

# THE ROLE OF AGGREGATES AND SANDS IN THE CONSTRUCTION INDUSTRY

DIRECTORATE: MINERAL ECONOMICS



**mineral resources**

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**REPUBLIC OF SOUTH AFRICA**

# **THE ROLE OF AGGREGATES AND SANDS IN THE CONSTRUCTION INDUSTRY**

**2014**

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## **ABSTRACT**

The rapid growth of South Africa's urban areas has put immense pressure on existing construction material resources, as there is increasing demand for land use for infrastructure, housing, recreation and industrial activity. The quality of aggregates is a critical component in determining the use and life of infrastructures. It is therefore important that the aggregates supplied are affordable, durable and secured for long term supply. The report focuses on the relationship between aggregate and sand sales and the impact on the construction industry.

Furthermore, the report establishes the link between Outcome Six of Government priority areas, which identifies infrastructure network as one of the key areas in unlocking the economic growth of the country. The infrastructure build programme had played a key role in South Africa's sustained economic growth since the 2008/09 economic downturn, with R1-trillion spent on economic infrastructure. The report also seeks to avail relevant information to decision makers when carrying out large magnitude infrastructure network projects as identified by the National Development Plan, focusing on measures that will contribute to South Africa's economic transformation.

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## **1. INTRODUCTION**

Aggregates are granular raw materials, including gravel, crushed stone and recycled concrete that are used in residential construction and commercial construction. Public funded infrastructure projects consume most aggregates, usually for use in road construction. Aggregates are vital to the construction industry which maintains and enhances the country's built environment and transportation infrastructure. The quality of aggregates is a critical component in determining the use and life of infrastructures. It is therefore important that the aggregates supplied are affordable, durable and secured for long term supply.

The rapid growth of South Africa's urban areas has put immense pressure on existing construction material resources as there is increasing demand for land use for infrastructure, housing, recreation and industrial building activity. The widespread use of aggregates result not only from its general availability and low value but also from the fundamental role they play in developing and sustaining modern society and economy.

Traditionally, sources of aggregate were found close to their demand locality due to the high cost of transportation resulting in quarries located on the outskirts of cities and towns. However, in numerous instances, these deposits have been depleted and new sources further away had to be found resulting in greater transportation costs. Urban development itself has, in recent times been responsible for the rapid depletion of readily available deposits. Hard rock aggregate quarries are often located on the slopes of hills and mountains, usually resulting in the defacing of areas of natural scenic beauty. Growing environmental awareness increasingly influences the exploitation of such resources in localities of this nature.

Before any project of a large magnitude can be undertaken, especially those identified by the Presidential Infrastructure Coordinating Commission (PICC), it is essential that an investigation of quality aggregate availability is conducted. This will ensure that decision makers are aware of the position and spatial extent of potential construction and building materials during land-use planning.

## **2. OCCURRENCE OF SAND AND AGGREGATE IN SOUTH AFRICA**

South Africa has various types of rocks which are characterised as aggregates which are widely distributed in abundance in a variety of geological environments. Coarse aggregate are derived from a wide variety of parent bedrock materials. The three main groups of coarse aggregates are:

- Igneous rocks – Andesite, basalt, dolerite, felsite, gabbro, granite, granodiorite, norite, rhyolite and syenite.
- Metamorphic rocks – Granite-gneiss, granulite, hornfels, quartzite and slate.

- Sedimentary rocks – Quartzite, sandstone, greywacke, shale and tillite.

A good concrete aggregate must be clean, chemically inert, and durable and roughly cubic in shape after crushing and of a size grade suitable to make concrete of desired physical qualities.

Natural sand consists of loose grains which are commonly the result of the chemical weathering and/or physical breakdown of rocks. The range of particle sizes is dependent on the original texture of the source rock and the state and degree of weathering. Natural sands include alluvial/eluvial sands, aeolian/windblown sands and marine/beach sands. Sand accumulates in rivers, on beaches, as dunes and in valleys between mountains. Manufactured sand is produced by the mechanical crushing or milling of rock and gravel. Mine-dump sand being a waste product in the mining industry can also be classified as manufactured sand.

