

# Carving a REPUTATION

**Macarten McGroder visits McKeon Stone at Threecastles, Co. Kilkenny to see their impressive limestone quarrying operation.**

**J**immy McKeon from Stradbally, County Laois, a master craftsman and a skilled expert in stone carving, started his own business in Stradbally in 1950. Since then, McKeon Stone has been extracting large premium blocks of stone, using world-class technology, from their 20-acre site

## Built stone

The special features and versatility of natural blue limestone offer architects, builders and sculptors countless design options. McKeon Stone is the last remaining Irish-owned and managed dimensional limestone quarry in Ireland and at their stone factory in Stradbally they cut and craft the stone to each customer's unique design.

## Overburden and unsuitable rock

The first step in the quarrying process is to gain access to the limestone deposit suitable for use as dimensional stone. This is achieved by removing the shallow clay overburden and the layer of rock unsuitable for cutting.

The unsuitable rock is drilled by Kehoe Drilling & Blasting Limited from County Tipperary with the drill holes set out after consultation between McKeon management, Rob Kehoe and the explosives company. The 105 mm diameter holes are set out in a 3m burden X 3m spacing pattern. Blasting operations are carried out by Exsol. Kehoe Drilling & Blasting also drills the 76mm production holes for the wire saws which cut the face of the quarry to produce blocks of limestone weighing up to 1000 tonnes.

## Crushing operation

Hilltop Quarries Ltd, which is owned by David Condell, has a commercial arrangement with Kilkenny Block Company and they produce a range of chippings and dust for their plants. The raw material includes the rock unsuitable for production as dimensional stone and the offcuts from the cutting processes. The Lokotrack LT120 primary jaw crusher, with its apron feeder, is fed by a Caterpillar 336F excavator and is used as a stand-alone unit in reducing the rock in preparation for the secondary crushing process. This

crushed rock is transported to the secondary plant using Cat 972M and a Volvo L180 loaders which also load trucks and stockpiles. The Lokotrack LT300HP secondary cone crusher, which has a belt feeder, is robustly constructed and can deal with the abrasive rock. The crusher cavity can be selected according to the specific application requirements to achieve high capacity, top end product quality as well as low wear part costs. The optimized power transmission system makes it extremely cost effective and using a cone crusher produces less dust and more aggregate product than an impact crusher.

## Screening

The Terex Finlay 684 screener is a compact, easily transportable triple-deck screen. The screen box features three 4.3m x 1.7m inclined screens giving a large screening area of 236 ft<sup>2</sup> to provide efficient screening and high capacity. The screen box features quick wedge tensioning, access holes and bottom deck hydraulic tensioning system to reduce time required for mesh changes. All four discharge conveyors are adjustable and

Managing Director of McKeon Stone Niall Kavanagh stands in front of the quarry in Threecastles



Cat and Volvo loaders work side by side

McKeon's Hitachi Zaxis 670 excavator sorting blocks of stone on the quarry floor



hydraulically fold for transport. The oversize product conveyor has variable tilt and side slew to accurately discharge material for recirculation and stockpiling.

The smaller size separation happens in a Lokotrack ST 2.8 screening unit which has the biggest eccentric throw on the market and can be fine-tuned to make it the best unit for screening finer products and dust applications.

Hilltop Quarries also have a Cat 345 with a rock breaker and a Komatsu PC600LC on site.

## Dimensional Stone

Irish Blue Limestone is a completely natural material and every single piece is unique and carries the marks of its geological history. Fossils are a characteristic feature and their distribution can give rise to subtle variations in the colour which is part of the attraction when used in a project.

The production processes are limited to cutting, shaping or applying surface dressings. The manufacturing process is controlled to ensure that nothing is done to the stone that will change its physical characteristics or cause deterioration over time.

