

REVIEW OF THE DIMENSION STONE INDUSTRY 2006

DIRECTORATE: MINERAL ECONOMICS



mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

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Picture on front cover by courtesy of Finstone South Africa.

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1. Introduction

Dimension stone is a term applied to naturally-occurring rock that may be cut, shaped or selected for use in blocks, slabs, sheets or other construction units of specific shapes or sizes. The stone is commonly used for the cladding of buildings, curbing, paving, flagging, revetting, or for its architectural or engineering properties; also in memorials, particularly tombstones. The construction sector accounts for over 80 percent of consumption, with the funerary, monumental industry accounting for 15 percent, and various special applications for around 3 percent.

South African dimension stone production consists mainly of granitic rock with slate and sandstone making up the balance. The term “granite” is applied very loosely in the industry, and is used to describe almost any medium- to coarse-grained igneous or metamorphic rock. Grey and black norites, trade named “black granite”, all from the Bushveld Igneous Complex (B.I.C.), form the backbone of the South African dimension stone industry. Red B.I.C. granite’s, which are true quartz-bearing granites and greenish metamorphic rock, the latter from the Namaqualand area (e.g. Olive Green, Montana Green and Verde Bitterfontein), are also well established on international markets.

The suitability of a particular rock type as a dimension stone depends on its quality and accessibility. The material should be free of cracks and have a uniform texture. An attractive colour is essential, and in most applications, the rock must be capable of taking a polish. Furthermore, resistance to weathering and staining on exposed surfaces is important.

2. History

While a wide variety of dimension stone has historically been used in South Africa, the current production consists of almost exclusively granite. Commercial production of granite has its roots in the Rustenburg area (North West Province). Grey-black granite (gabbro-norite) blocks from Bon Accord quarries were extracted prior to the Second World War, before eventually being closed down in the late 1930s. In the late 1940s, operations moved to the Rustenburg area where the quality was better. Exports of South African granite commenced in the 1950s and these soon became popular in the monumental market, with the result that many quarries were started in the Brits-Rustenburg area, up until the mid 1980s. Exploration in the Belfast area (Mpumalanga Province) resulted in the first production of a black norite, which soon became established as a leading black monumental granite in the world market. Production of pink granite from the Parys area (Free State) followed later and was popular for construction purposes.

By the mid 1980s, there were as many as thirty to forty different companies operating in the Brits/Rustenburg and Parys areas, all strongly focused on exports of rough granite blocks. By the late 1980s many of the smaller companies had merged into a few larger units, and four or

five were listed on the JSE. There was a downturn in the market in the early 1990s resulting from the Gulf War. By 2003, the South African dimension stone industry was dominated by three companies, Marlin Holdings Limited, Kelgran Limited and R.E.D. Graniti Limited; which accounted for 94 percent of South African dimension stone production, from 26 quarries.

3. Occurrence

Figure 1 shows the distribution of dimension stone deposits in South Africa. Granites are particularly well represented in Limpopo Province, North West, Northern Cape and eastern Kwa-Zulu Natal. The so-called “black and grey granites” are dark gabbros belonging to the Pyramid Gabbro-Norite of the Bushveld Complex. These rocks are well exposed at Belfast in Mpumalanga, and in the Brits and Rustenburg districts of the North-West province. The “Belfast Black”, which generally occurs along the central portion of the Bushveld Complex’s dark gabbro zone, represents the best quality by far.

