

Tudorstone Building Materials Ltd, Retford, DN22 8RB (Road Map), Nottinghamshire, UK

## Modern concrete block making equipment for Tudorstone, UK

One of the leading UK manufacturers for concrete products, Tudorstone, required a replacement machine to be built within the existing factory dimensions, and to produce high dimensional accuracy concrete bricks and parent blocks, which are split, pitched and aged in a secondary process, to be sold as walling blocks. Although the UK construction industry is going down recently, the new Tudorstone Retford plant is still running at high capacity. One of the main aspects for this is their advantage of having modern concrete block making equipment that enables them to produce at lowest cost highest quality products.

### Tudorstone Building Materials Limited - Background, History and Project details

Tudorstone Building Materials Limited was established in 1998 by Co-Owners Roy Howe and Bill Howe, and manufacture Reconstituted Concrete Split Walling stone, Architectural Cast Stone and Concrete Bricks. Prior to the recent capital investment programme the factory at Retford in Nottinghamshire had the capacity to produce 200,000m<sup>2</sup> of Reconstituted Walling Stone, 10,000,000 Concrete Bricks and 1,000m<sup>3</sup> of Cast Stone per annum.

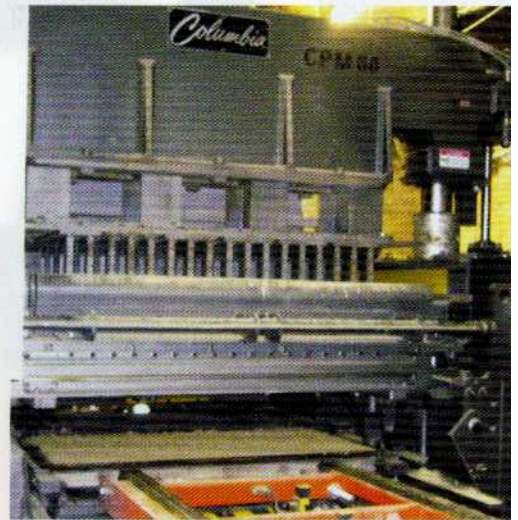
During 2006 a fully automated splitting, pitching, rumbering and packaging system had been installed to automate the secondary processing of the walling stone parent units. Prior to the project the walling stone operation employed 12 men, however, this is now reduced to 5 men. Two men are employed on the brick production and two men on the Cast Stone plant.

During 2007 the decision was made to install a new block plant with a number of specific objectives for the project:

- Increased output of Concrete Commons to give capacity of 20,000,000 pa
- Capacity to produce very dense and dimensionally accurate standard sized parent walling stone blocks to enable the production of an additional 200,000 m<sup>2</sup> of walling stone
- 8 hour turn around of product by curing in a temperature and humidity controlled environment
- A minimum 5% reductions in cementitious content of the concrete mix
- Production of voided packs of bricks to remove the need for pallets
- Maximum of two man operation
- Quick mould change over time to minimise downtime

The new plant was replacing a 28 year old block machine and automated handling system. The plan was to build up stocks of bricks during January and February 2008 before demolishing the existing buildings, scrapping the old plant, preparing the civils and foundations for the new buildings and equipment. Erection of new buildings was scheduled prior to the arrival of the block machine, racking and handling system in April. Production ceased on the 7th March and the press arrived on the 28th April. The new plant was commissioned and signed off on the 26th June 2008. Total project time was 16 weeks, with the curing racks taking three weeks, the Columbia press three weeks and the handling and packaging system 8 weeks.

The curing hall is 30m x 10.5m x 6.5m high. The hall is surrounded by existing buildings on two sides and the new production buildings on the other two sides. To save costs the Aluminium Racking was designed to carry insulated roof panels and side



Front- and back view of the CPM 60 block making machine from Columbia

sheeting so that no additional building structure would be required. To save space the racks are accessed by a 180 degree rotating finger car.