### **3. PRODUCTION PROCESS**

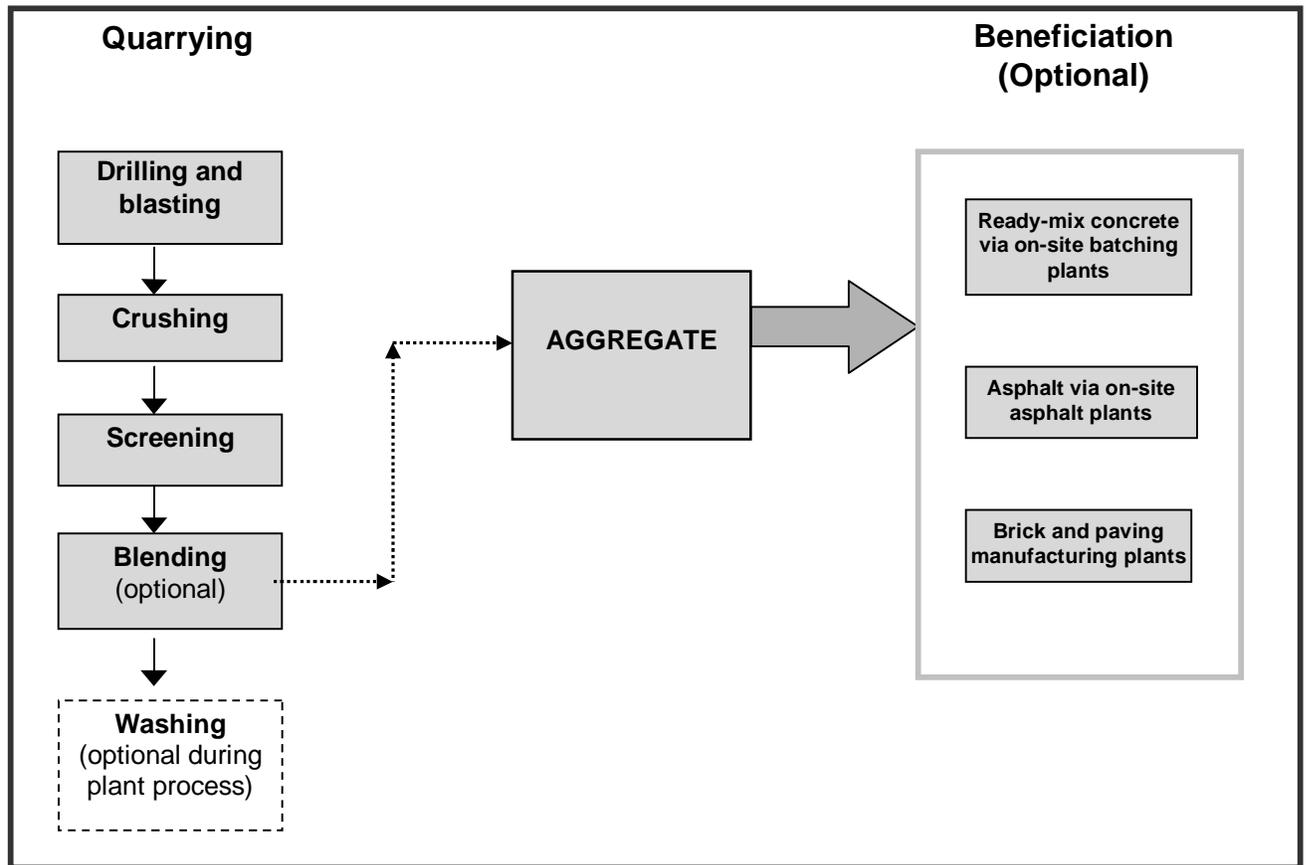
Most hard rock material used to produce coarse aggregate is sourced from open pit quarries and waste dumps. Quarrying usually requires drilling and blasting, after which the rock is extracted by means of bulldozers and draglines. The broken rock is transported to a processing facility for scalping, the process which involves the removing of unwanted materials, such as clay. The scalped material is then crushed to obtain the desired fragment size. The resulting material is then screened to obtain aggregates of the desired grade (Fig.1). In some instances, blending is done to meet customer's specification.