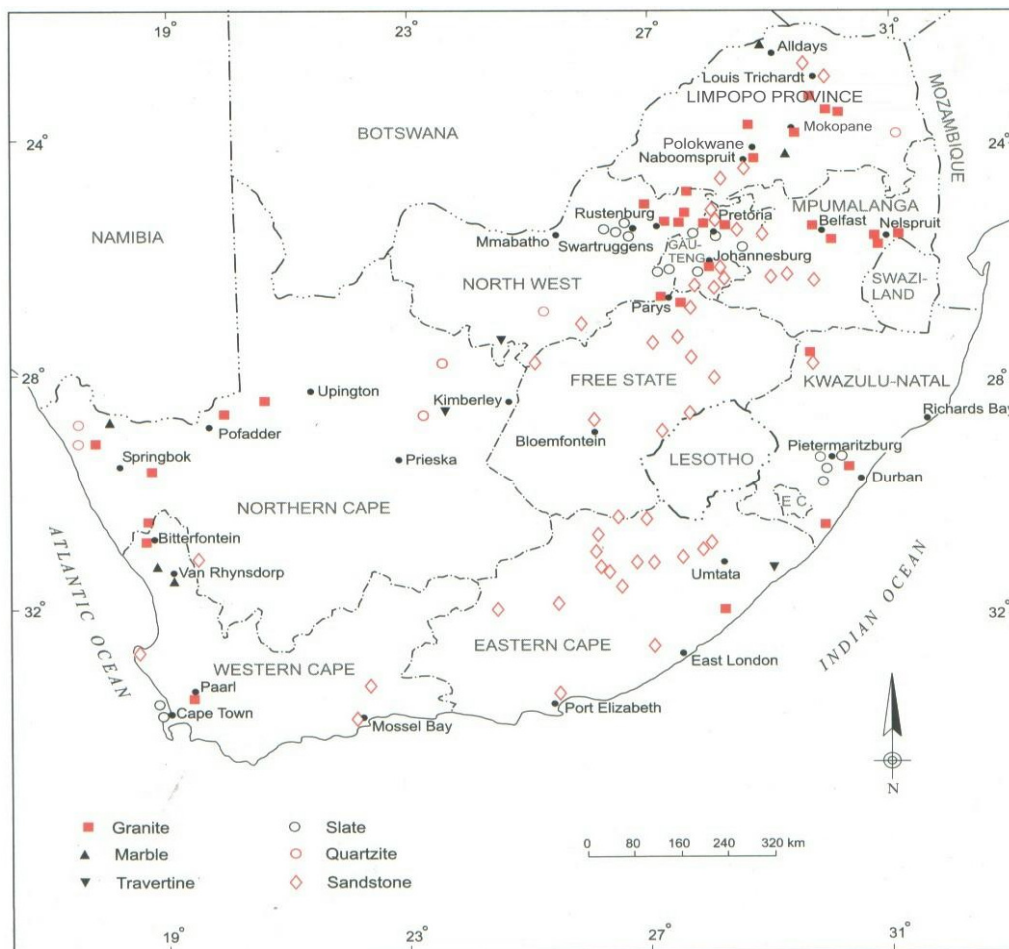


Figure 1: Distribution of Dimension Deposits in the Republic of South Africa
(Source: Council for Geoscience)

More than thirty different colours of granite are produced, along with several quartzites, sandstone and slate. However, most of the granites are produced in limited quantities from small quarries that open and close according to market demand for a specific material. The so-called classic material - Rustenburg Grey, Olive Green, African Red, Belfast Black and Verde Bitterfontein – are always in demand and used extensively throughout the world in both the construction and monumental industries. Rustenburg Grey accounts for over 70% of South African production, and is the single largest volume material traded on world export markets comprising more than 7% of world granite trade.

