

Quadra, 74130 Contamine-sur-Arve, France

# A multi-skill partner: commissioning a high-performance block making machine and a fully-automatic precast production line

Since 1954, Celtys, a subsidiary of the Quéguinier Group and based in Brittany, France, has been developing, manufacturing and selling a large range of concrete products designed for the construction and the landscaping industries. With 4 plants in operation, Celtys has been relying on its experience and its standing as one of the leading suppliers in the French market boasting a daily production that exceeds 1,000 tons of products. ISO 9000 certified since 1993, Celtys has been building its growth and reputation on a specific quality approach system in order to provide its customers with products that comply with these standards in terms of reliability, safety and environmental protection aspects. In fact, the company's product range offers numerous advantages in terms of aestheticism, product features and sustainability that enable Celtys to accompany any kind of project – from the simplest to the most advanced.

Celtys pays great attention to the modernization and performance of its manufacturing facilities. In 1998, Celtys solicited for the first time the manufacturer of equipment Quadra for commissioning a complete production line designed for manufacturing blocks with the block-machine type Quadra 6. Ever since, a strong partnership has been developed between these two companies. Featuring 4 block making machines delivered by Quadra, the latest Quadra 6 HP was commissioned in Carhaix that included state-of-the-art manufacturing and handling systems. Convinced in the reliability and the performance of the equipment supplied by Quadra as the french market leader in equipment manufacturing, Celtys has recently contracted Quadra for the replacement of a semi-dry production line designed for the manufacture of railway-related products. Quadra has been developing this new range of equipment resulting in a wide range of products such as concrete manholes and drainage systems.

## Production of blocks, pavers and curbstones: equipment tailored to the manufacturing needs of the client

Celtys provides an extensive range of concrete products such as slabs, curbstones, pavers and blocks certified CE or NF. In order to meet these manufacturing standards ensuring high-quality products,

the company has focused its investment on efficient and flexible equipment capable of ensuring reliable production processes with constant output qualities and versatile manufacturing conditions. The block machine Q6 HP and its additional equipment perfectly satisfy these manufacturing requirements.

## Batching and mixing plant: design and full realization performed by Quadra



*Celtys plant upgrade in Carhaix with latest manufacturing and handling equipment.*



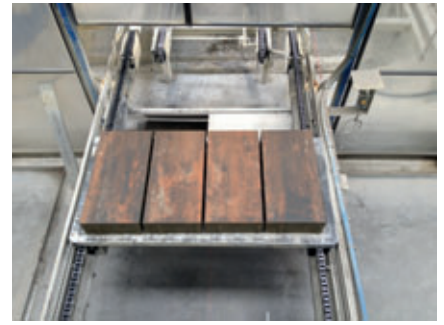
*Operating 4 plants, Celtys ensures a daily output that exceeds 1,000 tons of products.*

The batching and mixing plant was completed Quadra.

This latest generation of plant is equipped with a Kniele KKM1500 conical mixer boasting a 1.5 m<sup>3</sup> capacity for the rapid mix and homogenization of core as well as facing concrete. The mixer provides a quick discharge of material, automatic cleaning, and easy maintenance. In addition to manufacturing a consistent and high-class concrete, the mixer also allows for small batches (about 15% of mixer volume) which are then quickly fed into the color mixing system.

Celtys operates a color blending system supplied by the company KBH, designed for the manufacture of colored concrete. The colormix is directly installed on the top of the face mix hopper. This device allows the configuration of customized colors for pavers and slabs enabling a mix of up to 6 different colors within the hopper.

The batching plant comprises 5 cement silos. The storage hoppers can process up to 8 different aggregates. The concrete freshly manufactured is then transferred to the block machine via a belt conveyor



Color mix product range offered by Celtys.

which is driven by gear motors controlled by frequency converters. This system allows for a uniform mix within the hopper.

