. Vollert trained our production manager during assembly of the plant. Furthermore, we were able to define the personnel requirements in advance and could order what material, storage and tools we needed, so that we could concentrate on the essentials of commissioning: learning and producing high quality from the start".

During commissioning Mr. Philippe Marrié, Vollert project manager sales, was on-site for some weeks. SPL could fall back on his experience as works manager. Production began with five employees, who were intensively trained at each station. In the second week three additional workers joined the team. None of the original employees had any experience in the area of precast elements. In just four weeks the production manager and those from SPL entrusted with quality and safety had managed together with Mr. Marrié to build up a structure in production to train the workers, bring routine into the production process and to produce high quality. "In the first week we naturally set our priorities on safety, machine as well as product explanation and started with a relatively simple construction site project" Philippe Marrié explained. "The workers were all highly motivated and ready to learn. The start went well for us, so that already in the third week we were working with complex projects. The workers acquired their first experience in the area of architectural walls. At the end of commissioning on average two pallets per hour were produced."



3D plan of the plant



Situation during the manufacture of the foundation slab



Mounting of the pallet turning unit

The pallet circuit

The pallet circuit was designed in 2009 at the start of planning, so that double walls up to a overall thickness of 500 mm could be produced. The curing chamber is designed with a overall capacity of 31 pallets, which corresponds to a plant capacity of 3.5 to 4 pallets per hour. In terms of machinery the plant is designed for an annual capacity in 3-shift operation of up to 250,000 m² of double walls or 600,000 m² of floor slabs.

In the first construction stage the basic equipment of the pallet circuit for the production of double walls was delivered, installed and put into operation. The mixing plant was mounted at the same time.

The main machine components are:

- Mixing plant with a 1.25 m² planetary mixer
- Positioning and cutting plant with lattice girder active storage
- Pallet transport by means of friction wheels, roller blocks and cross-lifting truck
- Shuttering transport and shuttering robots for formwork with integrated magnets
- Concrete distributor with spiked rollers and flat slide valve output
- Concrete compaction by means of a vibration station
- Special station with concrete compaction by means of high-frequency vibration for core-insulated double walls
- Fully automatic storage and retrieval machine for the optional insertion and removal of the pallets into and out of the curing chamber compartments
- Curing chamber for optimal curing of the precast concrete parts
- Tilting table for gentle lifting of double

walls, with a supporting device for the lifting of solid walls

- Movable ladder near the tilting table
- 27 pallets with 2 fixed edge formworks and fixing system for the special forms.
- Stopend formwork system with integrated magnets
- Transfer table as run-off truck

In a second construction stage a doubling of the storage capacity is planned, the installation of the automated Iso-Matic[®] insulation processing centre, as well as the introduction of an ERP system.

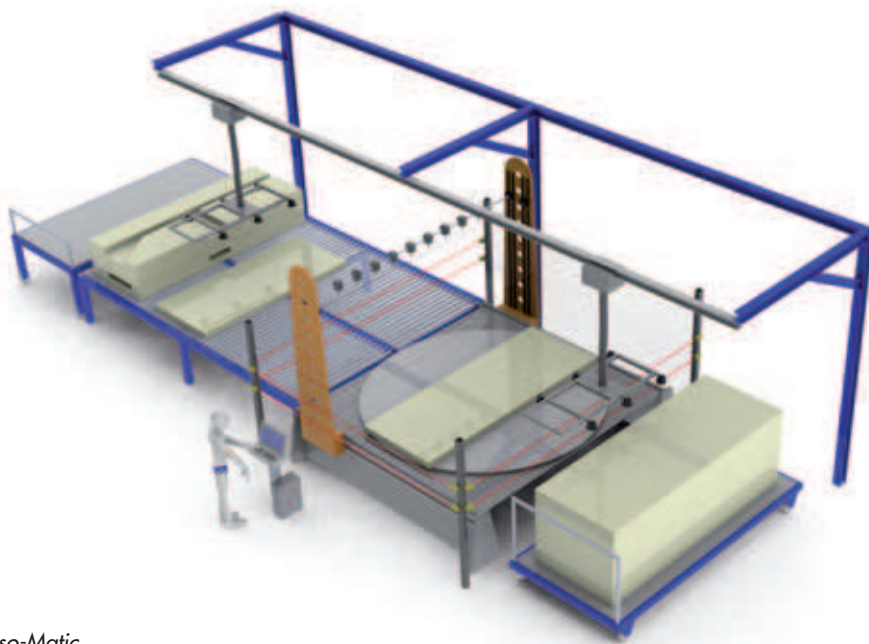
Special station for the processing of insulation: Iso-Matic[®]

The goal of the plant is, in future to produce up to 50% of double wall production with core insulation.

The solution from Vollert was a separation between circulating and special stations, so that the customer is able, regardless of the running production to produce higher quality products such as core-insulated walls, walls with form liners, white or coloured concrete, balconies and so on.

"Before planning the insulation processing station, we spoke to a lot of customers", Philippe Marrié explained. "We realised that the requirements for the functionality are very different from customer to customer. Many customers plan new product developments and for them it is difficult gauge the future requirements for the machines.