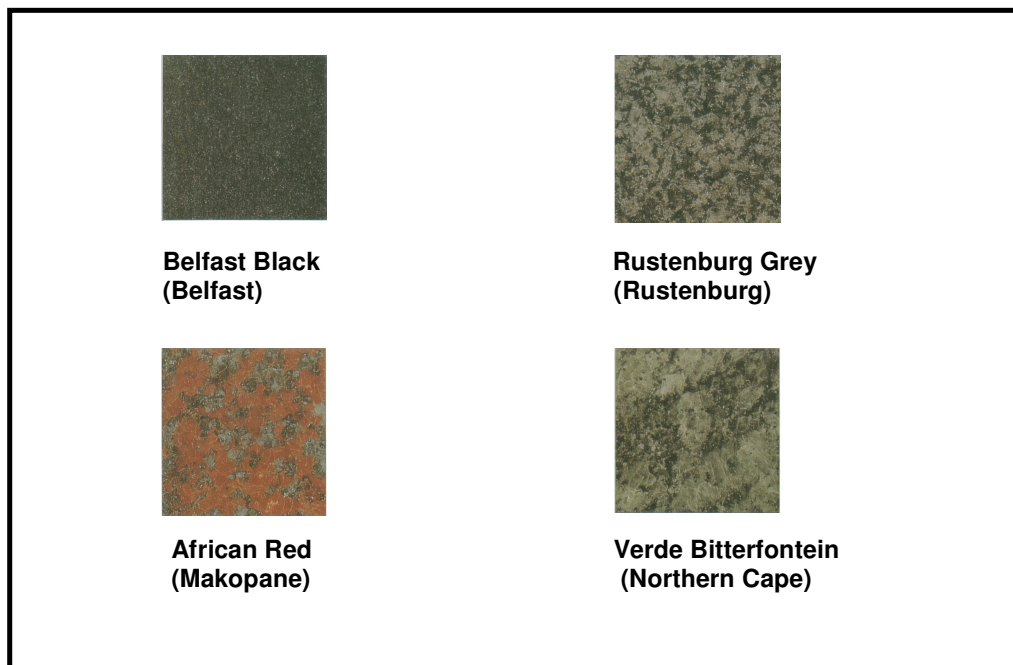


Figure 2: Examples of granite in South Africa (Source: Council for Geoscience)

For more information on producing quarries and processing plants in South Africa, refer to the DME's Directory D9/2005, Producers and Processors of Dimension Stone in South Africa, 2005.

4. Quarrying of Granite

Diamond wire sawing is used across the world, even in loosening benches of the hardest granites. By this method vertical cuts on a quarry face are made by threading a diamond wire through intersecting boreholes. For each cut, the wire is joined into a loop and rotated under tension (see figure 3), The horizontal base cut of a block is usually popped loose by means of explosives. As a result of the improved economies of diamond wire sawing, this method has replaced jet torching, slot drilling and multi-direction split blasting for the mining of dimension stone. The bench is then progressively split into smaller blocks until they are of a size that can

be handled by a front-end loader or crane. Recent improvements in cutting technology has resulted in the capability to cut thick slabs in the quarry, rather than large blocks.



Fig 3: Diamond wire-cutter in operation



Fig 4: Drilling activities carried out

5. Processing of Granite

Granite quarry blocks are lifted by crane onto trucks and transported to a processing plant. At the plant they are cut into slabs or blocks of the required size by a circular diamond edged block saw (working on the same principle as the wire saw in quarries), or single or multibladed frame or gangsaws using either abrasive grit or diamond tipped blades. The type of saw used depends on the speed and type of finish required. Once the granite is cut into slabs or blocks, usually slabs), it is then cut into smaller slabs and/or trimmed to shape. Modern trimming machines automatically measure and cut the slabs to size with great precision. A recent innovation has been the use of multiwire saws to replace gangsaws. The first multiwire saw in South Africa is currently being tested.

Granite can be given a variety of finishes by honing and polishing, bush hammering or flaming, each producing differing textures and colour effects. Honing and polishing is achieved by using a series of abrasive grinding discs graded from coarse to fine. Various types of machines are used, the older types in which the discs are changed or the stone moved manually from one to the next, and the newer ones in which the stone is automatically moved from one set of discs to the next. The granite can be either honed (ground to a smooth flat finish) or taken to a full polish depending on the desired application and effect. In bush hammering, a range of finishes are achieved by surface chiselling including scabbling (resulting in a pitted surface), chiselling and benching (linear groves in the surface). By flaming, a finish is created by applying a high temperature flame to the surface of the granite (acid granite only is suitable). The heat exfoliates and partly melts the surface giving it a characteristic rough and vitreous appearance.



