

One man's



Cobus Kotzé

A: Sourcing raw material

Cape Brick is not only a well known brick maker, but it is also an avid recycler of building rubble. It has substituted virgin aggregate with recycled material in its brick-making process with great success. *Cobus Kotzé* investigated.

A: Sourcing raw material

1. The rubble alternative
2. On-site preparation

B: Recovering the aggregate

1. Five years to perfection
2. The crushing circuit
3. Out with impurities

C: Bricks from building rubble

1. Environmental beneficiation

waste

- is another man's treasure



B: Recovering the aggregate

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C: Bricks from building rubble

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A: Sourcing raw material

1. The rubble alternative
2. On-site preparation

Right: Cape Brick is situated about 5 km from the city centre where significant demolition activity takes place, so the use of recycled building material is far more efficient than sourcing material from outside the city.



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Suitable source

Cape Brick started out with conventional concrete and used to make bricks from the conventional mixture of sand, stone, cement and chemical additives. About five years ago, the company evaluated its material supplies situation and decided to start recycling building material in order to reduce its reliance on quarried stone and mined sand from the surrounding area. "Quarried material was becoming increasingly scarce and expensive in the

Cape, so we started looking at recycling building rubble as an alternative, to ensure a steady supply of raw material for our brick-making plant," tells Jean Tresfon, a partner at Cape Brick. The company found suitable partners for the venture in demolition experts, such as Ross Demolition and Bradis, to help with the sourcing of the correct material to use from demolition processes that could help in brickmaking.

I The rubble alternative

The conventional quarry source of raw materials.



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Demolition sites presented a new source of raw material.

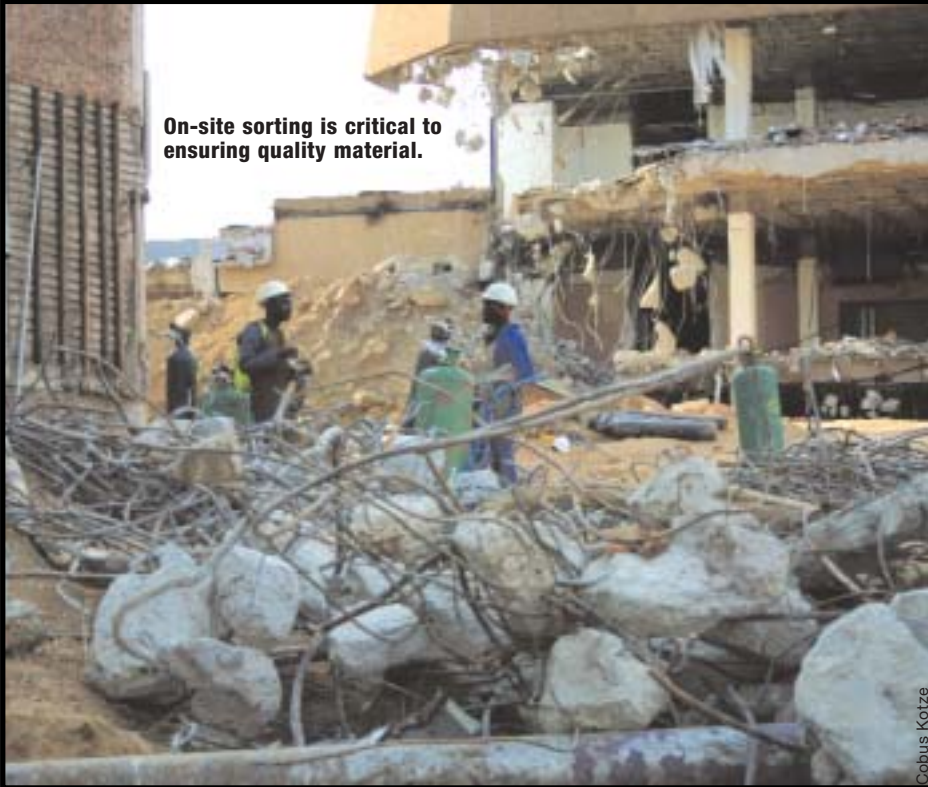


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Same, but better

The company then started experimenting with substituting virgin aggregate with recycled building rubble. The actual brick-making process was kept the same, using brick machines to produce normal concrete bricks. "Apart from the obvious energy savings, our product remains fundamentally the same. The only difference is that we use sand and stone in our concrete mix, recovered from rubble instead of originating from quarries," says Tresfon. The product is in no way inferior to other concrete bricks and has a much lower embodied energy as a result of the recycling process. Cape Brick has slowly increased the use of recovered aggregate over the years and now produces bricks that consist of up to 90% recovered material. In times of high brick demand, the company sources material from the surrounding quarries in order to supplement its stockpiles.

