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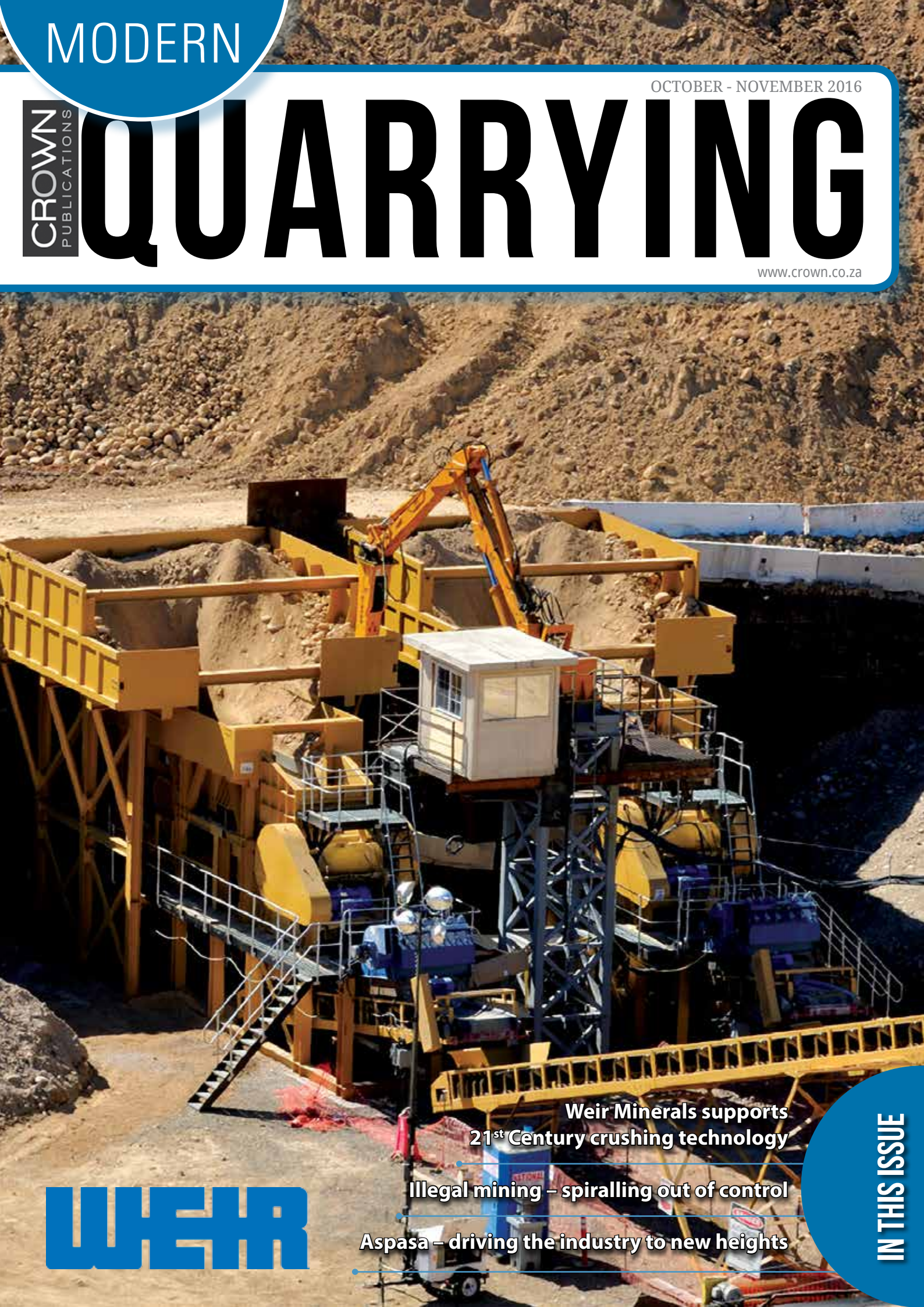

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Weir Minerals supports 21st Century crushing technology

Illegal mining – spiralling out of control

Aspasa – driving the industry to new heights

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Crown Publications cc
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Bedfordview, 2008
Tel: +27 11 622 4770
Fax: +27 11 615 6108
www.crown.co.za

Average circulation
2 521

Printed by:
Tandym Cape

www.modernquarryingmagazine.co.za

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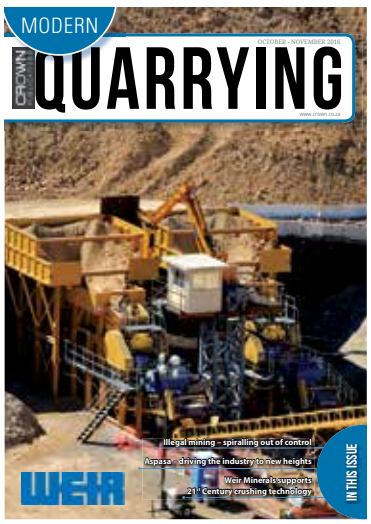

ON THE COVER

Quarries need to produce aggregates at the lowest cost-per-ton without affecting the overall quality of the product. To do this, operators need to take a long-term strategic view when purchasing crushing equipment. Quarry operators should ensure that the crushing machine selected is fit-for-purpose and meets the exact requirements of their operation; this is where **Weir Minerals** comes in.

See full story on page 8.

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Pious attention to BEE is not helping job creation

A company I have respected throughout my career as a mining journalist is Bell Equipment which, with a history spanning six decades, has made continuous progress through its mechanical and technological innovation, it's quality and highly-efficient manufacturing, a diverse product range and the expansion of the group's geographical footprint.

I met the founder of this remarkable company, the late Irvine Bell many, many years ago, when he took me on a personal tour of the manufacturing facility. A gracious and modest man; so incredibly smart; and I recall his immense pride as we walked through the facility. In 1984, I was present in Richards Bay for the launch of the company's first articulated truck, and again in 2001 for the exciting launch of the D-series ADT.

The company employs 2 200 people around the country with 900 abroad, and sources components and services from almost 1 000 companies in SA, 250 of which are in Richards Bay. However, when it made a bid to supply Richards Bay municipality with its world-class product, it lost out to a company importing ready-made machines from Hungary, with no value add, local content or jobs. According to CEO Gary Bell, this was supposedly in the name of BEE.