Fig 5: Slabbing saw



Fig 6: Blockyard with granite slabs

6. The International Dimension Stone Industry

In 2004, total world quarry production was 75 million tons, with processing waste of 30 million tons, yielding net production of approximately 45 million tons. China led world production with 14 million tons (raw), followed by Italy and India with estimated production of 7,8 million tons and 7,5 million tons, respectively.

Production of dimension stone has exhibited annualised growth of 4.9% over the last 75 years; annualised growth in consumption is 7.6% since 1986. This has been attributed to more frequent discoveries of new stone deposits, a stone conscious culture and technical advances in extraction and beneficiation techniques that have reduced mining and processing costs. The total value chain is estimated at \$40 billion worldwide. The major producers of raw natural stone are China, Italy, Spain, India, Brazil, Portugal, Greece, France, Turkey, USA, South Korea and South Africa, while the major consumers of finished products are China, Italy, USA, Spain, Japan, India, France, South Korea, Taiwan, Greece and Saudi Arabia. The major exporters of raw stone are India, South Africa, China and Brazil.

There have been major changes in the dimension stone industry over the past decade, both in the patterns of supply and demand and in the technological field. Vastly improved rock cutting machinery has changed the business from one of high margin, low volume to low margin, high volume. Automated gang saws can equal the work done by two or three of the first generation machines, and have drastically reduced running costs and final sawing costs. The cutting of thinner slabs, particularly in the case of the harder rock types (such as granite), has been made possible, thereby improving efficiencies for cladding, tiling, etc. Secondary cutting has been revolutionised by the use of computerised bridgesaws, laser and water jet cutting technology. Capital costs have increased while final production costs have greatly reduced. The ability to cut and process hard rock more efficiently than in the past, has led to a vast increase in the type and colours of material being supplied to the market.

Architects have become the drivers of fashion in the stone industry, and suppliers have had to align themselves more closely with fast changing demands for particular colours of stone. This extensive selection of materials as well as 'perceived' short lead times, have created some problems for producers. Although production costs have been reduced, the costs and risks associated with establishing a new product in the market have increased quite considerably. This is clearly illustrated by the increasing rate at which quarries are opened and closed, especially those producing exotically coloured stone.

7. The South African Dimension Stone Industry

The industry has historically comprised of small, often family run enterprises, usually specialising in one phase of the entire process. Specialisation thus developed in the fields of stone quarrying, primary beneficiation (sawing and surface finishing of slabs), secondary beneficiation (fabrication of finished goods such as tombstones, vanity slabs, cladding panels, stairs etc), and the physical installation of stone in buildings.