The main production hall is 17m x 31m x 7.5m high (max). This space comprises the existing mixing and batching plant, (the mixer is situated directly above the new press), the press room, wet line, dry line, depalletiser grab, pallet storage area, pallet return conveyor, walking beam sorting table, pack building grab and roller out



Positioning of the steel pallets with magnets for the block machine



Quality control on the wet side



After collecting the pallets on the wet side, they are put into the curing racks by the finger car

feed conveyor with automated strapping and wrapping system. The elevator and lowerator are located within the curing hall plenum chamber. The main plant building is open plan.

Adjacent to the curing Hall is the Curing system boiler room and diesel storage building, along with a mould store for the Columbia moulds.

Cycle times are dependant on the product being manufactured, however the system has been set up to achieve an 8 second cycle on the Columbia, and they are able to achieve this on the 65mm wall stone parents units. The limiting factor at this time is concrete production capacity which will be upgraded during 2010 by the installation of a larger capacity mixer.

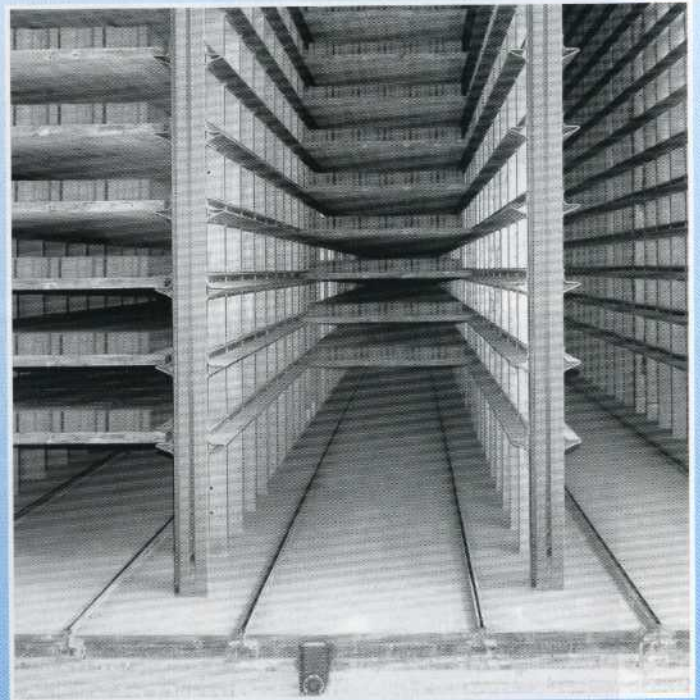
With the existing batch plant and the Haarup mixer, with 2 output doors, Tudorstone blend 2 colours on top of one another, so that when the parent block is split, the layers of concrete create the strata effect of natural stone. New conveyors were constructed to allow the 2 concrete colours to be layered onto the infeed belt to the machine hopper.

Penta Automazioni Industriali from Bologna, Italy was asked to act as a main supplier, and purchaser of the majority of the equipment, and to supervise the plant installation. Thus, the complete handling factory layout was designed, built and installed by Penta Automazioni Industriali srl.