Bell Equipment is SA's only major manufacturer and distributor of heavy equipment and over the past five years, has pumped around R800-million into the upgrade and expansion of its product range. However, a major challenge facing this local company is the cost of doing business in this country; an ever-increasing cost which includes import duties, regulatory controls and the costs of BEE.

Sadly, every time the municipality imports finished equipment, those supplier employees move another step closer to losing their jobs.

In the *Business Times* a week back, Gary Bell spoke to Chris Barron, and reiterated the fact that 250 companies in the town rely on the company. "Local people paying taxes and shopping here would benefit if our local municipality bought a machine from us instead of buying imports.

"But in spite of SA's high unemployment rate, regular assurances by President Jacob Zuma that creating jobs is his priority, and commitments to the ratings agencies that the government will prioritise job creation – having the right number of points of the BEE scorecard trumps jobs every time."

He points out that less than 3,0% of the company's business done in SA comes from the public sector. "We don't get any preference at all from local municipalities. The way that these tenders are adjudicated has very little to do with local production or local jobs."

The Bell Equipment division comprising 22 sales outlets across the country is BEE compliant. Bell's BEE partner exited last year, and the company is about to confirm a new deal. However, the bulk of its product comes from small and medium-sized entities that are not compliant to the same extent.

Bell believes this is a legacy of the past. "There's a huge shortage of engineering skills, which starts at school level where maths is a problem. It will be 20 years before we get the right number and quality of engineering people coming through our colleges and universities."

Most of the product produced at its Richards Bay plant is for markets in Germany, the US, UK and Russia where BEE compliance is not an issue. The irony is that Bell Equipment would be more compliant if it shipped products from its German factory to its South African company. "Because the product would then be imported and not made here, we'd get a higher BEE rating," Bell says. "Any of our competitors who bring a product from overseas get a better BEE rating because they import.

"If you procure from a local entity that does not have the highest BEE rating, you're disadvantaged."

He would like to see BEE scorecards giving more preference to local products and local jobs. "A lot of people don't understand what our value add is in this country. We have a huge multiplier effect. Every time we sell a piece of machinery in this country, there are 980 companies deriving some benefit. However, at a local government level there's not a very good understanding of the multiplier effect."

Doing business only with companies that score the highest business points is not helping job creation, and this challenge affects most local businesses in South Africa.

Mining sector needs to grasp missed opportunities

Signs of resurgence in platinum, a stronger gold price and growing coal exports to India should be triggers for South Africa's mining leadership to grasp the opportunities it missed in the last commodity boom, according to consulting engineers and scientists SRK Consulting (South Africa).

"It is time for the mining sector to get some traction from the National Development Plan, Mining Operation Phakisa and the Mining Lekgotla – all crucial initiatives that have yet to be given real substance," says Marcin Wertz, partner and head of the mining unit at SRK Consulting. "Technical, social, labour and policy issues have to be resolved urgently – so strong leadership is now vital if we want to catch the next upturn."

Wertz says that stemming job losses is a national priority, and mines can only do this if there is better collaboration toward the common goal of economic sustainability.

"SA mines face serious technical and cultural changes if they are to survive," says SRK partner and principal consultant Andrew van Zyl. "There is a younger generation of professionals who can do this if they are supported by a conducive and more cooperative environment, but changes in attitude are essential. We cannot keep kicking this can down the road and leaving our successors to solve the sector's problems."

Van Zyl cautions that SA's mature mining industry is not well placed to create more jobs in future; however, better-paid jobs that demand higher-level skills and technology are on the cards as mines are forced to raise productivity.

The more likely source of future employment growth is in mining's supply sectors, says Wertz, especially those focused outwardly at the substantial unexplored potential in other parts of Africa. He says there are already early signs of renewed interest in Africa among explorers and developers who see the value in preparing well in advance of an economic recovery.

"SA's support sectors, from mining machinery and technology to engineering skills and local experience, have much to offer the continent," he says, "as our local solutions today have to address not just the technical demands of mining, but broader challenges such as local economic development, empowerment and migrant labour. These are common themes throughout Africa."

Many clients appreciate working with SA companies which have experience around the continent, according to Van Zyl, especially as projects became larger and more complex. "These more ambitious projects require lengthy stakeholder engagement and familiarity with different regulatory and policy regimes. Generally speaking, SA has walked many miles on a mineral journey that some African countries have yet to begin."

Van Zyl emphasises the developmental potential of successfully exploited bulk minerals in Africa, which demand local, national and even cross-border regional infrastructure that precious metals like gold and platinum can often do without.

"Large mines extracting commodities like iron ore or bauxite – when planned with consultation, patience and detailed investigation – can leverage public and private funding for considerable national advantage," he says. "Public sector provision of rail lines and harbours, augmented by mine-related products and services from the private sector, leads to positive knock-on effects that ripple through the whole economy."

Indeed, he adds, the constrained financial climate provides much-needed breathing space for mining companies and governments to consider, plan and discuss ambitious mining opportunities – especially those requiring intricate contractual arrangements among many participants. "A good pre-feasibility study, for instance, is not a costly exercise but can lead to huge savings –by helping optimise a planned operation, by facilitating meaningful negotiations with stakeholders, understanding options should the macro environment change or by preventing the wastage of much greater sums," says Van Zyl. "But to rush the planning process opens the door to considerable risk that Africa's struggling mining sector can ill-afford."

www.srk.co.za

Marcin Wertz, partner and head of the SRK Consulting's mining unit.

SRK partner and principal consultant Andrew van Zyl.

ARC makes offer for stake in Afrimat

African Rainbow Capital (Pty) Ltd (ARC) has made an offer to purchase an 18,36% stake in Afrimat Empowerment Investments. The transaction is subject to various conditions precedent, including the participants of the Afrimat BEE Trust voting in favour of the offer.

ARC is a fully black-owned and controlled investment company focusing on delivering exceptional returns on equity. It is a strategic long-term investor with no predefined exit strategy. "It invests in businesses that can grow exponentially or acquisitively and ARC can enable and accelerate this growth by providing funding where necessary," says Afrimat CEO Andries van Heerden.

"Afrimat is of the view that this will create a long-term and sustainable BEE partner with certainty around shareholding which will build further value for us," he says, adding that "ARC has also shown a willingness in wanting to work with Afrimat on our proposed growth strategy."