Natural sand is dug from the ground often using hydraulic excavators. The quality and final use of the sand usually determines the amount of processing necessary. The sand undergoes complementary processing including washing and scrubbing, primarily to make them cleaner before being stockpiled to go on to their end use.

It is now a common practice to further beneficiate the aggregate into:

- Ready-mix concrete,
- Asphalt,
- Bricks and paving material.

FIGURE 1: BASIC FLOW DIAGRAM OF THE SAND AND AGGREGATE INDUSTRY



Source DMR, Directorate Mineral Economics

## 4. OWNERSHIP AND SMALL SCALE MINING

### 4.1 OWNERSHIP

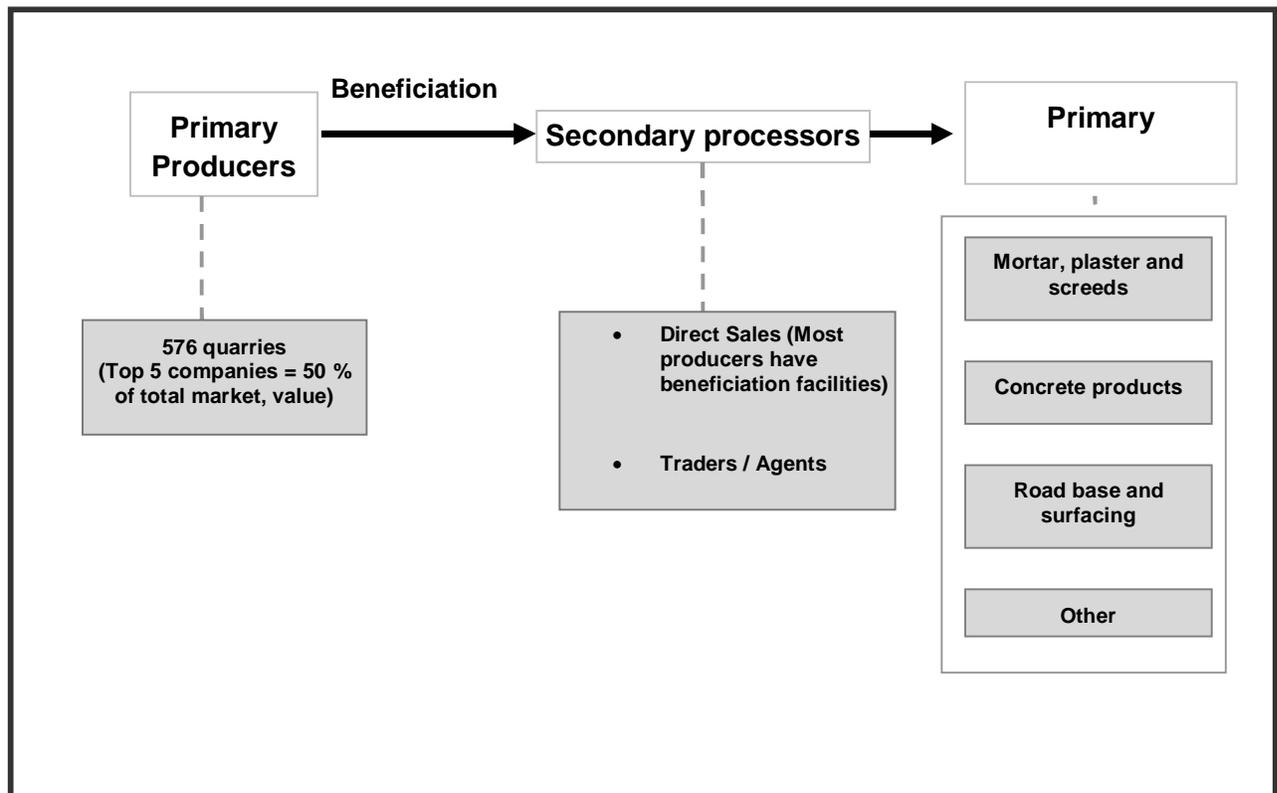
The sand and aggregate industry comprises some 576 registered operating quarries in South Africa.