The mixing system is computer-controlled that enables to continually follow the mixing process and the choice of desired

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manufacturing recipes. It also provides various information regarding hopper fills and silos and all other elements influencing concrete quality. Finally, the pieces of equipment delivered by Quadra are fully galvanized.

**Block machine type Quadra 6 HP**

As for the rest of the block making machinery delivered by Quadra, the Q6 HP features a streamlined configuration. Mounted on anti-vibration feet, the frame has been designed as a massive, single-piece steel structure well protected from any vibratory energy input. No pit is required for the machine setup. Vibratory transmission to the ground is avoided and the elevated and ventilated design of the system permits easy cleaning and maintenance as the vibrating motors are located on one side of the machine..

Designed to meet versatile and multi-product manufacturing requirements, the block machine Q6 HP provides outstanding production rates as well as high adaptability. The vibrating features are patented and enable the manufacture of products with high precision in terms of density, strength, weight and height within an optimal cycle time. These unique features have quickly convinced Celtys to ensure a perpetuation of its product quality. In terms of product

dimensioning, height was one of the particular features that the new plant had to focus on. The challenge of this newly commissioned machine was to manufacture slabs of the dimensions 50 x 50 x 4 cm providing outstanding quality levels.

The vibrating system included in Quadra's units also ensures a perfect product compaction. The vibration system with "flexible force and speed" enables a more uniform and homogeneous fill across the entire surface of the mold.

The retractable bars (patented system) located over the vibrating table are moved into their lower position during this filling operation, thus resulting in maximum vibrating amplitudes of the mold. This way, the filling operation is perfectly carried out and optimizes product density and consistency. During final vibration, the retractable bars are elevated to a defined height and act as the product bottom reference. As regards product top referencing, this is ensured by means of mechanical stops that secure the tamper head in a well defined and rigid position. Final vibration is completed when the tamper head has reached these mechanical stops. Whatever the height of the products, the tamper head will always stop at the same position, thereby achieving consistent height accuracy.

These unique technical features developed by Quadra offer innovative manufacturing conditions. The synergy between the electronics, mechanics, automation, and system information exchange aims at adjusting, for each cycle, the manufacturing conditions which will be optimal for producing a first-class product. The mechatronics integrated in this machinery permits an all-inclusive automatic control and regulation of each cycle ranging from initial mold filling settings to final vibration times. Therefore, the adjustments for filling the exact concrete quantity into the mold are guaranteed to be carried out automatically from one cycle to the subsequent one within an optimal cycle time.

**Additional equipment designed for high-end finishing**

Celtys managed to penetrate the market on account of product quality and originality in terms of shape, color, texture and facing. To this end, the company has integrated additional equipment that enables it to meet the expectations of the most different markets. Employing a facing concrete mix system, Celtys is capable of manufacturing two-layer products with core concrete and facing concrete. This equipment is fully remote-operated. Its forward movement and clamping toward the block machine is very



*Block machine type Q6HP.*



quick. The unique features offered by this system offer a homogeneous distribution of the facing concrete across the entire product surface to produce a uniform outer appearance.

A washing station has also been commissioned on the fresh product conveyor. This equipment aims at producing a high-end finishing ensuring a great aesthetical appearance. As the production pallet exits the block machine, it undergoes a surface treatment for withdrawing concrete aggregate grain. A trolley is equipped with water high pressure water and air spraying spraying devices moving transversally. The treatment is carried out through water projection along the product and all across the surface of the panels carrying curbstones, slabs or pavers. All settings that may have an impact on the final product makeup (distance, water pressure, speed, number of passages, inclination etc...) are configurable. The device has been designed in such a way that it just consumes a minimum amount of water.



*A washing station has also been commissioned on the fresh product conveyor.*



*The washing station allows for high-class surface treatment.*

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**State-of-the-art handling system**

Quadra manufactures fully automated handling equipment whose movements are programmed with precision in order to ensure continuous productivity.