The purchase of Afrimat shares by ARC will facilitate the settlement of all debt outstanding in relation to the Afrimat shares held by AEI and the distribution of the economic benefits under the current scheme to its participants, who are all black employees. The transaction is subject to a number of conditions precedent which includes approval of the offer by the participants of the Afrimat BEE Trust.

ARC has agreed to be locked in for at least four years on successful conclusion of the purchase of the Afrimat shares.

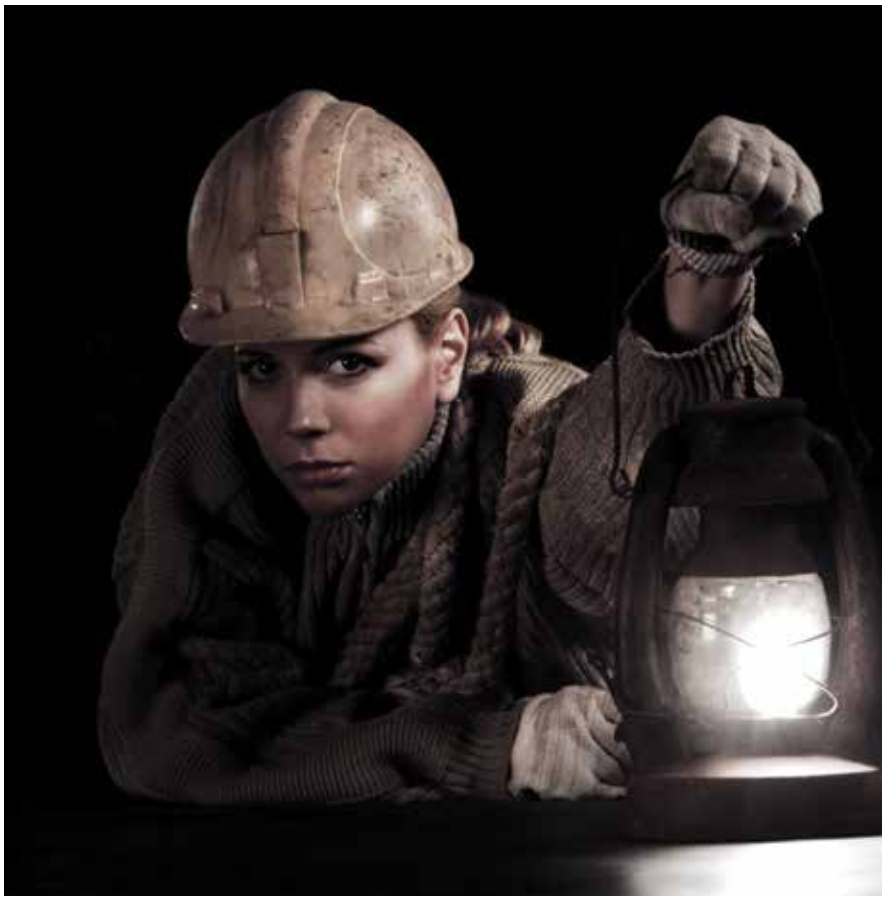
In order to facilitate the purchase of Afrimat shares by ARC, the current trust deed of Afrimat BEE Trust is being amended. These changes will be sent to Afrimat shareholders in a circular and will also be provided to scheme participants for approval.

ARC is owned by Ubuntu-Botho Investments, which is in turn owned by Patrice Motsepe's family trust, along with a number of broad-based empowerment groupings and the Sanlam Ubuntu-Botho Community Trust.

www.afrimat.co.za

Industry committed to transformation

Chamber of Mines president Mike Teke recently reaffirmed the industry's commitment to transformation at the recent Electra Mining Innovation in Mining workshop hosted by Women in Mining South Africa (WiMSA). The representation of women in the mining sector has improved significantly from around 11 400 in 2002 to some 53 000 women working in the mining industry in 2015, with women now representing more than 10% of people employed in mining activities.



We have to be able to work in a world where skin colour and gender are not an impediment to people's dreams and aspirations.

According to Teke, in a transforming country, mining is continually challenged to deliver on its transformation objectives and that the empowerment of women is critical. While the industry acknowledges the significant increase in the number of women in the sector since the laws preventing them for working underground were scrapped, more needs to be done to ensure that yet more women feel that the mining industry is one in which they have a career and a future.

"We have to be able to work in a world where skin colour and gender are not an impediment to people's dreams and aspirations. Until we get there, we are going to have to create a level playing field. And that means transformation programmes that must be put in place, and must work.

"Lip service is simply not an option, let's make way for lipstick," he says on a lighter note.

www.chamber.co.za

Condition monitoring firm expands

South African-based condition monitoring company WearCheck has opened two more cross-border laboratories, bringing to 13 the number of laboratories operated by the company, in nine countries.

Electrical operations and other industrial concerns in Zimbabwe now have their very own local WearCheck laboratory, right on their doorstep.

WearCheck recently acquired the long-established oil analysis laboratory in the form of Harare-based Tribology Services, and brought it into the WearCheck fold. The Zimbabwean laboratory has been operating for 27 years, and already services a wide range of clients. Now, as well as traditional oil analysis, WearCheck Zimbabwe also conducts thermography, vibration analysis, balancing, laser alignment, motor current analysis and milling. WearCheck Zimbabwe offers on-site sampling, as well as a 24-hour sample turnaround.

In addition to the new laboratory north of the border, the company also headed west, and recently opened an on-site condition monitoring laboratory in Namibia, at the Husab Uranium Project. Swakop Uranium, owners of the mining operation, awarded WearCheck a five-year contract to supply and operate an on-site laboratory for the mine.

As an open-pit mining operation, Husab uses the conventional truck and shovel mining method. WearCheck's laboratory is well-placed to maintain the plant used in this process – including a huge scale of loading and hauling equipment – at optimum output capacity. This aligns perfectly with the company's target to help save customers time and money through reliability solutions for plant maintenance.

The Namibian laboratory was set up as part of a joint venture with sister company, Set Point Laboratories, who built and supplied the assay side of the laboratory.

This year the company celebrates its 40th anniversary of condition monitoring excellence.

www.wearcheck.co.za

The brand new Husab oil analysis lab at Swakop Uranium is kitted out with a full complement of laboratory instruments.

Atlas Copco gets down to earth

Atlas Copco South Africa employees rolled up their sleeves and got down to earth, planting trees as part of their 67 minutes in honour of the iconic Nelson Mandela. In partnership with Save the Planet, the company assisted with the planting of 12 River Bush Willow trees on the sports fields and playgrounds of Isaac Makau Primary School in Benoni.