The basic idea of Iso-Matic is to use the CAD data available and to handle multiple processing steps of the insulation processing with just one plant in a space-saving, precise and economical way. The station is designed such that simultaneously precise drilling, milling and cutting of any angle can be carried out in polystyrene and other



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Pallet turning unit with pneumatic clamping system

insulating materials such as rockwool among others. In the Iso-Matic processing station patented by Vollert different modules are used.

In this way the basic version can be equipped at a later stage with additional tools or extra functionality. Furthermore, it is possible to work with all the usual fixing systems on the market, such as systems from Schöck, Thermomast, Halfen-Deha or the like.

The Iso-Matic should be installed in a second section of SPL's building. All the necessary preparations have been taken into consideration in the current plant. The

Iso-Matic will be installed on a platform directly above the work space which has been designated for it. A vibrating station enables the short entry of compaction energy to allow the anchoring of the insulation in concrete.

Pallet turning unit with pneumatic clamping system

The pallet turning unit works above three circulating stations in the plant

- Station 1: Provision and clamping of the first shell
- Station 2: Turning in
- Station 3: Handover of the empty pallet

The provision of the first shell of the double wall takes place, as does the handover of the empty pallet, at its own respective pallet station – independently of the circulation and optimised with regard to the cycle time. The first shell of a double wall is tensioned with the pallet by means of tensioning arms and a pneumatically-operated clamp and the turning machine crossbeam. Then the crossbeam is lifted via a four-rope hoist, rotated 180° by a rotary drive with worm gear and then travels transversely over the vibration station. The crossbeam is lowered with the first shell into the prepared second shell of the double wall and compacted together by means of the vibration station.

After compaction the tensioning arm clamping is released and the tensioning arms are removed and placed in the tensioning arm holders provided on the turning crossbeam. Turning back over and the handover of the empty pallet take place in automatic operation. A peculiarity of the SPL turning machine is an additional construction which allows the turning of the first shells with insulation. The tensioning arms are attached

directly to the insulation and clamped using a solution developed especially for SPL.

Shuttering robot

A shuttering robot which is proven in double wall production is also in use at SPL. Particularly for SPL's requirements this is planned with an additional function to place components such as electrical boxes or M16 sleeves. It allows the positioning of components to within millimetres. Component magnets with an adhesive force of about 800 N ensures that the component does not move during the concreting process.

Additionally individual magnet boxes are set by robots in the area of window and door recesses to allow a precise and quick manual installation of the recesses.

Steel processing

The steel processing of the Filzmoser company encompasses a straightening and cutting plant RaXe 16/5 and an automatic GTA lattice girder storage.

The straightening and cutting plant is equipped with a bending unit for the manufacture of reinforcements for the floor slab as well as a spacer mounting device. The data is prepared via the Just In Time host computer. The reinforcements are pre-sorted, deposited in a store and subsequently manually inserted.

Concrete distributor

The SPL company chose a concrete distributor with a flat slide valve and spiked rollers. The use of a hydraulic slide valve width adjustment allows the processing of concrete of different consistencies. From self-compacting concrete (SCC) to rigid concrete. With this technology a concrete distributor with screw discharge is preferable to avoid high



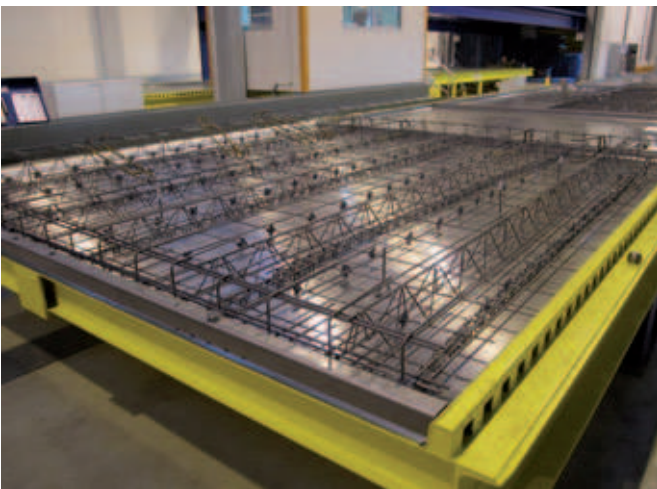
Built-in components, placed by robots



Storage for component magnets and magnet boxes in the robotic area



Circulation in the area of steel processing



Pallet during the manual insertion of the reinforcement

maintenance costs for the screw. Furthermore, the processing of self-compacting concrete with screw feeders is very problematic. The drawback of a concrete distributor with slide valves in comparison with a concrete distributor with screw discharge is that the valve concrete distributor needs a longer familiarisation time. This is due to the higher functionality which requires more sensitivity from the operator. The benefits and savings with regard to the maintenance costs justified the decision for the valve discharge. An interface



Concrete distributor and vibration station (front), the turning machine in the background



Mixing plant with cement silos and aggregate storage



Storage and retrieval machine and curing chamber

between circulation and mixing plant allows an automatic reservation of the concrete. The machine operator must confirm and cancel or change the pre-programmed order as required. The automatic pre-order allows control of the concrete quantity and reduces concrete wastage.