The finger car completes loading and unloading storage operations. This equipment can handle up to 22 production pallets at the same time. Equipped with WiFi, the finger car communicates with the block machine and stores all the information on the products it is processing (type and number of product, day and time of manufacture etc.). This communication permits calls addressed to the finger car to unload the lowerator when it is full to subsequently transfer the products to the curing chambers.

The curing area boasts a total capacity of 5,280 pallets and is equipped with a ventilated and humidity-controlled system that ensures sound and uniform curing. The position of the finger car is continuously monitored by a laser sensor and driven by servomotors for accurate platform positioning in front of the rails of the curing chamber, elevator and lowerator. The finger car is driven by gear motors with frequency inverter in order to produce an automatic control and regulation of speed such as gradual acceleration and deceleration.

After a curing time of approximately 36 hours, the finger car retrieves the production pallets with cured products and moves them back to the lowerator. The pallets loaded with products are finally transferred to the cubing station via a walking beam conveyor. This type of conveyor lifts and moves the pallets without any friction and without any wear and noise. The plastic production panels (1,400 x 700 x 50 mm) are of the Uniplast Ultra type and were delivered by Wasa.

With 6-axis operation, the cubing robot Kuka KR 1000 can handle a maximum payload of 1,000 kg. The pneumatic clamp is designed and manufactured by Quadra. The settings and recipes are easily changed from the control desk with the operator inputting the number of layers, the number of products per layer, and their positions on the pallet.



*Featuring 6 axes, the cubing robot Kuka KR 1000 can handle 1,000 kg.*

The particularity of this cubing solution provided by Quadra is the commissioning of a conveyor that ensures product selection and grouping. This tile conveyor allows for the sorting of products to adapt the palletizing to the size of the pallet or to the type of the product. In this way, this clamp ensures a 4-side clamping which allows the definition of the exact number of products that the grouping conveyor is to receive first before handling the remaining products on the pallet.

The automatization of the production line also includes a gantry that loads the line with pallets. With a capacity of 80 pallets subdivided into 4 stacks, this gantry moves the clamp moving all along the line's length. The clamp retrieves one pallet stored on the top of the stack to return it to the loading line. The commissioning of this automatic loading device allows for substantial autonomy in terms of time for operators, i. e., between 2h30 and 3h00) during which they are not busy loading the line.

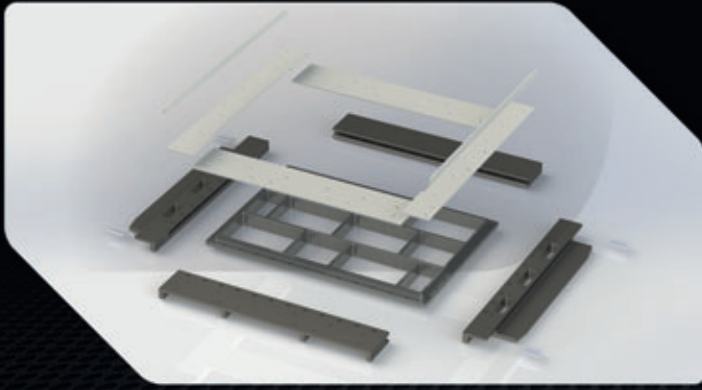


*The finger car can handle up to 22 pallets at the same time.*



*Conveyor ensuring product selection and grouping.*





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*At the heart of the facility is a noise-insulated control cabin located in the middle of the production line.*

Finally, pallets with finished products are transported outside to the storage platform via a trolley carrying 2 finished cubes. The rail-guided trolley places the pallets on the 42 meter dock. This system permits automatic storage of about 30 pallets outside the production hall. Consequently, pallets can be evacuated within 60-90 min without the employment of any forklift transporting