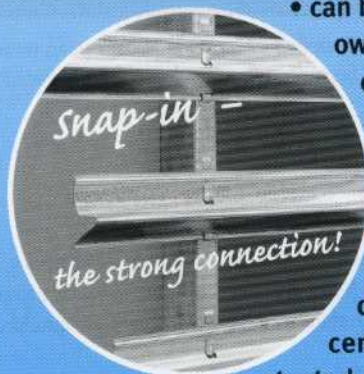
## Curing / drying chambers

Safe in storage, rugged in use, flexible design



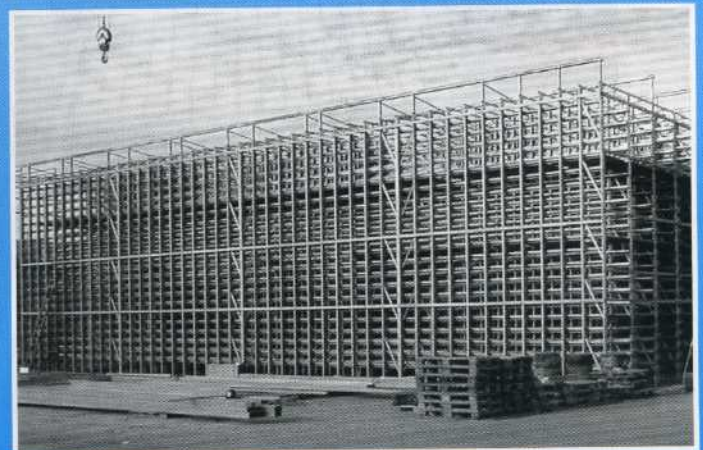
Here are the facts - the HS modular system

- can be assembled easily by the owner because of its simple design
- does not need additional stabilising supports
- has a long service life because it is special galvanised
- has an HS support profile with continuous pallet feed and centring system
- has a TÜV-tested snap-in connection for any application.



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The CDS Envirocure System installed at Tudorstone uses independent control of temperature and humidity allowing the ideal conditions for the process to be set

### Block production process

The block machine was purchased from Columbia Machinery Inc, after visiting their booth at Bauma 2007. The decision was made to purchase the CPM 60 machine, including 11 sets of moulds, to



Transport system on the dry side



Cuber offloading the dry side

make the correct sizes for splitting 10 different sized walling blocks, and 1 brick mould.

Columbia Machine demonstrated that their CPM 60 concrete products machine could deliver high volume product with very fast cycle times, and with the most dimensional accuracy in the industry. The Columbia CPM range offers the quality producers are striving for through robust engineering that is built to stand the test of time. Unique to the CPM line is the direct-to-mold, true vertical shaker shaft vibration, which ensures that the vibration goes exactly to where it's needed: into the mix in the mold itself.

2700 steel production boards were purchased from Clarkes of Stillington Plate & Profiles Ltd, size 1400 x 700 x 15mm. Steel production pallets were chosen over plastic or wood for their longevity and at the preference of Columbia. When combined with the largest format product each full pallet weighs 365kgs.

Clarkes of Stillington Plate & Profiles Ltd have been supplying production pallets to the concrete block making industry for over 20 years. Their "in house" production facility allows pallets to be either precision guillotined or profiled to size, with chamfered or rounded corners. All pallets are supplied dress ground and precision levelled to a flatness tolerance of within 1.5mm in any direction. They only use material supplied from a Reversing Mill (not Coil Mill), this ensures all pallets remain flat throughout their working lives.

Clarkes can tailor parent plates, minimising scrap content, to give them the ability to offer extremely high quality pallets at a competitive price, for any size or gauge, from 6mm to 25mm thick. Clarkes and Penta Automazioni have worked closely together to service Tudorstone with high quality competitively priced pallets, delivered on time.

The block machine pushes the board off the production table and with an electrical handshake, passes the fresh concrete blocks on the steel board to the Penta handling system. The out feed conveyor moves the pallet under a brush to clean off any concrete flashing from the blocks or bricks, and places the pallets, 2 at a time, onto the elevator with 16 levels.

### Curing process

The racking size, and therefore the number of boards, was dictated by the space available. Knowing the cycle time of the machine,

and the market requirements, led naturally to considering a sealed environment for curing the concrete, to allow for the accelerated curing conditions. The big box design keeps the climatic conditions correct for the concrete, so the elevator, finger car, transfer car and lowerator are installed within the big box, so that the only openings are 2 letter box style gaps as the single level production boards enter and leave the curing zone.

The transfer car moves the finger car out of the elevator, rotates it by 180°, and transfers it to the chamber selected, where the finger car places the 32 pallets into the curing racks. Information is sent to the car by wireless technology.