School Principal Derrick Moeketse reached out to Save the Planet for assistance in providing trees to green the school's environment so that the learners will have shade which is particularly important during the hot summer months.

Save Our Planet – Plant a Tree is a registered non-profit organisation that was founded by Jonathan Richmond in 2012 with the sole objective of greening South Africa. With the assistance of sponsorships, the organisation provides on average 1 500 school children with 'tree gifts' on a monthly basis. "With 75 000 trees already in the ground, we are half way in realising our mission to plant over 150 000 trees around Gauteng," Richmond says, adding that Atlas Copco was the perfect partner for this initiative.

www.atlascopcogroup.com

Planting trees to honour Madiba: ***From left:*** *Kgothatso Ntsie , Atlas Copco Corporate Communications manager, South and sub-Sahara; Bongani Ndlovu, admin assistant, Atlas Copco Holdings; Deborah Laforte, HR manager, Secoroc; Amukelani Mhlongo, financial controller, Secoroc; Marilyn Govender, Supply Development manager, Atlas Copco Holdings; Claudette Schwartz, financial manager, Atlas Copco Holdings; and Johnathan Richmond, founder of Save our Planet.*

Komatsu to acquire Joy Global

Joy Global has approved a definitive merger in terms of which Komatsu America Corporation, a subsidiary of Komatsu Limited, will acquire the company in a US$3,7-billion transaction.

Komatsu intends to operate Joy Global as a separate subsidiary of Komatsu and retain the strength of the Joy Global brand names. The companies will align the organisation and operation for optimal customer support from Joy Global's headquarters in Milwaukee, Wisconsin.

www.komatsu.com

Construction materials expertise hotspot

Not only is Roodepoort in Johannesburg, Gauteng, home to the AfriSam state-of-the-art clinker grinding plant, it is also a hotspot of construction materials expertise.

AfriSam's Centre of Product Excellence is a major driver of innovative cement, aggregate and readymix products and has become a critical point of technical support to South Africa's construction industry. Consulting engineers, architects and contractors have all relied on the Centre of Product Excellence's extensive resources to provide invaluable advice on the use and application of AfriSam's building materials.

The Centre of Product Excellence is home to 15 technical personnel with almost 200 years of combined experience and a SANAS ISO 17025-accredited laboratory. The laboratory is used to test raw materials to optimise concrete mix designs and test products to help customers build better. This is over-and-above being put to good use in AfriSam's own product development programmes. It is used to undertake physical, chemical and material tests to verify and monitor its own cement products' quality

Mike McDonald, manager of the Centre of Product Excellence, says that the facility has recorded many milestones since it started operating in 2012. One of the most important of these is the valuable role it has played in assisting precast concrete manufacturing start-ups.

As he notes, the complexities of working with aggregates and admixtures can be daunting in the beginning for many of these fledgling companies. Equally important is the role the centre is playing in ensuring quality of concrete works, by using its thorough understanding of cementitious products to investigate the failure of concrete products. It recently started exporting this aptitude to other countries on the continent, such as Zambia.

Last year alone, the Centre tested 859 external concrete samples, undertook 86 durability tests and crushed more than 13 000 cubes for strength testing, while testing 150 concrete mixes to monitor the performance of other company's products. It is also focusing on innovative ways of building that challenge conventional brick-and-mortar projects in South Africa, while spearheading ongoing product development into 'greener' concrete mixes and construction practices.

The Centre of Product Excellence, for example, continues its work in reducing the CO_2 footprint and embodied energy of AfriSam's products. This includes ongoing studies geared at reducing the clinker content of cement. Last year, the centre undertook 30 comprehensive tests to monitor ash performance in concrete and 90 tests to assess the performance of slag in the material.

Clearly, McDonald and his team are not only at the forefront of new product innovation, but making sure that AfriSam transfers industry-leading skills to keep its customers at the cutting edge of construction.

www.afrisam.co.za

Last year alone, the Centre of Product Excellence tested 859 external concrete samples, undertook 86 durability tests and crushed more than 13 000 cubes for strength testing.

Weir Minerals supports 21st

Quarries need to produce aggregates at the lowest cost-per-ton without affecting the overall quality of the product. To do this, operators need to take a long-term strategic view when purchasing crushing equipment. Most importantly, these operations ideally require equipment from an Original Equipment Manufacturer (OEM) capable of not only providing an optimal crushing solution but also able to supply the highest level of customer support for the full life of the operation.

Maximum throughput at minimum downtime is a maxim that is often used; however achieving this requires more than just purchasing quality crushing equipment, according to JD Singleton, general manager Trio crushing and screening equipment at Weir Minerals Africa.

Singleton says that quarry operators need to ensure that the crushing machine selected is fit-for-purpose and will meet the exacting application requirements of their particular operation.

Weir Minerals Africa has a dedicated team of crushing and screening application engineers who are tasked with visiting the customer's site where a full assessment of the crushing operation is conducted. This takes factors such as the feed size of the material, product type, the capacity required, product sizes required, shape of material, hardness and moisture as well as the available infrastructure including power and footprint into account.

This information is used to select the most appropriate crushing equipment solution that will best meet the needs of the operation. Weir Minerals boasts an extremely comprehensive portfolio of crushing and screening machines catering for all ore bodies with capacities from 50 tph to 1 500 tph.

In line with the company's customer support strategy, local technical and engineering support is available directly from its Isando facility.

"This is a major advantage to customers as having the team of applications engineers and engineering support at the same premises means individual solutions can be optimised for customer-specific needs," Singleton says. "This means that a custom-engineered solution will be provided and customers can be assured that the operation's exact crushing needs will be met."

This high level of support from Weir Minerals Africa is carried all the way through to on-site commissioning as well as ongoing aftermarket support. A dedicated aftermarket support structure with teams that understand the customer operations, are on the ground visiting these sites to assist with and plan for preventative maintenance. Customers have ready access to technical support as well as a good off-the-shelf availability of consumable spares and wear parts.

Rasheel Sukdhoe, product manager Trio crushing and screening equipment at Weir Minerals Africa, says that significant research and development has been undertaken on those products that have the greatest impact on customer operations. "Notably, these are our Trio TP cone crushers and our Trio Vertical Shaft Impact (VSI) crushers, as these machines are responsible for producing final product and therefore directly impact on the operation's revenue stream."

