Tudorstone's successful split-slab paving installation

Tudorstone Building Materials Ltd was formed in 1998, when the company took over the Ranskill Works (at Lound near Retford) from Tarmac Topblock. At that time, the works was using a Henke press to manufacture common bricks.

Tudorstone still makes concrete bricks but, within months of acquiring the brick plant, the addition of a Rino four-station slab press enabled the company to move into the production of concrete paving slabs. This machine has since been supplemented by a stone splitter, rumbler, dressing machine, pallet stacker and associated conveying equipment, to permit the manufacture of a full range of split slab walling products.

This installation, which will be featured in this article, now enables Tudorstone to maintain a 21-hr per day production programme on a 5½ day working week for the manufacture of high-quality walling products to meet growing demand from both the domestic and commercial markets. Slab production from this installation now represents about 75% of Tudorstone's total production.

The aggregates used comprise sand, crushed limestone and crushed concrete waste. These materials are delivered to the site by tipping road vehicles, and are discharged either directly into a receiving hopper for immediate use, or into a ground storage bay for future use. When the ground-stored material is required for production, it is collected by a front-loading shovel and fed into the batching system ready for use.

The ground-stored materials usually have high moisture content when they are of a fine particle size. However, when weather conditions are good and their water content is low, fine materials that could cause a nuisance to neighbours by wind transmission are damped down by means of water sprays.

The powders used in production are Ordinary Portland cement (OPC), ground granulated blast-furnace slag (GGBS), and oxide-based pigments.

The OPC and GGBS arrive by bulk tanker and is discharged directly to one of two storage silos. Each silo is fitted with a filter to discharge excess air from the charging process to atmosphere without the passing of cement particles, and each is fitted with a high level alarm system to give warning of the approach of a full condition.

These silos are inspected on a regular basis, as are the relief hatch and warning devices.

The pigments, from Hawley, arrive in 750kg bulk bags or in 25kg paper sacks. When tneeded for production, the bulk bags are loaded onto an automatic dispensing system. The pigment supplied in 25kg bags, and which represents about 15% of usage, is manually tipped into a hopper which holds ten bags of material. This pigment is batch-weighed and delivered to the aggregate weigh conveyor like the bulk material.

Aggregates from the storage silos are fed onto a weighing belt, which receives pigment from the dispenser, and then discharges the material into a skip, which transports the material to a point close to the mixer, ready to feed in its contents.

Cement and GGBS are transported by an enclosed screw-type conveyor to a cement weighing hopper above the mixer. The metered proportions of cement and GGBS are then discharged into the mixer for blending with the aggregates.

Transportation of the cement and GGBS from the weigh hoppers to the mixer is by a dust-proof flexible tube.

After a short period of dry mixing time, water is added to the mix along with a small quantity of accelerator. As the mixing process continues, further water is added until the mix reaches the required moisture content, as measured by sensors in the floor of the mixer pan.

The final moisture content of a mix is between 8% and 12% depending on the product that is being made. The mixer is enclosed by doors to prevent dust emissions.

The mixed concrete batch is then discharged into one of two storage bins, which are situated below the machine, ready for delivery to the Henke and Rino production machines.