## Extraction Process

After the limestone face is exposed, the stone is removed from the quarry in benches. Benches typically have a height of 11 meters. In mining





*“When James McKeon first took this limestone to the continent in the 1980s, it was not even always acknowledged as coming from Ireland, but it is now sought after, often being specifically included in specifications”*



Harry Lawlor operating one of the saws in the processing yard at Threecastles quarry

**Vertical cuts**

Two Benettis saws work on the quarry faces, each taking 27 hours to pull 50m of diamond wire through 110m<sup>2</sup> of limestone 11m high, slicing up to 1,000 tonnes of stone from the face at a time, to leave towering sheer rock faces in the quarry.

A length of string is dropped down two of the drilled holes and fished out at the bottom using an iron rod hooked at the end.

The ends of the string are tied and used to pass the diamond wire through the holes to form a continuous loop, which is placed over the flywheel of the saw. As the flywheel rotates driving the diamond wire through the stone, the saw moves backwards along a track in order to maintain tension on the wire.

The diamond wire is composed of a steel wire, along which there are pearls in the shape of impregnated synthetic diamond cylinders.

With its fast action of clean cut, the diamond wire has proven to be an efficient system of non-destructive extraction. Niall Kavanagh, who is the Managing Director, says that the success of the art depends largely upon taking advantage of joints and cleavage planes in the rock. When operating the diamond wire saw, a continuous

dimension stone, it is necessary to split or cut the stone into successively smaller pieces until the final desired block size is achieved, and saleable blocks are produced.

McKeon’s operations typically include drilling vertical holes approximately 2.7 meters from the face and close to the natural bedding plane.

Two Fantini 70 Super-H chainsaws cut horizontally along the base to a depth of 3 meters. The Fantini 70 Super-H is the most powerful

model in the range and equipped with PKDs polycrystalline diamonds has a vertical cut capability up to a depth of 7 meters at speeds up to 8 m<sup>2</sup> per hour.

It is started by a hydraulic system with a main variable speed pump put on by an electric motor. The electro-hydraulic controls give suitable power and speed in different working condition. The chainsaw makes horizontal and vertical cuts with no water.



This hand-carved base will hold a Celtic Cross



Some of the finished products at Stradbally



stream of water is required to dissipate heat generated by the process, as sufficiently-elevated temperature can cause damage to the wire rope. This also effectively controls the dust emanating from the process. This cooling water is recycled through settlement ponds. The saw operators must be constantly on the lookout for and avoid the dark grey or black nodules of flint which are very detrimental to the expensive diamond blades.

## Knocking out the blocks of stone

Fill material is placed on the floor to dampen the fall of the 1,000-ton block. Three excavators fitted with ripper teeth-like attachments are used to move the block until gravity takes over. When the block hits the quarry floor it breaks along the natural bedding planes and faults. The quarry manager Edward McEvoy orchestrates this operation.

The damping fill material is removed sufficiently to facilitate dragging the blocks out into a clean open area where they are then divided into more manageable sizes by other wire saws on the quarry floor, discarding any waste material as the process is performed.

These blocks are then carried by the Caterpillar 988s with fork attachments to the yard at the top of the quarry to be cut into slabs on the frame saws, ready for transport to McKeon Stone's processing yard or directly to a customer.

## Production and processing

McKeon Stone uses diamond technology which minimises cutting waste and ensures the accuracy of the cut limestone. A travelling crane is available to pick up the blocks from the stock yard and position them on the frame saw and sophisticated flocculation plants, or settlement lagoon systems clean up and recycle the large amounts of water used by the processing plant. The water in many cases originates from rainfall collected within the quarry area making the plants almost self-sufficient.

The quarry operates two Bennetti and one Bidesi single-blade saws plus a Tema Frugoli multi-blade gang saw in the yard at the quarry.



Hilltop Quarries primary crushing operation



Hilltop Quarries secondary crushing and screening operation



Quarry manager Edward McEvoy



These are designed for cutting slabs and block trimming. The friction is again reduced by means of a water film. The tensioning of the belt is controlled by an automatic hydraulic system which also controls the down feed and guarantees very precise cutting, optimizing the tool's life and performance. A PLC on the control panel guarantees the complete control of all movement and cutting operations. It allows automatic, preset and continuous cutting to be made.