Mixing plant

The EDM mixing plant is equipped with a planetary mixer with a capacity of 1.25 m³ concrete. Five cement silos, each of 80 tonnes, are planned for white, grey and special cement as well as for the admixtures. This mixing plant allows the manufacture of grey and coloured concrete.

A tower with 5 intermediate silos is planned for the storage of the aggregate. This has an overall capacity of 200 m³.

Vibration station

The requirements for a vibration station are easy to define:

- outstanding surface finish and edge quality
- economic production in regard to demand for cement
- Max. noise of 70 dBA

In practice however, these requirements are difficult to achieve. Movements must be controlled and are directly related to the product to be compacted but not related to weight. Above all for dual walls there is a wide range of large weights to compact. A pallet with a first shell can weigh 11 tonnes, for example.

A double wall (two pallets, first and second shell as well as turning machine crossbeam) weighs three times as much in this example. The same vibration station must be able to bear these weight differences.

The Vollert solution is based on three components:

1. multiple servo drives
2. lower frequency motors
3. pendulum suspension

Multiple servo drives with adjustable unbalanced masses are synchronised. Usually four motors are needed for a double wall plant and only two for a floor slab. Depending on weight the unbalanced masses are synchronised such that their forces are more or less added and so reach the optimum energy level. Like the oscillation direction (circular, lengthwise or crosswise), this value can be selected infinitely via the central controller without mechanical intervention. The noise level of the station is less than 70 dB(A).

The next feature of a Vollert vibration station is suspension of the vibration frame. Instead of using relatively rigid and intensively-wearing rubber buffers and rubber-bonded metal, the vibration station is suspended on a pendulum. The Vollert patented solution was first implemented in 1993 and has since been successfully deployed in over 100 concrete works.

A further feature is the use of low frequency motors. With a frequency of 4 to 7 Hz the motors are rotating with between 240 and 420 oscillations per minute. In this way the energy is used to best effect.

In SPL a pendulum system which has been developed further is in use. The rigid pendulum suspension normally used is replaced by a cable pendulum developed especially for this area of application. Thus maintenance-free and smooth use is guaranteed. The compacting energy optimised for the corresponding weight of concrete, also allows the use of rigid concrete at SPL.

For the same end product surface quality, a saving of 20 to 30 kg of cement per cubic metre of concrete, can be in comparison with similar lower frequency compaction systems.

Quality control

After the vibration station the freshly concreted items proceed to a circulation station for quality control. The various quality controls are carried out here. These take place with fresh concrete in order to catch production errors before the curing process. Above all components or reinforcements can slip during concreting. Quality control ensures that the products arrive in the curing chamber and later at the construction site, in the best condition. Vollert has developed and made available a range of manual tools to optimise and speed up the quality control process.

Together with SPL the type and number of checks was decided in advance, so that right from the first day these controls could be carried out. The result of the check was transferred directly to a touch panel on the "Quality control" circulation station, thus making paper redundant. The data is stored centrally and is then immediately accessible for quality assurance manager.

The pallet is then transported via the storage and retrieval machine to the curing chamber.

Lifting station and storage area

SPL decided for a transportation system with an inloader for transporting double walls to the construction site. The element ceilings were transported conventionally to the site, i.e. on the back of a truck.

The double walls were lifted with the assistance of a tilting station. The tilting station



Circulation of the movable ladder in the area of the tilting table

had an additional built-in supporting device. It also allows the support of solid walls. A movable ladder ensures safe and ergonomic lifting of the elements when they are tilted.

An overhead crane lifts the concrete items from the pallet. These are then subsequently stored in up to four stations either in transport cradles or lying down.

The transport cradles or element stack are subsequently transported to the storage area with aid of a run-off truck system. Here they are stored temporarily with two gantry cranes.

Vollert developed a crossbeam especially for the transportation of loaded inloader cradles and the element stack, which allows transportation to and storage at the storage area.

Summary

With SPL the CADDAC group expanded its product range from stock items to project-dependent large concrete items such as floor slabs, double walls, core-insulated double walls and solid walls. With the plant in Landaul an open and developable concept has



Finished products

been created. Vollert convinced SPL with the overall planning, both as a machine manufacturer as well as a general contractor. As a company with a lot of know-how in the area of precast concrete technology, Vollert could pass on a considerable amount of experience. This was an important guarantee for the rapid production start-up, together with a high quality of the precast concrete elements.

With Vollert, SPL also has a team in the area of precast concrete element manufacture, who has the competence to help a newly founded company from the start and to enable it to have a successful market launch. Four weeks of knowledge transfer and production monitoring are a short time, but SPL saved about 4 to 5 months, when you compare the project process with other newly founded precast concrete element manufacturers.



Run-off truck system for transport cradles and element stack

FURTHER INFORMATION



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