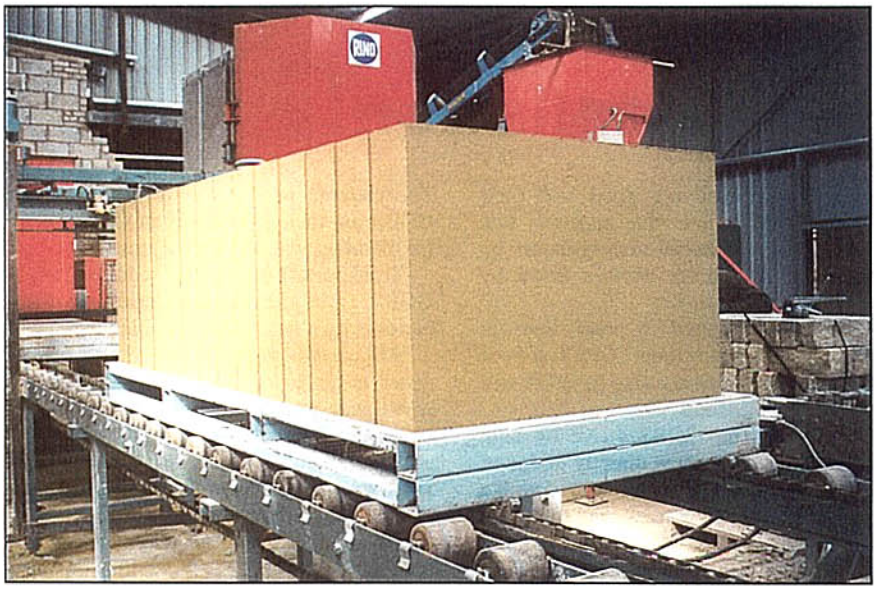
For brick production, the mix in the Henke holding hopper is gravity fed into the feed box which shuttles backwards and forwards over the brick mould, to feed in the concrete assisted by a combination of gravity and vibration.

When the mould is full, the semi-wet concrete is compacted by vibration and compression, and the product is discharged onto a wooden pallet and transported through the handling system into the curing chamber, which is contained within the production building.

The large curing chamber within the main production building is sealed and isolated to contain the heat and moisture generated.

The curing process takes about 24

The Rino four-station slab-press at Tudorstone's Ranskill works.



The 600mm x 900mm concrete slabs are produced in one of five standard colours.

Pallet-loads of slabs are collected by fork-lift for transfer to the curing chambers.

One of the five curing chambers which are adjacent to the press shed.

hours, at which point the bricks are hard enough to handle.

The curing hall is fully automated, and there is no access other than for maintenance purposes.

On completion of curing, the bricks are transported through an automatic packaging system, where they are cubed, banded and then shrink-wrapped, forming them into finished product packs, which are then transported out into the stocking area.

The production of concrete wallstone is a two- or three-stage process. Firstly 600mm x 900mm concrete slabs are produced in one of five standard colours. These slabs are then cured before being automatically split into the required product size. They are then packed as split stone, or undergo secondary processes to produce dressed or rumbled stone.

The concrete from the holding hopper below the mixer is transferred to the Rino Press feed hopper via two inclined conveyor belts.

The mix is then discharged into a mould box on the press table, which rotates round to the tamping position where the concrete is compacted into the mould by a hammering action.

The Rino press is a four-hammer tamping press capable of producing slabs up to 600mm x 900mm and in thicknesses from 65mm to 215mm. Production from this machine is 200 slabs an hour.

The tamping head is fully enclosed for noise and dust suppression, the dust being collected via an extraction unit. The mould then rotates to the discharge position where the slab is ejected from the mould and positioned on a steel pallet.

When the steel pallet is full, it is removed by a fork-lift, and transferred to one of five curing chambers, located adjacent to the press shed.

Once fully loaded, each chamber door is closed and the slabs cure overnight. The following day the chambers are emptied, and the pallets are stored outside prior to being taken to the splitting machine.

Slabs are removed from the curing

chambers by fork-lift and loaded whilst still on the storage pallets onto a chain conveyor that feeds the block splitting machine. The loaded pallets are indexed forward to the splitting machine by a chain conveyor, and up to this point the whole production operation is under one-man control.

The edge-stacked cured slabs are picked off the storage pallets at the splitting machine and loaded by powered rollers onto a turn-table unit feeding the automatic splitting machine.

This machine is fitted with an additional cropper unit for cross cuts, so that combinations of split stone lengths of 225, 300, 375 and 450mm from the full slab can be achieved in one pass. Without using the cross-cut feature, lintels 900mm long can be produced..

Meanwhile, the empty steel pallets are collected together on an adjacent stacker magazine which will hold up to ten pallets at a time.

Pallets are collected from this magazine and returned back to the tamping press to continue production.