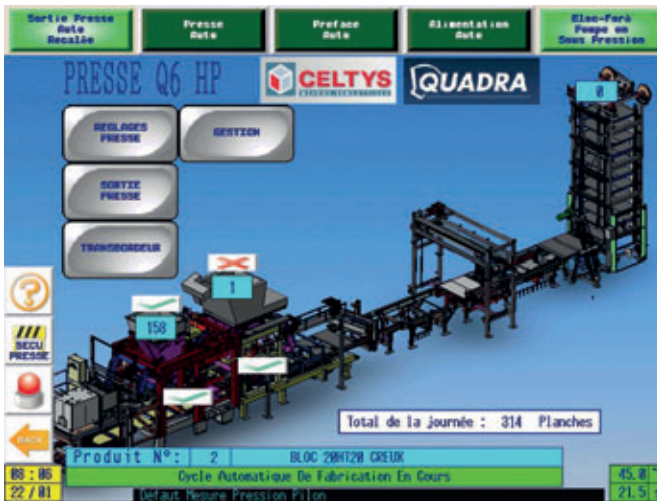
them to the platform. This automatic pre-storage therefore provides organisational flexibility and productivity.

#### **Operator comfort and safety conditions : supervision vs handling**

As part of its approach aiming at top level quality and continuous improvement, Celtys ensures constant plant upgrades for the

preservation of operator health. The company has therefore chosen a fully automatic line featuring the latest technologies in terms of supervision.

At the heart of the facility is a sound proof insulated cabin located at the center of the production line. Its glazed surface enables the operator to control the block machine



A clearly structured, intuitive and user-friendly interface permits easy modification of block machine settings.

while supervising the entire production line from manufacturing to cubing operations.

The line was commissioned with high-end control software (PLC program) designed by Quadra visualizing the entire plant. Operators are capable of monitoring and supervising the whole production cycle quickly and easily. A touchscreen makes it possible to observe and adjust all parameters. A clearly structured, intuitive and user-friendly interface permits easy modification of block machine settings. Reasons for production downtimes are described in detail, and the program structure makes it possible to resume automatic cycles simply and rapidly. Machine settings are stored and recorded by production recipes to easily retrieve manufacturing parameters associated with individual product types.

This control system is also an indispensable tool for managing the overall production process because it indicates operating data in progress (cycle time, filling level, daily production, output rates etc.) as well as other information such as production downtimes and operations per each mold.

This production data is detailed and recorded and may then be analyzed by the manufacturer to continuously optimize production output.

### Fully automatic precast production line

Based on its 60 years experience, Celtys benefits from the faith of leading local partners such as SNCF and RATP. Celtys manufactures a very special range of products specifically designed for rail projects (draining systems, concrete channels etc.) suitable to any kind of public construction.

As part of this activity, Celtys has solicited the manufacturer of equipment Quadra for the replacement of two semi-dry production lines. The aim of this investment was to ensure the full automatization of the process. Supervised by only one operator, this new type of production line achieves higher production outputs than the old one. Designed for manufacturing any kind of rail products such as manholes or gutters, this tailor-made plant enables Celtys to manufacture its entire product range with just one installation.

The line consists of a manufacturing station equipped with an automatic mold filling and finishing unit, demoulding unit, stocking area for pallets and a palletizing robot.

### Filling station: automatic steel frame insertion

The modernization of the line focuses on automatic mold filling. No physical effort is required as the filling of the mold and the finishing of the products are performed by the machine, thus ensuring production quality and cycle time consistency.

The mold is placed on an fully electronically controlled vibrating table. Vibrating frequency and force are automatically adjusted to cycle progression: filling, compaction, or finishing.

This station is equipped with a device ensuring the automatic steel frame insertion into the mold. This automatic handling is completed in hidden time to avoid a prolongation of the cycle time. From a safe workplace, the operator can lower the steel frame into the template while the machine is



Celtys manufactures a range of products specifically designed for rail projects.





Automatic steel reinforcement insertion.

operating in the automatic operation mode. Located before the mold filling station, a gantry equipped with pneumatic clamps retrieves the steel frames that have been manually inserted and moves them toward the mold waiting to be filled. The gantry stops just above the mold and lowers the steel frame into the mold.