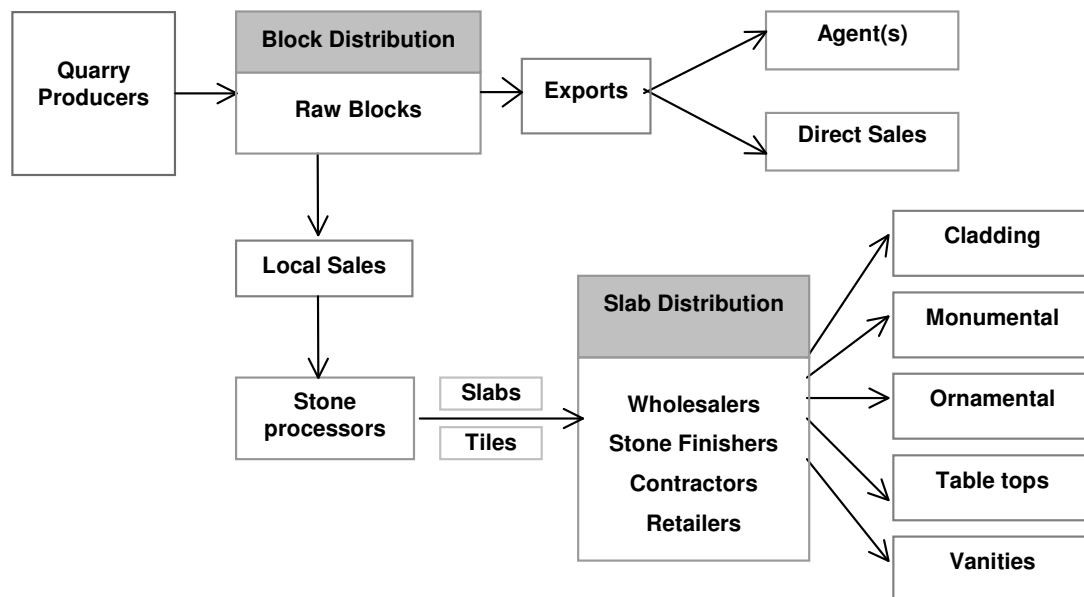


Fig 7: Industry Flow Diagram

The currently depressed South African dimension stone industry reflects the challenges faced by exploiters of relatively low-value bulk products, which traditionally have been exported in raw or near-raw form to satisfy the demands of the European, Asian and Far Eastern markets that reap the benefits of value addition via both local and export sales of their products.

There is a growing trend to export stone in slabs rather than rough blocks, as a result of demand, and improved cutting and packaging techniques. Increasing freight charges have contributed to this trend, as 20-30% of a block may be lost in the cutting of slabs. It is an unnecessary expense to transport material that is going to be lost in further processing.

The current structure of the industry makes entry of new players difficult, as large companies such as Finstone, Kelgran, Red Graniti and Keeley dominate the local and export market. It is difficult for new players to force their way into an international market that is controlled by Europe, Asia and the Far East.

The South African industry is export based and faces stiff competition from China, India and Brazil. Approximately 80 percent of South Africa's granite is exported; the majority via trading companies, however large quarrying companies and beneficiaries do conduct business directly with each other. A recent trend in the industry has been a tendency towards vertical integration, with the largest quarrying companies moving forward into block distribution, and to a lesser extent beneficiation, while several primary beneficiaries are integrating backward into block trading and quarrying.

8. South African Developments

In 2004, Finstone Srl (Luxemborg) and RED Graniti Spa (Italy) purchased equal shares in 51 percent of Kelgran Investments, under the name Joint Venture Kelgran (JVK). A put option in the original agreement has been exercised, in terms of which JVK has purchased the remaining 49% of Kelgran Investments, after obtaining shareholder approval.

Finstone (the former Marlin Corporation) is on the brink of major productivity improvements through a radical change in mining methods. This involves the use of 'slab mining', a method widely used in marble quarries. This was, until recently, not very successful in the Rustenburg granites until the size of the slabs mined were increased to at least 3m and new equipment developed in-house enabled the tipping of such large slabs.

Finstone is the biggest beneficiary of granite in Africa. Approximately 15 % of South African dimensional stone block production is channelled through Finstone's processing group of companies housed in Minaco, which comprises four separate processing facilities, being Natural Stone Processors (NSP), Impala Granite, Minaco Contracts and Wanli Stone. NSP produces up to 500 000 m² a year of construction slabs for the domestic and export market. Impala Granite produces 75 000 m² a year of thicker slabs for monumental applications. Minaco Contracts specialises in design, cutting and detailing of construction slabs and granite panel wall cladding, as well as flooring and decorative detailing and the installation of natural stone products, while Wanli Stone, a joint venture with Chinese partners, produces finished natural stone products and monumental components for the local and international market.

The Impala factory has started making use of second and third grade blocks, which previously would have been regarded as waste material. The final product is often first grade, as slabs can be cut out between flaws. Finstone has also opened Stone Connection outlets in South Africa, USA, Europe and Australia, which go hand-in-hand with the group's beneficiation

programme. These international outlets are established to trade natural stone slabs and are drawing resources of construction materials from different parts of the world, like South African-based NSP.