HS Anlagentechnik from Germany and CDS, UK, work together in the UK in projects such as this, and the two companies delivered the curing chambers and the climate control equipment

**Aluminium rack system**

HS Anlagentechnik supplied Tudorstone with their innovative rack system, completely made of Aluminium. Aluminium is a durable lightweight material that can be used very advantageous for various applications. For the curing racks HS delivered to Tudorstone, a special aluminium alloy was used to be extremely robust, additionally to the build in corrosion resistancy of aluminium, of course. The snap-in-connection from HS facilitates the stiffness needed for the



Magnetic board turner and stacking device



▲ ALICANTE



▲ ROLL STONE



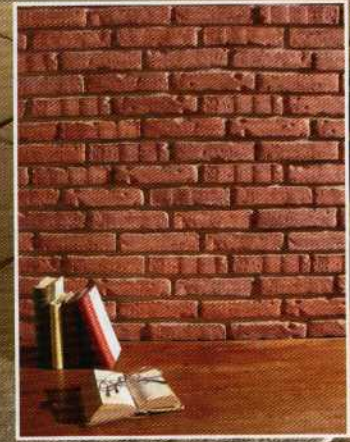
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Waste products scraper

curing racks within fastest erection times, guaranteeing stability, parallelism and a very high load bearing capacity at the same time. The racking HS installed at Tudorstone is 16 racks high, 10 pallets deep, with 17 chambers, so they have a total of 2720 storage places.

#### Envirocure system

The CDS Envirocure System installed at Tudorstone uses independent control of temperature and humidity allowing the ideal conditions for the process to be set. A major advantage of the CDS System is that it does not use steam to generate either the heat or humidity. CDS uses separate heat generation and humidification to create the desired conditions.

The whole concept of installing the CDS Envirocure System at Tudorstone was to reduce manufacturing costs - lower cement content and give cement substitution opportunities, reduce the amount of energy consumed and to reduce the amount of maintenance.

What the CDS system does is effectively ensure that the temperature is optimum. All the heat of hydration is used and there is little heat loss (well insulated structure) and little air (a balanced airflow) lost from the system. The air circulation ensures very even and constant conditions at all places in the chamber - top to bottom - front to back within 1 Deg C and with a controlled constant humidity condition of 90 - 95 % RH

Humidity is monitored continuously and is maintained at a very high level, but just below the dew point - i.e. a non condensing atmosphere. All of which is a massive advantage for any mechanical handling equipment that operates within the kiln.

After the curing cycle is finished the products leave the kiln in a very consistent, high strength condition.

With the CDS System the product is very hard and non friable because of the lack of evaporation from the surface in the high humidity atmosphere however.

Other advantages of the CDS System at Tudorstone can be given as follows:

- As the system is constantly monitoring the temperatures within the kiln, heat of hydration is also taken into consideration thus maximising the efficiencies.

- During the warmer months there may be a situation where the heat source on the CDS System will actually de-energize as the temperatures are satisfied by the conditions and the heat of hydration.
- Humidity would only be injected when required i.e. when the humidity level falls below the desired setpoint of around 95%.
- The fully self contained recirculation system also ensures that the product is maintained at the same conditions throughout the kiln.
- Because the atmosphere is non condensing, plant corrosion and maintenance is kept to an absolute minimum.
- The system will just require routine maintenance and a 12 Monthly service, no special requirements as far as testing goes. Maintenance is simple.
- The system does not require any specialist water treatment, just as long as it is a clean water supply. The CDS System takes care of filtration and cleaning at very low operational cost.