Both cone crushers and vertical shaft impact crushers are integral to the final product quality at quarries and the application of appropriate crushing technology in these areas will allow operations to

Trio TP series cone crushers are designed to allow for maximum mobility without sacrificing versatility or crushing force.

Century crushing technology

increase their flexibility and, more importantly, reduce operating costs.

Trio Top Performance (TP) cone crushers

The Trio TP cone crusher has been engineered with a unique combination of high crushing force, high throw and high pivot point; these characteristics facilitate continuous performance and allow the operation to maximise its return on investment.

The machine has a steep crushing chamber angle, a large crushing stroke, and operates at optimum speed to deliver a finer product. The high pivot point provides a greater reduction ratio at the top of the head, resulting in greater flexibility in feed size and higher production. The large throw crushing action facilitates maximum throughput and increased interparticle breakage.

"The crusher is 10% heavier than comparable machines, allowing it to accommodate an increased throw," Sukdhoe says. The robust three-arm frame design, inside the one-piece cast high strength alloy steel mainframe of the Trio TP cone crusher, provides more discharging space for the crushed material. It also reduces material build up inside the machine.

A number of integral self-protecting features provide high levels of mechanical reliability in the harshest operating conditions. One such feature is the unique anti-spin device which provides continuous proper alignment of bearings inside the crusher.

Sukdhoe explains that this device ensures that the machine will instantly crush rock as it is introduced to the crusher.

The advanced hydraulic system on the Trio TP cone crushers features pre-charged accumulators and relief valves. This ensures the safety of both operator and equipment. The fully-integrated hydraulic console is equipped with push buttons for monitoring and controlling the crushing force, bowl thread clamping and crusher Closed Side Setting (CSS) adjustment.

A 250 tph modular Trio aggregate plant installation in East Africa.

The Trio TP cone crusher is equipped with temperature, flow and pressure sensors that are integrated into a cloud-based data management system. "This allows the creation of an individual crusher maintenance and operating profile, further enhancing performance and reducing operational costs," Sukdhoe says.

Ease of maintenance and servicing has been addressed through the design of the machine. The compact countershaft box assembly with pinion gear can be easily removed without disassembly of the crusher. This also provides a more structurally stable machine.

The Trio TP range of cone crushers can be installed as a single machine or combined with a full product line of Trio crushers, screens and conveyors to provide total solutions for stationary, portable or modular plants.

Trio Vertical Shaft Impact (VSI) crusher

Engineered for use in tertiary or quaternary stage crushing, the Trio VSI crusher is suitable for a wide range of applications including the production of high quality manufactured sand and premium shaped aggregates.

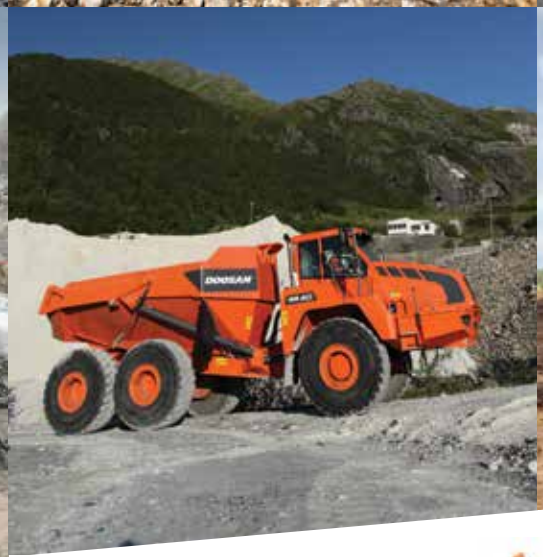
JD Singleton, general manager Trio crushing and screening equipment at Weir Minerals Africa.

Rasheel Sukdhoe, product manager Trio crushing and screening equipment at Weir Minerals Africa.








Construction Equipment

DOOSAN. The closer you look, the better we get.

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www.doosan.co.za

DOOSAN

Timdrum 160/79

Featuring advanced open table designs, multi-port rotors and a larger bearing capacity than most other VSI crushers in the industry, the Trio VSI crusher is capable of achieving high throughput while offering reliable and cost-efficient performance.

The large receiving hopper facilitates easier feed conveyor placement while the adjustable feed diverter ensures even feed distribution into the crusher. An important feature is the externally adjustable feed tube which allows adjustment without opening the crusher. The convenient inspection door mounted in the lid allows safe and easy inspection.

Sukdhoe says that the Trio VSI crusher is available with three different interchangeable chamber configurations. "This allows for maximum application flexibility and the Trio VSI crushers have consistently demonstrated their ability to produce high-quality cubical aggregates," he says.

Steel-on-steel configurations are suitable for crushing non-abrasive materials in secondary and tertiary crushing applications with larger feed sizes, while a rock-on-rock configuration is best where additional fines or shape of material are required. Rock-on-steel configurations are used for crushing low abrasive materials where a higher rotor speed is necessary to achieve additional fines production.

Fully customisable to meet individual operation requirements, the crushers can operate in either open or closed circuits, dependent on the type of performance required.

An independent modular oil lubrication system with built-in heating and cooling ensures optimum bearing lubrication. A flow meter and temperature sensors with interlock safety shut switches provides protection for the bearings.

An integral vibration protection system that includes a maintenance alarm alerts personnel to potential problems. In the event that excess vibration occurs, the vibration switch will shut down the crusher to protect it from possible damage.

A further safety feature is the micro switch incorporated into the lid lift. This prevents the crusher from starting up during inspection or maintenance.

Weir Minerals is known for its design, engineering and manufacturing capabilities, and Singleton says this plays an important role in ensuring the crushing machines provide reliable performance while reducing overall cost of ownership.

"By partnering with customers from design through to final decommissioning, our skilled personnel are able to devise the best crushing solution to meet customer requirements including the production of a quality product for the quarry owner," Singleton concludes.

www.minerals.weir

A customised Trio modular crushing and conveyor system.

All types of infrastructure requires restoration as a result of wear and tear from use or climate; haulroads are no different.

Haulroads can make money

by AT Visser, Department of Civil Engineering, University of Pretoria

The objectives of this paper are to present a critical review of the status of mine haulroad design and management, and the impact that these principles have made on operations, particularly as far as cost effectiveness is concerned.