If the product is required as split stone, it is then packed by hand into cubes, which are strapped and shrink-wrapped ready to be taken to stock. Otherwise, it passes through further finishing processes.

It can be fed onto an in-feed conveyor which passes through a brick/block rumbler, which outputs an out-feed conveyor where the product is cubed, banded and shrink-wrapped ready for taking to the stock yard.

Product intended to be dressed stone is put onto wooden pallets after splitting, and taken by forklift truck to a holding area outside the dressing shed.

When required, the pallets are moved into the shed where each piece of stone is passed through a flail dressing machine before being cubed, strapped and shrink-wrapped ready for transfer to the stocking area.

The equipment is provided with compound guards to EN294 and EN349, and complies with current health and safety act requirements.

The complete process is under PLC control for fully-automatic and manual running of the splitting and rumbling system, and is provided with safety-interlock switches, plant-condition indicators and associated wiring, etc.

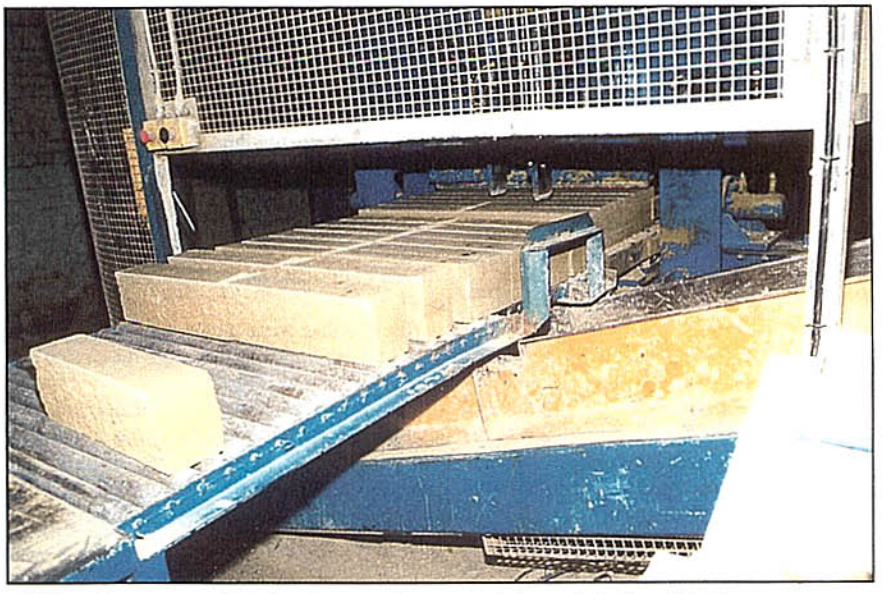
Bricks and walling stone finished packs are transferred to designated areas of the stock yard by fork-lift. The same machine is used to load delivery vehicles.

Process and equipment details

The chain feed conveyor to the splitting machine is six metres long by approximately one metre in width. This is fitted with heavy duty deep link roller conveyor chains to support and transport the loaded pallets towards a tippler head.

Each chain is driven by a pair of chain wheels on a common shaft supported on

At this turn-table, slabs are edge-stacked for feeding short- or long-face to the splitter.



This split stone can be taken into stock or passed through further finishing processes.

Empty steel pallets collected on the pallet stacker, which will hold ten pallets.

Split stone is packed by hand into cubes, strapped, and then shrink-wrapped.

bearings and driven by a sprag clutch powered by an hydraulic cylinder. Mounted over the end of the chain conveyor is an hydraulic tippler head with two clamp arms that tipple the edge-stacked slabs singly.

Indexing of the slat bed together with clamping and tippling of the slabs is controlled by an individual hydraulic power pack incorporating four control valves. From the tippler head, slabs are fed by powered roller-conveyor to a turntable unit, mounted directly under the block pusher, which is also equipped with hydraulically-powered rollers.

This unit can be selected to rotate the slabs so that they can be fed into the splitter with short (600mm) or long (900mm) face first.