9. Production

Production of granite has varied between 600kt and 800kt between 1995 and 1999, but increased to 952kt in 2000 as a result of the opening of two new quarries by Kelgran in the Northern Cape. The closure of three quarries resulted in lower production in 2001 and this trend has continued over the past few years. South Africa's production of dimension stone was estimated to be 527kt in 2004 valued at R490 million, which was an approximate 10 percent increase in production compared with that of 2003. Sales of granite to the local market jumped to 145,4kt in 2004 compared to 2003, an increase of 85 percent. Natural stone has gained popularity in the local market, with most of the growth in domestic and monumental applications. As a result of the effect of the strong rand on exports, the Finstone Group has concentrated on promoting finished goods in the local market. The Garankuwa thin slab facility sold 70 percent of its production into the local market. Also, their Minaco construction division makes use of local material for their overseas projects.

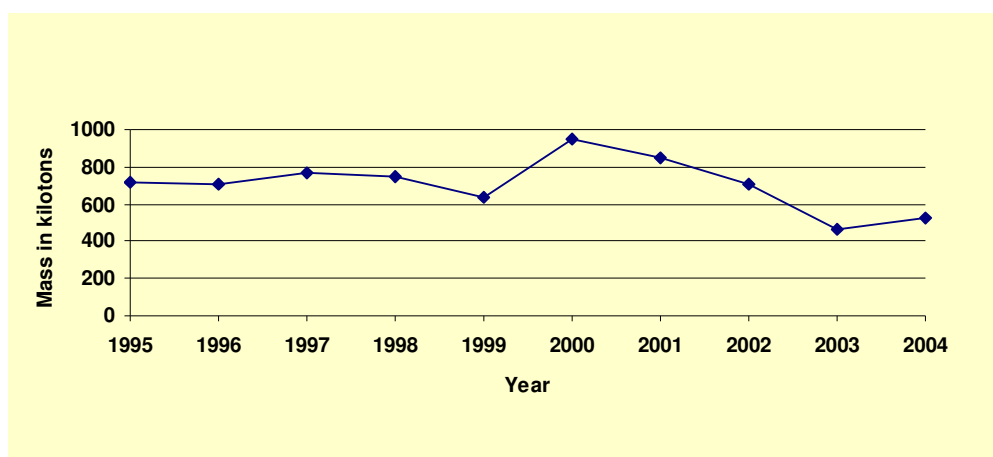


Figure 8 – South Africa's production of granite, 1995 – 2004 ¹

Other locally mined dimension stone included slate (47,5kt was sold in 2004, all of which was sold locally), plus minor amounts of sandstone and siltstone.

The dimension stone industry in South Africa appears to be extremely wasteful in terms of recovery if compared with the global average, but is in fact on par with other granite producers. Rough block recovery from a local quarry may vary between 10 and 19%, and of the blocks recovered from a quarry up to 45% may be lost during further processing into

¹ - In the absence of available data, production is taken to be equal to total sales volume

slabs, polished slabs and tiles. These figures convert to an approximate ore: waste ratio of 1:8, which is high, but comparable to some other forms of mining. The difference between world and South African recovery percentages can be explained by the different nature of the average world production. Yields are lower from granites than from calcereous materials. The latter make up some 58% of world total quarried volume of dimension stone. It is important to note though, that other world granite producers only operate with recovery grades of 8 – 15%.

Dimension stone mining is extremely flexible – a quarry may be opened if sufficient orders for a particular product are obtained or, if these decline, a stockpile of blocks may be prepared, and the quarry then left dormant until further orders are received. During 2004, 36 quarries were operational (29 granite, 5 slate and 2 sandstone quarries), but not necessarily simultaneously.