Almost 20 years have passed since the cutting-edge research by Thompson and Visser on the design and management of opencast mine haulroads in South Africa (Thompson and Visser, 1996a, 1996b, 1998, 1999, 2000a). This system is based on three principles, namely the structural ability to support the ultra-heavy truck loads, the selection of vehicle and environmentally-friendly riding surfaces, and an appropriate level of maintenance to counteract wear and tear. Obviously, proper layout and geometry are essential.

These principles have been implemented worldwide, and it is useful to review the lessons learned. This paper will briefly review the principles of the process and the extent to which they are applicable. Case studies of a number of implementations will be presented to demonstrate that the principles are sound and have been used effectively. Besides the implementation on opencast operations, the principles are equally valid for underground applications, and initial development will be discussed.

The focus of the proper design of a haulroad system is the following:

- The provision of safe, world-class roads for all roads users (safety is non-negotiable).
- Reduced truck operating costs due to less stress on the drive train, tyres, frame and suspension, resulting in extended component life.
- Faster cycle times leading to higher productivity and lower cost per ton, because of higher asset utilisation.
- More effective utilisation of road maintenance equipment through a managed approach to routine road maintenance.

Geometric layout

The layout of the haulroad network has to be tailored to the mining requirements. This often leads to a conflict in requirements, as the ideal layout in terms of vertical gradients and horizontal curvature is not always achievable. The guiding principle should be that the haulroad should permit the haul trucks to operate at maximum efficiency. The horizontal curves must be of the largest possible radius to allow the trucks to travel at maximum speed without causing undue damage to the road.

A limitation is the curve radius at switchbacks. Invariably there is insufficient space to allow high-radius curves, and the result is severe road damage as the truck wheels scuff around the curve rather than rotate, leaving loose material on the surface which affects traction and increases rolling resistance. A major complication that has been encountered is that switchbacks have too small a radius when a larger truck fleet is introduced, and there is no space to increase that radius.

The result is that the truck has to make a three-point manoeuvre to negotiate the switchback. This is extremely dangerous and affects productivity. At the time of planning the mine layout, all switchbacks need to be such that a larger truck, which has a larger turning radius, can be accommodated.

Trucks are happiest when an incline has a constant gradient. *Figure 1* shows (red line) a typical gradient out of a pit

across the various benches. At every gradient break, which may range from 8,0% to 13%, the truck has to change gear, and under load this places great strain on the drive train. Every time the torque converter is engaged, the wheels spin momentarily and cause damage to the road surface. Since all trucks will change gears in the same area, there is a perpetual maintenance problem that cannot be resolved.

The solution is to ensure that the gradient is continuous and uniform, as shown by the green line in *Figure 1*. This may be readily achieved by overdrilling on the outer part of the bench, so that the correct gradient can be constructed with ease. As an example, considering a 389 t class of rear dump truck running up the ramp where the grade of the road varies between 8,0% and 13%, with a 3,0% rolling resistance. This road 'design' will allow a fleet of seven trucks to transport 340 t/truck per hour.

However, by removing the grade breaks (using a constant 10,3% grade from bottom to top), 470 t/truck per hour can be transported – an increase of 38% or 500 000t/a. If an annual excavation target of 10-million t were set, by using an improved road and construction guideline, the target could be achieved with five instead of seven trucks.

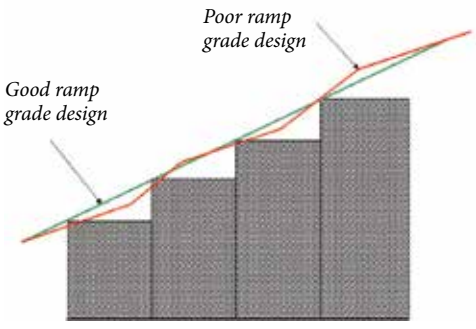

Figure 1: Incorrect (non-uniform) and correct (uniform) gradient.

At the mine planning stage, a minimum cost approach is often taken. This means that the road layout is designed to a minimum standard, and this includes road width. Due cognisance is not taken of the geotechnical considerations, such as stability of the pit slopes. Serious problems have been encountered when a rockfall or slip has resulted in either a road being closed, or the road is narrowed such that transport operations are impaired.

Most opencast operations have at least two haulroad exits from the pit due to safety considerations, and a road closure could have serious implications. Where only a half-width of road is open to traffic there is potential conflict and the accident risk is increased; productivity is affected as trucks have to wait at the narrowing. Road width could also be a factor when a larger truck type is introduced. It is safer to build the roads wider than narrower so that potential complications are minimised.

At a coal mining operation in South Africa, savings of about 1-million ℓ of diesel were made in the year following improvement of the non-uniform gradients and curve radii, without any change in the annual volume of material transported. This is a direct saving and does not include improvements in engine and tyre life. Excessive transmission shifting on the laden haul will reduce engine, drive-train and wheel motor life. On the empty return trip, retarder overheating will occur on the non-uniform gradient with concomitant mechanical wear. These aspects demonstrate the significant savings that can occur by optimising the haulroad geometry.

Road structural considerations

The structural design principles are based on limiting the vertical compressive strains in any layer of the road pavement structure under the highest wheel loads. This is computed using a multilayer linear elastic computer program.

The basis for this approach is from structural analysis of public roads (Thompson and Visser, 1996a, 1997). From an investigation of haulroad structures, the limiting criteria and the design approach using a dump rock structural layer resulted in the comparison and benefits of the new approach, as shown in *Figure 2*.

For comparative purposes, two design options were considered: a conventional design based on the CBR cover curve design methodology, and the mechanistically designed optimal equivalent, both using identical in situ and road construction material properties. A Euclid R170 (154 t payload, 257 t GVM) rear dump truck was used to assess the response of the structure to applied loads generated by a fully-laden rear dual-wheel axle. The assumption, based on multi-depth deflectometer measurements on other roads, was that no load-induced elastic deflections occur below a depth of 3 000 mm. The various design options are summarised in *Figure 2*.

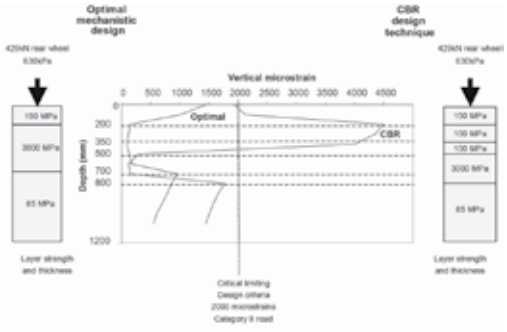

Figure 2: Comparison of new mechanistic design method results with the old CRB method (Thompson and Visser, 2002).