The leading sand and aggregate operators are:

- **Lafarge** (subsidiary of Lafarge International), 26% of its mining activities in Lafarge Mining (Pty) Ltd and 10% of its manufacturing businesses held in Lafarge Industries (Pty) Ltd, to its employees and Sinako (Pty) Ltd ("Sinako"), a women-led empowerment consortium.

- **AfriSam** (AfriSam is 100% owned by the AfriSam Consortium, the company also has a 62.5 percent interest in Tanzania-based (Tanga Cement Company). Empowerment partners are Skills Train Distribution, Bunker Hills, a Black Economic Empowerment (BEE) investment company, Motheo Wa Basadi Trust, Holcim Ltd, an international company based in Switzerland, the Public Investment Corporation (PIC), and all management and employees of the southern African operations of AfriSam.
- **Afrimat** (empowerment partner Kwezi mining, Mega Oils and Mvelaphanda Holdings and Afrimat black employees via Afrimat BEE Trust acquire 16.8% interest in Afrimat),
- **Wearne** (empowerment partners Moseme Road Construction and Imisebe Trading and staff),
- **NPC** (Natal Portland Cement) is a member of the Intercement Group of Companies.

FIGURE 2: INDUSTRY AND COMPANY STRUCTURE



#### 4.2. OPPORTUNITIES FOR SMALL SCALE MINERS

Opportunities for small-scale mining in South Africa involve the mining and quarrying of high-bulk, low-value industrial minerals and construction materials. The bulk of the demand (90%) for small-scale mining ventures is associated with industrial commodities such as slate, sand, clay, sandstone, dolerite

granites for the production of products for construction and infrastructure such as tiles, clay and cement bricks, aggregates, and dimension stone for cladding. Sand and Aggregate mining opens up more opportunities to small scale miners since it requires less capital for operation. Small-scale mining involves the extraction of minerals with simple inexpensive underground machinery. Potential opportunities for small scale miners exist in the following areas:

- **Waste from underground mining operations** e.g. gold and platinum mines are suitable for beneficiation into good quality aggregate and sand for concrete and roads.
- **Slag and ash** formed as by-products from power generation, the iron and steel and petroleum industries have potential for the provision of aggregate.

**“Used” concrete and asphalt** can be recycled for use as aggregate in road building

All mineral and mining operations in South Africa are regulated in terms of the Mineral and Petroleum Resources (MPRDA), Act 28 of 2002, with health and safety aspects being regulated by the Mine Health and Safety Act (MHSA), Act 29 of 1996. These Acts are administered by the Regional Managers and Principal Inspector of Mines in the respective Regional Office. Unfortunately, not all quarries are registered and illegal operations continue to pose a threat to the environment, health, safety and revenue collection for other regulated industry players. However, the Department of Mineral Resources has embarked on a project to encourage illegal operators to register, as some of these small scale miners do not have information on regulatory processes that are required before quarrying of aggregates can take place.