2 On-site preparation



On-site sorting is critical to ensuring quality material.

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Win-win situation

The key to the whole operation is finding and preparing the right building rubble. "We can use some clay brick in small amounts, but it is the reinforced concrete we are really after," Tresfon points out. "It is, therefore, very important that the contractor separates the different materials on-site so that our material is less contaminated. We can handle a small amount of contamination like wood, plastic and steel, but it is absolutely critical that the demolisher does sorting on site." Tresfon advises that instead of knocking the building down as a whole, the demolisher should first knock out the brick faces and remove them from the rubble pile, leaving the concrete structure intact. The reinforced concrete can then be separated and sent to Cape Brick. Although it is a bit more hassle than normal, the demolition company has the benefit of dumping some of its material close to the site and instead of paying for dumping the material on a landfill site, it is paid by Cape Brick for good material, making it a clear win-win situation.

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B: Recovering the aggregate

1. **Five years to perfection**
2. **The crushing circuit**
3. **Out with impurities**



Recovering sand and stone aggregate from the rubble.

Cobus Kotze

Quality in; quality out

The quality of the material Cape Brick receives on site is of absolute importance. Cape Brick originally allowed people to dump for free, but has moved to a model where it pays for 'good' rubble and does not accept badly contaminated rubble. Quality control, therefore, starts from the word go – this greatly improves efficiencies. Tresfon informs, "The process is quite simple in that they

knock down a building, dump the rubble here and we crush it up, recover sand and stone from it and then make the bricks from it." The company draws material from its rubble stockpile and takes it through the crushing operation to eventually produce a fine sand and crushed stone aggregate which can be used for making concrete bricks through conventional methodologies.

I Five years to perfection



The company uses about 8 000 t of recycled aggregate per month.

Cobus Kotze

Refined process envied

The control process starts when the company goes to a site before demolition and points out what it wants to use. Once the rubble is on site, the production of aggregate really begins. The crushing circuit seems rather straight forward, but Tresfon assured *Quarry SA* that it was a bit of trial and error at first. "It was a steep learning curve. We started off with a single jaw and refined our process to such an extent that we produce aggregate that can often be superior to mined material available at the same price," says Tresfon. "No-one in the world uses more than 10% of recycled material in their product, but we use between 70% and 96%. We get phone calls from all over the world from people wanting to know how we do it." Cape Brick also introduced various measures for quality control and a number of sieves to prevent double handling and to remove the fines whenever possible throughout the circuit.

2 The crushing circuit

1. Loading



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Material from the stockpile is loaded into the primary crusher.

2. Primary crushing



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The primary crusher takes concrete blocks of up to 1 100 mm x 600 mm and crushes it to an average aggregate size of 100 mm. Light sorting of the material takes place as it goes into a bin and over a sieve that splits the material into coarse, fine and in-between sized aggregate.

6. Stockpiled



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The right size stone and sand aggregate is screened out and stockpiled, with the overburden directed back to the gyros for a second run.

3. Coarse material to secondary crusher



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The material goes onto the sand and stone stockpile from where the coarse material is loaded into a secondary jaw crusher, followed by a set of twin gyro crushers.

5. To VSI crusher



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The material goes from the gyro crushers to a vertical shaft impact (VSI) crusher that shapes the stone.