In the evaluation of both designs, a mechanistic analysis was performed by assigning effective elastic modulus values to each layer and a limiting vertical strain corresponding to a Category II road (2 000 microstrain). In the case of the CBR-based design, from *Figure 2* it is seen that the excessive vertical compressive strains were generated in the top of layers 2 and 3, which are typical gravel layers, whereas the rock layer is buried under the weaker gravel layers.

For the optimal mechanistic structural design, no excessive strains were generated in the structure, due primarily to the support generated by the blasted rock base. Surface deflections were approximately 2,0 mm compared with 3,65 mm for the CBR-based design which, while not excessive, when accompanied by severe load-induced strains would eventuallly initiate premature structural failure such as rutting and depressions.

The proposed optimal design thus provided a better structural response to the applied loads than the thicker CBR-based design and, in addition, did not contravene any of the proposed design criteria.

Originally, a single vertical compressive strain criterion was used, but it was realised that, depending on the

importance and anticipated life of a road section, the structural design has to be different even though the same traffic volume is carried. The importance of a road section is designed by road category, as shown in *Table 1*, and the structural strength in terms of the vertical compressive strain is related to the road category and expected performance. The daily traffic (kt) is adjusted by multiplying with the performance index, and the permissible vertical strain is shown in *Figure 3*. For an adjusted traffic volume greater than 240 kt, a vertical compressive strain of 900 microstrain should be used. Most South African operations are in the lower range of traffic volume, but many international operations are considerably higher.

These design procedures were developed based on observations of existing haulroads and monitoring the in-depth deflections. Subsequent to the development of the analysis procedures, at least 10 roads were constructed following the mechanistic design method, and during the extremely wet summers of 1996 and 2000, superior performance and traffic load was reported compared with the previously existing roads. In one particular base, the improved traffic load of the road meant that the planned implementation of trolley-assist could be further delayed by virtue of reduced road construction and improved hauler productivity.

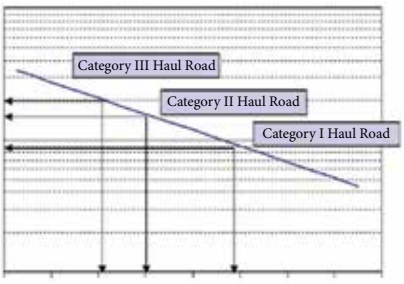

Figure 3: Limiting vertical strain related to road importance and category (Thompson and Visser, 2002).

In many cases the improved quality response was anecdotal. As part of the ongoing research, several of the roads that were constructed were monitored and in-depth deflections under haul truck loading were taken at two mines. The latter procedure was fraught with problems since, on one mine, it was difficult to drill a 40 mm hole through the hard rock layer with many voids. Nevertheless, at the other mine, measurements were obtained that confirmed the stiffness of the rockfill layer, but at the lower range of previously determined values. Stress sensitivity was confirmed, which meant that the higher the load the stiffer the pavement structure. This is valuable information when a larger truck fleet is introduced.

On the basis of the research, a number of greenfield haulroads were designed and constructed in South Africa as well as in Botswana, Namibia, Brazil, Chile and Australia. Invariably the contractor will be of the opinion that it is 'a solid road'. As pointed out above, surface deflection of the road under a haul truck is reduced. This means that the deflection bowl is reduced in extent, and this in turn has the result that the tyre does not have to climb out of the bowl, which reduces fuel consumption.

In Thompson and Visser (1996a), it was demonstrated that the design based on the mechanistic procedure was 28,5% cheaper than the old method on an actual tender for variable costs, and 17,4% cheaper on total costs (including preliminary and general costs). At Khomamani iron ore mine in the Northern Cape, a significant saving was made on the main haulroad construction compared with the budgeted costs. This saving was applied to improve other parts of the road system.

This design procedure has been applied at several mines to investigate whether the haulroads are able to support larger trucks than were then used, and if not, how the deficiencies could be improved. This allowed planning for larger trucks to proceed, without surprises when the trucks arrived. The same procedures have also been successfully applied in designing a dragline to walk from one mine to another. Without the theoretical understanding, such major undertakings would not have been possible.

Finally, the concept of a dump rock layer as a strong structural layer (stiffness values were derived), has provided a solution for underground haulroads. Underground tunnels have an uneven footwall as a result of the drilling and blasting technique, and significant quantities of water tend to pond in the lower points. This water causes fine material to be pumped out through the concrete slabs under the action of the heavy loads, leading to voids in the layers and faulting, cracking and potholing of the concrete wearing course. The use of dump rock with minimal fines provides a layer that is strong and water resistant, and no pumping takes place. Initial experimental sections have shown promise, and further work is being planned.

Functional design

The functional design is related to providing a user-friendly wearing course material. An ideal wearing course for mine haulroad construction should meet the following requirements:

- The ability to provide a safe and vehicle-friendly ride without the need for excessive maintenance.
- Adequate traffic load under wet and dry conditions.
- The ability to shed water without excessive erosion.
- Resistance to the abrasive action of traffic.
- Freedom from excessive dust in dry weather.

Table 1: Summary of haul road categories (Thompson and Visser, 2002)

Haul road category	Daily traffic volume[1] (kt)	Required performance index[2]	Description
Category I	>25	7-9	Permanent high-volume main roads from ramps to tip. Operating life of at least 20 years.
Category II	8-24	5-6	Semi-permanent ramp roads, in-and-ex-pit hauling roads on blasted rock on in situ, medium traffic volumes. Operating life under 10 years.
Category III	<7	>4	Transient in-and-ex-pit roads, low traffic volumes. Operating life under 3 years.

[1]*Traffic based on maximum dual rear wheel load of 2-axle 480 t GVM haul truck.*
[2]*Based on acceptable structural performance of roads and maximum deflection under fully-laden rear wheel, where 10 = excellent performance; 1 = unacceptably poor performance, following Thompson and Visser (1996).*

- Freedom from excessive slipperiness in wet weather.
- Low cost and ease of maintenance.