## **5. MARKET ANALYSIS AND DEVELOPMENTS**

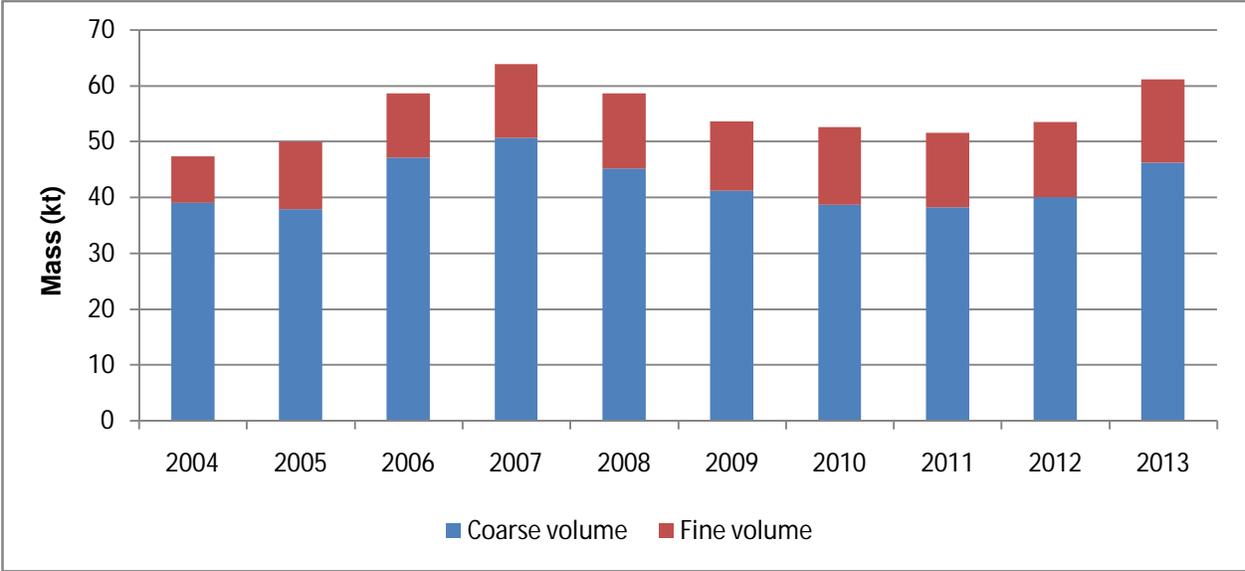
Demand for aggregate and sand in South Africa is driven by the construction industry, which is comprised of residential building, non residential building and civil construction. Projects in South Africa's construction industry have been subdued in the past few years, owing to a myriad of events such as the local and global economic uncertainties, strikes in the mining sector and low consumer and business confidence. These factors had a significant impact in the private sector as companies reviewed investment decisions and re-assessed projects priorities. Many companies operating in South Africa's construction sector faced high competition for both private and government tenders whilst at the same time experiencing tighter margins.

According to Absa residential building statistics, levels of residential activity for new housing remained subdued in the first 10 months of 2013 due to rising construction costs, affordability constraints and low consumer confidence. As a result the residential sector has been the hardest hit. Growth in residential investment slowed from 3.2 percent in 2012 to -0.6 percent in the first half of 2013. In 2013 the

Competition Commission discovered that a total of 15 major South African construction companies were involved in collusive tendering to a combined value of R26 billion between 2006 and 2011 in contravention of section 4(1) (b) of the Competition Act relating to restrictive horizontal practices. The companies were fined R1.46 billion collectively by the Competition Commission. The penalties were a percentage of the annual turnover of each company which also took into account the number of projects each company was involved in. These punitive measures highlighted the importance of the construction industry to economic growth and the strong provisions of the regulatory framework.

Growth in the construction industry subsided in 2008 following the effects of the global economic financial crisis resulting in lower aggregates and sand sales volumes (Fig 3). However, the full effects of global economic slowdown was offset by momentum of long term contracted projects as the country embarked on massive projects such as the building and renovation of stadia, airport and transportation infrastructure for the 2010 soccer world cup, resulting in sales volumes of aggregate and sands stabilizing between the period 2009 and 2010. After the completion of the above mentioned projects, construction activity subdued as new projects were lacking. Nevertheless, the South African quarry industry gained momentum in 2013, with local sales volumes of coarse aggregate increasing by 15.2 percent to 46.2 kt compared with the 40.1kt in 2012, owing to a slight increase in infrastructure development in the country (Fig 3). The local sales volumes of fine sands increased by 12 percent in 2013 to 14.9 kt compared with 13.4 kt in the previous year due to the increase within the construction industry attributed to higher activity in civil construction.