A block pusher fitted with a chain driven crank mechanism feeds slabs directly into the block splitting machine, the pusher blade being carriage-mounted with four flanged wheels per side running on a frame incorporating wear strips.

Provision is made for chain tensioning throughout and the associated geared brake motor is provided with a safety clutch fitted into the final drive.

The splitter machine is a Haith AutoSplit 36 unit with a twin-cylinder system fitted to the main blade. A baby cropper unit is fitted to the front of the splitting frame, which houses a pair of cross-cut units adjustable between each other and the whole housing. This combination provides maximum versatility for variation of split-stone output.

Once empty, the pallets are automatically stacked on the hydraulic pallet stacker. This can accommodate up to ten empty pallets and comprises both inner and outer frames, with the inner lifting frame mounted on guide wheels running inside the main outer frame.

Empty pallets are lifted and placed accurately onto a set of support feet with a stop-bar mechanism provided to limit the stack to a maximum of ten pallets. Once this figure is reached, the pallets are then returned to the press to accommodate the continuing slab production.

The Haith stone splitting machine is a development of the earlier AutoSplit 24 unit, designed for the fully-automatic production of split-stone walling products. It incorporates multi-chisel floating blades fitted into both top and bottom splitting heads, and provides a 40-tonne splitting force.

Fixed side blades are provided in adjustable side-cutter cylinders, which will accommodate slab sizes from 450mm to 900mm.

Replaceable wear plates are fitted into the bed of the cutting table for maximum operating life and efficiency.

This table is hinged at the rear of the machine and supported on springs with lifting cams and rollers to lift the table above the bottom blade when the block is being indexed forward, so avoiding blade wear.

The baby cropper unit and control system fitted to this machine has a 75mm off-centre adjustment to split 600mm stone in half or at 225mm and 375mm dimensions. With the 900mm wide slab, it will produce lengths of 225, 350, 375 and 450mm.

The 600mm-wide in-feed conveyor from the stone splitter to the rumbler is totally enclosed and fitted with 102mm diameter rollers on a 300mm pitch on the carrying side, with the head pulley having adjustment for one-side tracking. The tail pulley has provision for belt tensioning on both.

The brick rumbler is designed to handle split stone, and comprises a steel barrel where the inside shell is fitted with steel-backed wear-resistant rubber linings at intervals throughout both the diameter and the length of the barrel.

The barrel is supported on eight nylon-tyred wheels and support bearings. Drive is from a geared motor through chain and sprocket, and the barrel is kept in position by adjustable guide wheels fitted to both ends of the barrel.

The main frame of the rumbler is manufactured from pressed steel, and a steel guard is fitted over the barrel, which also doubles as a dust cover.

The under-side of the machine is fitted with mesh guards to prevent inadvertent or unauthorised access to the area. The machine is also fitted with adjustable legs at one end, to permit a variable operating angle of the barrel which determines the throughput rate of material and also the amount of rounding-off of the split stone that takes place during the operation.

In-feed and out-feed chutes are fitted at each end, and these are equipped with replaceable steel liner plates.

Heavy gauge tipping waste skips have also been provided to handle the debris from the rumbler, and these are emptied using forklifts.

The out-feed conveyor from the rumbler is 600mm wide and 6 metres long. Once again, this is fully-enclosed to minimise environmental dust and is fitted with a rubber belt running on 102mm diameter rollers at 0.6 metre pitch.

Both head-pulley and tail-pulley adjustment is provided, together with conveyor side skirtings and a bottom-end feed hopper.

Product from the rumbler is either packed down as finished rumbled stone, or subjected to further processing on the dressing machine.

Mr William Howe, Co-Director of the Tudorstone Company says, 'We worked very closely with Haith Industrial Ltd over the design and layout of our splitting-plant to reduce slab handling and minimise the labour content of the operation.

"This is now a very cost-efficient and fully-automatic production process, and all the equipment has performed well up to our expectations."

Acknowledgements
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