The cutting and slabbing saws are often the first stage in the limestone manufacture. The slabs are then carefully loaded on to a trailer.

## Mobile plant

Two Caterpillar 988 loading shovels are equipped with quick hitch devices for the removal and attachment of bucket and forks depending on the job requirements.



The excavators on site are a Hitachi 670 and a Caterpillar 365 with the Caterpillar 245 on standby to perform any task required of it. The A30 Volvo articulated dump truck is used to draw the waste from the saws to the contract crushing operation.

McKeon Stone and Hilltop Quarries work very well together and frequently help one another out with machines when the need arises.

## Stradbally

Here, the cut panels may be subdivided for use as cladding on a building or provide raw material to produce flooring tiles. Thicker slabs yield ashlar, kerbs, lintels or sculptures. A wide range of finishes, appropriate to the end use, can be applied to the surfaces.

The workshop in Stradbally is as well-equipped as the quarry, with two 50-year-old frame saws still working alongside a Gilbert 2.7 metre Disc Saw to slab the blocks and feed the two Donatoni Quadrix CNC secondary saws along with three GMM secondary saws, one with a lathe attachment.

Older secondary saws include a German Spielvogel, a Dutch Van Voorden and an Italian Aple saw. The Donatoni Quadrix SPD saw is a numerically-controlled 5 interpolated axes cutting and working centre bridge swing milling and shaping machine that can cut orthogonal, oblique, circular, elliptical and inclined cuts as well as straight, concave and convex shaping work with the utmost precision.

The worktable is a fixed bench which eliminates the need to rotate the table when making orthogonal or non-square cuts.

The disc motor is an electro spindle. It can accommodate diamond discs of various diameters (600-1100), and diamond tools can also be fastened to allow milling, engraving and bas-relief work.



Hilltop Quarries secondary crushing and screening operation

It can perform 3D jobs such as hollows, shower trays, sinks and columns with a lathe. CAD generated files can be transferred to the machine via a USB drive which means that anything that can be drawn can be cut precisely. The control panel is a touch screen monitor.

Off-cuts from the blocks and slabs in the factory are chopped up on a Steinex guillotine to be sold as building stone.

## Finishing

The primary function of the Pellegrini flaming machine is finishing raw sawn slabs to a dark mottled or bush hammered finish. The flaming process is very fast, achieving up to 10-15 m<sup>2</sup> per hour with only one operator. The slabs are loaded onto a motorized table and are fed through the flaming machine, where they are processed and washed under high pressure prior to being unloaded onto another table ready for production. This machine can also be set up with special equipment for finishes such as chiselling, scratching and various degrees of bush hammering. Flamed finish is used for paving stones and also for wall cladding.

## Export

Current production at the quarry is about 50,000 tonnes a year of which exports accounts for a high percentage. Agents represent the company in Holland, Belgium and surrounding areas

Builders in Belgium use stone for door steps or window sills and the Irish stone has built a good reputation. When James McKeon first took it out to the continent to explore the export market at the end of the 1980s it was not even always acknowledged as coming from Ireland, but the stone has proved itself and is now sought after, often being specifically included in specifications.

## Quality control

The workers at McKeon Stone, who number about 45, are experienced and skilled and quality control is based on visual inspections that examine for faults or irregularities.

The limestone has been tested by a wide range of laboratories in a number of countries during the last 20 years with little variation in the periodic test results taken

In accordance with various International Standards, McKeon Stone always facilitate the collection of representative samples which prospective customers may wish to test prior to use in major projects.

The beds of limestone in the quarry tilt at an angle of 6% north - south and it is found that the quality of the beds is consistent throughout the quarry

The cutting and finishing equipment used by McKeon stone enables them supply material within very small tolerances to the specified sizes.

## Acknowledgements

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A work in progress shows the life-size statue of "Invincible Spirit". The smaller statue shows how the finished product will look