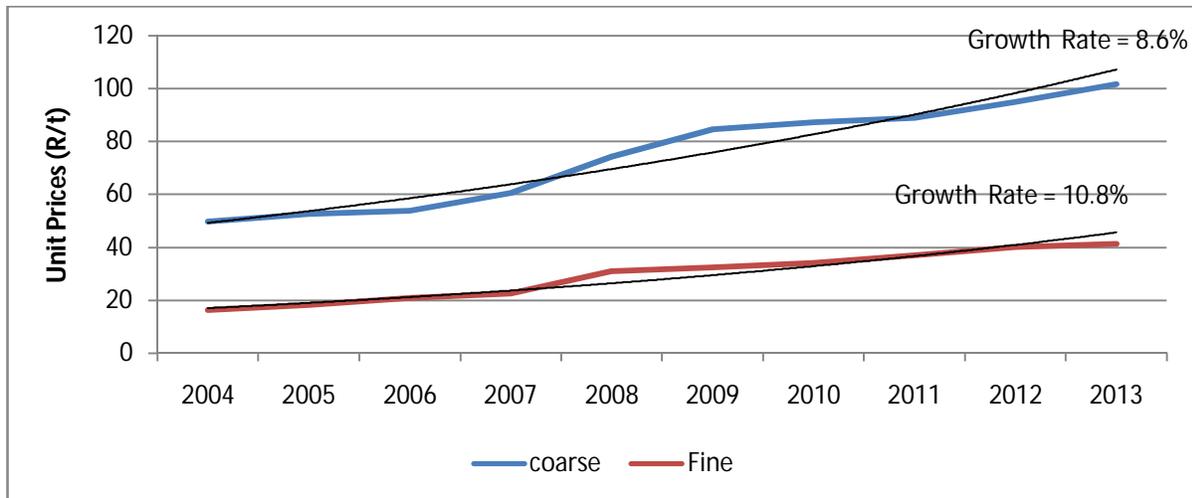
FIGURE 3: SOUTH AFRICAN SALES OF SANDS AND AGGREGATES BY VOLUME, 2004-2013



Source: Directorate Mineral Economics

Prices of both fine and coarse aggregates displayed annual growth averages of 10.8 and 8.6 percent respectively on the back of modest recovery in the construction industry (Fig 4).

FIGURE 4: AVERAGE UNIT PRICES OF SANDS AND AGGREGATES, 2004-2013

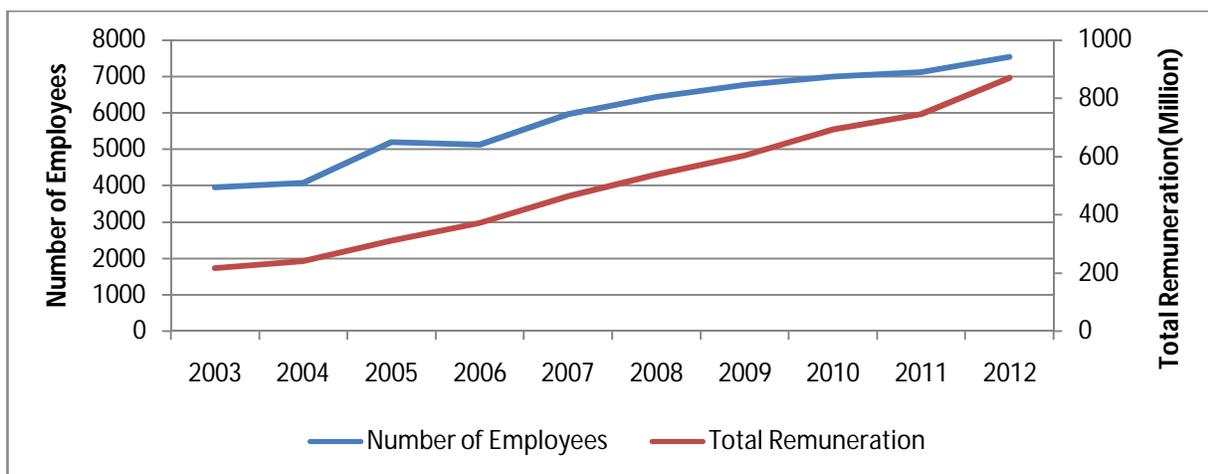


Source: Directorate Mineral Economics

## 6. EMPLOYMENT

Employment in the sand and aggregate industry increased by 5.9 percent and remuneration by 16.5 percent over the past ten years, as a result of additional quarries coming online (Fig 5).