The filling operation is carried out as follows. The concrete is stored in a hopper. A belt conveyor is continuously delivering fresh concrete into a feeding box. This feeding box is moving in longitudinal direction over the mold and a rotating arm guides the concrete to drop into the mold. According to the product type, a finishing is then performed by a trowelling disk.

**Product curing**

The demoulding pallets dimensioned 5,450 x 1,250 x 220 mm provide a molding surface of 5,250 x 1,150 mm and a maximum height of 130 mm.



The curing area may receive up to 210 demoulding pallets dimensioned 5,450 x 1,250 x 220 mm.



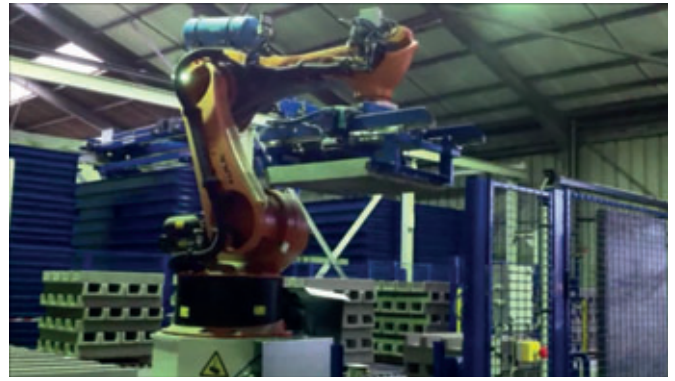
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The palletizing station is equipped with a Kuka PA 700 robot.

Following the finishing operation, a crane featuring a tilting device sets an empty pallet onto the mold. Mold and pallet are now clamped by the crane, raised and tilt by 180° in the demolding station. The pallet is released and the mold slowly elevates to demold the product. The mold is then again tilt by 180° and returned to its home position to commence the next cycle. The pallet with fresh products is now taken up by a storage crane to be stacked. The storage area may receive up to 210 demoulding pallets. The storage crane finally transports the pallet loaded with the products designated for the drying area to the palletizing station.

#### Robotic palletizing

A Kuka PA 700 robot cubing has been included in the palletizing station. Equipped with 4 axes, it can load 700 kg. This robot ensures the performance of 3 activities: product handling and its positioning on the pallet, empty pallet handling on the conveyor, and the positioning of spacers between every layer of product. This robot is equipped with 2-side pneumatic clamps.

The commissioning of this robotic solution aims at completing a uni-product cubing from multi-products panels. The panels may indeed receive up to 3 different products for each manufacturing cycle.

The robot automatically sorts the products and, depending on product type, places them on one of the three conveyors.

#### Conclusion: Quadra offers overall control solutions for the concrete industry

For Quadra, Celtys is a reference partner. The commissioning of these 2 plants has once again demonstrated both the technical skills of Quadra and the company's expertise in developing manufacturing processes tailored to the needs and require-

ments of its clients. Whatever the type of product to be manufactured (characteristics, execution, and finishing), Quadra is capable of designing comprehensive, consistent and sustainable manufacturing solutions.

Celtys as a manufacturer is absolutely satisfied these both upgrades. The commissioning of the block machine enables it to manufacture pavers and slabs boasting top quality features that are widely recognized in France. This state-of-the-art plant achieves outstanding production outputs in a safe and ergonomic operational environment.

As far as the semi-dry production line goes, this represents a first collaboration for this kind. The efficiency of the new process (full automatization and high output rates), the associated flexibility and the quality of the finished products have proven to be a great success.

Now specialized in this type of customized machinery, Quadra is able to offering its cooperation pertaining to any kind of pre-cast project in Europe and all over the world. Quadra takes on the challenge of creating technical solutions within existing plant. Production lines are completely customizable and can be upgraded from manual to fully automatic operation modes. According to customer requirements, Quadra is able to propose the most appropriate solution in terms of product quality and outer appearance, productivity, automation level, and working conditions.

#### FURTHER INFORMATION



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