#### Handling and Packaging

Penta Automazioni organized the complete circuit to handle the production steel boards inside the factory, before and after curing, as well. When leaving the curing area, an electrically driven gripper with air clamps removes the products from the board, and moves a short distance to a table, which has a pusher bar, that moves the blocks sideways to make up the correct number of rows for the brick packs; the machine produces 3 rows of bricks, the brick pack requires 4 rows. After the 4 rows are grouped together, the table separates from another table where the bricks are accumulated and then split by a walking beam conveyor from under the table. This beam brings 13 rows of bricks forward for the cubing gripper, and also creates the void hole for the brick packs. The majority of the cubing equipment is designed and built using brushless motors, to give high speed, flexible and accurate positioning, and a maintenance free life in a harsh industrial environment. In the UK it is uncommon to handle bricks on reusable pallets or with hydraulic clamps. They are nearly always handled by forklift truck whether in the factory, in warehouses or on site. For this purpose the concrete brick packs need "voids" to accommodate the fork tines. Therefore this plant was designed to build void brick packs, but solid packs for Tudorstone to store, and then transport to another part of the factory for the secondary processing. Both types



Cubing of dry products

# CONCRETE PLANT SOLUTIONS

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*Cyklop strapping equipment*

of packs are built on an out-feed conveyor, the packs are transported along the line through the various packaging machines, and then the packs are bough together for 2 packs to be removed. At full capacity one pack of bricks containing 456 units is produced every 1.8 minutes. A twin pack 8tonne Linde grab truck is used to keep the plant working at full output.

Tudorstone specified and purchased a vertical strapper; a horizontal strapper and a stretch wrap machine from Cyklop, as they have had good experience with them over many years. The packs first pass through a fully automated Cyklop XPV111-MVB vertical strapping machine which applies 15.5mm wide polyester strap around the packs, and from there through an XF172-M horizontal strapper where 12mm wide polyester strap is applied to maximise load retention. The strapped loads are then fed into a Cyklop GL2000 automatic pallet stretch wrapper - the first installation for this industry in the UK. This is an orbital wrapper, designed specifically for high throughput applications of up to 120 loads per hour, involving heavy, fragile or potentially unstable product.

Once the blocks are removed from the board, the board is moved on to an area where it is scraped clean of any built up concrete, brushed, and then turned by 90° by magnets, and stacked 10 high. The pack of boards is then lifted by a specially designed board gripper; where they either moved onto the conveyor to feed back into the block machine, or stored in a buffer for 900 boards. The gripper crisscross's each layer so that each pack is stored directly on top of the pack below.

The large buffer was designed for 2 reasons: The dry line can continue to empty the curing chamber when a mould is being changed, or the machine is being cleaned and also Tudorstone has one very high product that has to be produced occasionally, so the elevator fills every other level for this product, therefore half the boards need to be removed from the curing chamber.

To complete the boards cycle around the complete plant, a conveyor moves the production board pack to behind the Columbia in-feed conveyor, where an electrically driven arm moves 4 electromagnets to collect 1 board, and place it onto the infeed conveyor, when the block machine asks for the next board by a handshake switch.



Contact us today and learn more about Columbia Machine's complete concrete plant solutions for your company.

*Columbia*

FURTHER INFORMATION



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Packs ready for removal

All the equipment is guarded with fences as required by EC regulations, gates are installed with electric switches to close down any piece of equipment within a zone if a door is opened, until the controls are re-set. The safety system was designed using the SIEMENS Technology SIMATIC Safety Integrated. This system has an increased flexibility for managing the safety, and it also allows Penta to carry out a thorough diagnosis, in the event that any anomaly occurs in the safety system, or to search for any faults.

The plant has two dedicated operatives. One man oversees the press and handling system and the other operates the forklift truck and overseas the packaging equipment. The whole factory, (including one rotary tamping press, the automate splitting

plant and the Cast stone plant), is managed by one production supervisor and one plant fitter, with additional electrical and technical support from an external contractor. The new plant plc is hard wired into the companies broadband server thus allowing remote access for the Penta technicians to trouble shoot and make any programme amendments.

Tudorstone were handed the keys to the machine after commissioning and training, they are extremely satisfied with the production quality from the Columbia, and also the simple and logical controls of the Penta machine. All the pre planning and meetings before any plant was delivered made for a very effecient installation, 1 week quicker than planned.



Final product