The four most important varieties of granite in South Africa are Rustenburg Grey, African Red, Belfast Black and Olive Green. The supply/demand balance for Rustenburg exhibits inelastic behaviour as a result of price sensitivity and the ease of substitution with other materials. At current pricing levels, Rustenburg is slightly oversupplied hence putting pressure on pricing, and at current exchange rates may lead to closure of quarries, particularly small operations without the financial backing to survive the difficult times. Olive Green supply/demand is balanced at current levels. The market for green coloured materials is probably in decline overall. The market for African Red is substantially less than it was several years ago due to changes in fashion trends as well as competition from other red materials from India and China, but there are indications of a recovery. Belfast Black is virtually unobtainable as few reserves remain. Reprocessing of old waste dumps may be enabled by modern equipment, and is being investigated.

10. Trade

Italy is the greatest single importer of South African granite, and is the greatest overall importer of dimension stone from all over the world. India and China are the leading producers and exporters of granitic stone. South African exports amount to about 380 kt; 29 percent directed to Italy followed by China and Belgium, which accounts for 15 and 13 percent respectively. In 2004, export earnings decreased significantly by 50 percent to R342 million compared to 2003. This was due to group restructuring at Finstone and the strong rand. Finstone now sells to Dorking SA (Pty) Ltd on a free on truck or free on rail basis. Dorking is then responsible for the transport costs to the port, where previously this cost was carried by the quarrying company and reported in quarrying companies' sales figures to the DME.

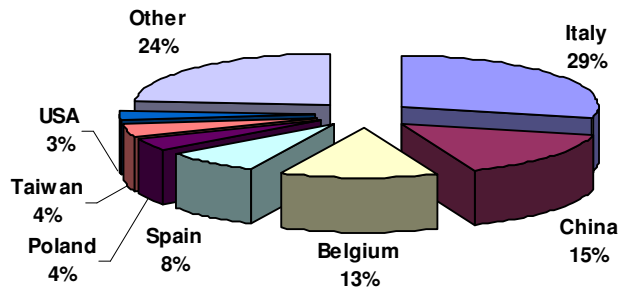


Figure 9 – South Africa's exports of granite, 2004 (source SARS)

11. Pricing and Employment

Prices for dimension stone are quite variable and depend on factors that include colour, texture, finish and consistency as well as regularity of supply. Average prices for 2004, were R828 per ton and R897 per ton for exports and local sales respectively. In 2004, there were 2 356 people employed in dimension stone quarries.

Table 1: South Africa's Dimension Stone sales, 2000 –2004

Year	Production	Local Sales			Export Sales		
		Mass	Value		Mass	Value	
	kt	Kt	R'000	R/t	kt	R'000	R/t
2000	977,1	125,2	53 784	430	844,8	627 687	743
2001	869,9	108,6	47 149	434	761,1	677 698	890
2002	730,6	100,0	45 663	457	630,6	837 332	1 220
2003	503,9	119,2	56 844	477	384,7	718 746	1 868
2004	574,6	192,9	159 692	828	381,7	342 284	897

Table 2: Employment and Remuneration in South Africa's Dimension Stone industry, 2000 – 2004

Year	Employee	Total Remuneration
		R'000
2000	2 563	82 010
2001	2 580	88 115
2002	2 742	96 131
2003	2 570	80 367
2004	2 356	91 807

12. Recommendations

There is a shortage of quarrying and stone dressing skills in the sector so there is a need to provide training and equipment to local entrepreneurs. There is potential for small-scale mining of materials such as slate and sandstone for use as paving material and building blocks the processing of which requires manual labour.

There has been overseas interest in the manufacturing of monumental stone from quarry waste owned by quarrying companies. The situation may be complicated by the owner wanting to pass all his environmental obligations to a party wishing to use some of that 'waste'. In some cases deals have been successfully concluded.

A scoping study should be done to identify the potential for small-scale dimension stone exploitation in South Africa. A feasibility study should be undertaken to identify the potential for creating a hub, in say Rustenburg – where in addition to mining; cutting, polishing and ornamental sculpturing activities can be undertaken.

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