FIGURE 5: SOUTH AFRICA'S AGGREGATE AND SAND EMPLOYMENT AND REMUNERATION, 2003– 2012



Source: Directorate Mineral Economics

## **7. ENVIRONMENTAL IMPACT**

Some of the environmental disturbances created by quarrying are caused directly by engineering activities during aggregate extraction and processing. The most obvious impact of quarrying is a change in geomorphology and conversion of land use, with associated change in visual scene. The major impacts on the environment may include increased dust, noise, and vibrations, increased truck traffic near aggregates operations, visually and physically disturbed landscapes and habitats and affected surface or groundwater.

The geologic, hydrologic, vegetative, climatic, and man-made characteristics of an area largely determine the potential environmental impacts of aggregates production. Effects such as dust, noise, and vibrations are typical of nearly any construction project. These impacts commonly can be controlled, mitigated, or kept at tolerable levels and restricted to immediate vicinity of an aggregate operation by using available technology. In South Africa, it is a legal requirement that each project that will result in a negative impact on the environment needs to have allocated funds for rehabilitation before an operation can commence as stipulated by the Mineral and Petroleum Resources Development Act. Unfortunately, not all quarries are registered and illegal operations continue to pose a threat to the environment. However, the Department of Mineral Resources has embarked on a project to encourage illegal operators to register, as some of these are small scale miners without much information about mining requirements and processes.

## **8. OUTLOOK**

South Africa's construction industry is experiencing a period of stagnant growth, owing to overcapacity in the current environment of reduced demand for construction services. However, the subdued conditions are expected to improve in future, reinforced by government's continued commitment to infrastructure development, alongside the principles set out in the National Development Plan (NDP). The NDP primarily focuses on putting in place measures that will contribute to the country's economic transformation. Despite sluggish domestic performance and prolonged global economic uncertainty, the South African government has been able to expand social services and improve infrastructure delivery. Government spending on infrastructure amounted to R1 trillion over the past five years and will be R847 billion over the 2014/15- 2016/17 medium-term expenditure framework (MTEF) period. Priority will be given to programmes to eradicate school infrastructure backlogs, the upgrading of informal settlements, public transport systems and refurbishment of clinics and hospitals, all of which will drive demand for construction materials including aggregate and sand.

The National Infrastructure Development Plan developed by the Presidential Infrastructure Coordinating Commission (PICC), which was set up to coordinate infrastructure expenditure between the three different spheres of government is a positive signal for the future growth in the construction industry. As outlined in the National Development Plan (NDP) the government is planning to spend 10 percent of Gross Domestic Product (GDP) for public infrastructure investment which will boost the construction industry in future and raise demand for aggregates and sands. The PICC has streamlined infrastructure projects into 18 Strategic Integrated Projects (SIPs) intended to transform the country's economic landscape and creating a significant number of new jobs.

Future demand for aggregates and sands is expected to be driven by SIPs projects, which will require huge volumes of quality raw materials closer to development sites in the case of civil construction. Hence, the South African Council for Geosciences has embarked on a study along the Durban-Gauteng freight corridor to produce an aggregate and sand map showing the technical properties and quality of required raw materials within the proximity of construction sites. The information will contribute to capacity building by ensuring long term supply of aggregates, engineering materials and addressing issues that will have a negative impact on the environment.

The growth outlook for the construction industry remains positive on the back of projected increases in infrastructure spending by government from 9.6 percent in 2012/13 in nominal terms to 14 percent in 2014/15. This could ultimately raise demand for aggregate and sand. Furthermore, growth in the construction industry could be facilitated by the implementation of the Infrastructure Development Bill, which aims to facilitate coordination and accelerate the implementation of the identified strategic infrastructure projects.

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