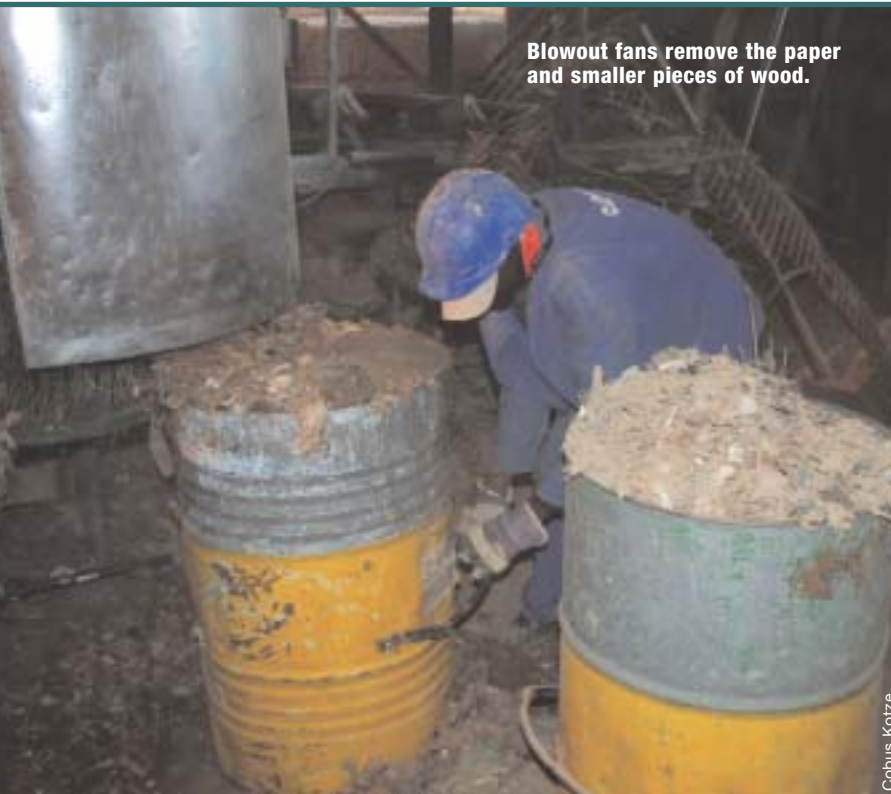
4. In-between material to gyro crushers



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The in-between material goes straight to the gyro crushers after primary crushing. These crush the material to a 6 mm to 9 mm stone.

3 Out with impurities



Blowout fans remove the paper and smaller pieces of wood.



Electro-magnets remove the ferrous metals.



Hand sorting takes care of the non-magnetic contaminants.

Removal of contaminants

The crushing process is relatively easy, but the biggest challenge lies with removing the contaminants. A small amount of contaminants is possible, but careful care is taken to filter them out as much as possible. However, certain contaminants can be disastrous. The primary methods of filtration are the extensive use of electro-magnets throughout the process, with blowout fans for lighter materials, together with hand picking stations for final quality control. Tresfon tells *Quarry SA* what the main grades of contaminants are and how the company removes them:

- Ferrous metals (magnetic), like iron and steel, are removed by electro-magnets, which we use several times in the process.
- Non-ferrous materials, like brass and copper tiling, are somewhat more difficult because magnets don't pull them out. They have to be removed by hand. However, these materials are generally more precious and are normally gathered on the demolition site for recycling.
- Wood and paper is easily blown out by fans.
- Glass is a silicate, as is sand, and does not present a problem when in the mix.
- Tar is a problem, but not the end of the world in small quantities. It is quite hard to spot and has to be removed by hand.
- Old brick is manageable because it is easily spotted and can be used for up to 10% of the brick mix, but no more as it makes for a poor aggregate.
- The most problematic contaminant is raw clay. It retards the setting of cement and there is no way to take it out right through the system once it is in the aggregate. Demolition site control is, therefore, very important to prevent the digger from digging up raw clay in the first place.

C: Bricks from building rubble

1. Environmental beneficiation



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The company produces both fair face and plaster grade bricks.

Not just another brick maker...

Many companies make concrete bricks, but Cape Brick is one of the few companies in South Africa that produces its own aggregate and is a world leader in using recycled building material. The brick-making process is as per normal standard technology: make a concrete mix, press it in a mould and leave it to cure. "We produce two types of bricks, these being fair face and plaster grade. Fair face is used if you are not going to cover the wall, whereas with plaster

grade, the wall will be plastered over. We do have a bit of a challenge in keeping the colouring of the bricks the same, because of the nature of the building rubble, so most of the recycled building rubble goes into the plaster grade products," he adds. "We have four brick-making machines working around the clock to keep up with demand." Cape Brick produces about 30-million bricks per year and provides the market with a top quality environmentally-friendly product.

Environmental beneficiation



Cobus Kotze

Cape Brick has the lowest embodied energy of any other concrete product in the Western Cape.

Achieving lower embodied energy

Energy efficiency in building material is normally measured by the natural thermal efficiency (referring to what extent the material retains a building temperature) and its embodied energy (referring to the energy needed for its manufacture). The use of recycled material already gives Cape Brick's products a much lower embodied energy than normal concrete masonry. But, to further reduce the embodied energy, the company also uses recycled cement slag instead of pure cement for about 50% of the cementitious content of the mix. "People often ask about quality, but we produce a typical 14 Mpa plaster brick comprising 96,5% of recycled material," Tresfon concludes. The company seems to be very proud of the fact that it is producing a product that is of a very good quality, while improving environmental sustainability. ■