By examining what wearing course material properties lead to defects, a specification has been developed for wearing course materials selection as shown in *Figure 4*. The guidelines are based on an assessment of wearing course material shrinkage product (Sp) and grading coefficient (Gc), defined as:

$$Sp = LS \times P425 \quad Gc = \frac{(P265 - P2) \times P475}{100}$$

Where:

LS	= bar linear shrinkage
*P*425	= percentage wearing course sample passing 0,425 mm sieve
*P*265	= percentage wearing course sample passing 26,5 mm sieve
*P*2	= percentage wearing course sample passing 2,0 mm sieve
*P*475	= percentage wearing course sample passing 4,75 mm sieve

Invariably, mine management wishes to know how to benchmark the haulroad network, and the effectiveness of the existing materials. A procedure was developed to relate a range of defects to provide a defect score (Thompson and Visser, 2000a). Defects are evaluated according to the severity of each defect and the areal extent of occurrence to provide a sump of all the defect products as a defect score.

The defect score can be related to the need for maintenance, as it was developed in conjunction with mine maintenance teams.

Figure 5 shows the influence of daily traffic (in kilotons) and the effect of a substandard wearing course material compared with the correct material. The maximum defect score on the mine was 60, which dictated the maintenance frequency. Interestingly, Komatsu adopted this procedure and trained their field staff to provide the mine with recommendations regarding haulroad quality and how to improve productivity, reduce costs, and get the best service out of the trucks.

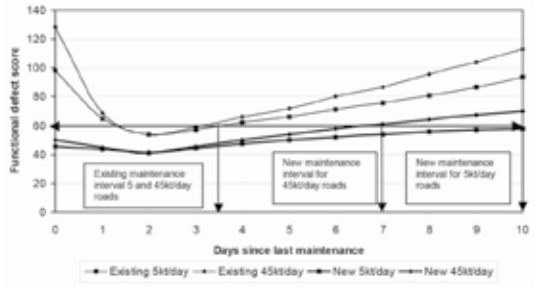

Figure 5: Predicted improvement in functionality for new wearing course material mix at 5,0 and 45 kt/day traffic volumes (Thompson and Visser, 2002).

Use of the correct wearing course material resulted in a significant improvement in the times between blading, from 3,5 days for the poor-wearing course to seven and 10 days for the improved wearing course material on roads carrying 45 and 5,0 kt respectively. Besides determining the defect score, the visual inspection of defects was also correlated to rolling resistance by considering defects such as potholes, corrugations, rutting, loose material and stoniness in

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the surface, which have an influence on rolling resistance.

Rolling resistance is an added resistance during motion as a result of energy losses incurred through the wheel/road interaction. A benchmark of 2,0-2,5% is considered as good, and rolling resistance of 6,0% was encountered on some mines.

If the rolling resistance is higher than that used during mine planning, the trucks are unable to achieve the expected productivity. In one case, a diamond mine initiated a pre-feasibility study of block caving since owing to the excessive rolling resistance, the trucks were unable to exit the 450 m deep pit when fully loaded and partial loading had to be resorted to. Replacement of the wearing course material with one that met the functional requirements resulted in the problem being solved, and block caving was postponed for a further 100 m depth.

After the successful solution of the problem, the mine manager expressed his unhappiness since a fleet of motor graders was standing idle. The symptoms of the problem, namely poor road quality and high rolling resistance were treated by increasing the maintenance activity. By means of correct design, significant savings in maintenance cost and improved production were achieved, resulting in increased profits.

When a special effort is made to obtain a suitable wearing course material, spillage that can change the material properties needs to be controlled. At one mine, it was found that liquid mud was loaded into a dump truck to try and make the loading area operable. As soon as the truck moves onto a gradient, large quantities of mud will be spilt onto the road. This is unsuitable material and generates excessive dust when dry. A further problem is that in normal operations, the truck is laden to the limit, again on the level. The material will again spill onto the road. These situations must be avoided. However, a properly-loaded, fully-laden truck may still cause spillage, and consideration should be given to attaching the movable flaps at the rear and sides to counter this problem.

Whenever problems are encountered with the wearing course material, one of the first solutions to be considered is a chemical additive, as many markets claim that the product will improve the road quality. *Figure 6* shows the annual costs for the existing inferior wearing course gravel when treated with water and with a chemical additive. Clearly, there is a reduction in cost. However, using better quality gravel that meets the requirements results in significant savings compared with the existing gravel treated with the additive. However, a minimal reduction in cost is found when applying the additive to the new wearing course gravel.

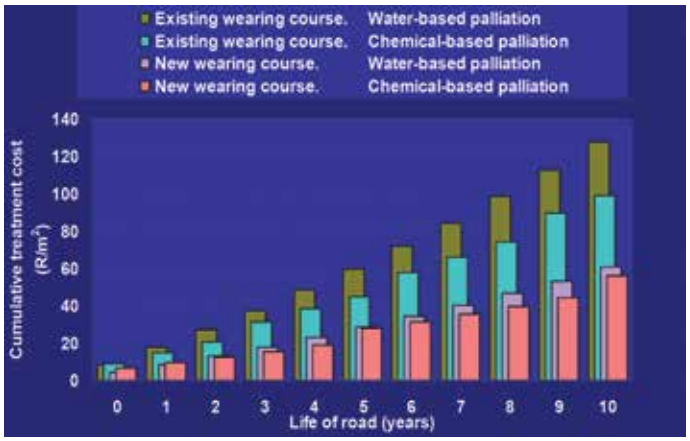

Figure 6: Unit cost assessment of dust palliative options (Thompson and Visser, 2000b).

Chemical additives may be used to minimise road maintenance such as availability of water, since there are no additional costs. Chemical additives that are mixed into the upper 75 to 100 mm of the wearing course have been found to be the most effective, with rejuvenating sprays applied when necessary. Surface sprays form a thin layer on the surface and tend to wear away rapidly under the abrasive tyre action of dump truck traffic.

When dust control is necessary, the first question to ask is the origin of the dust. Invariably, rejuvenating sprays are applied when dust is visible, assuming that the road generates the dust. If the dust is from spillage then the spillage should be removed, as further addition of palliative results in a mix of dust and palliative. If the palliative is bituminous, then a layer of bitumen mastic (bitumen and dust) is formed which could become unstable and slippery when hot. The dust should be removed.

Sometime a rotary broom is used, but this has been seen to create large clouds of dust which impair visibility and does not completely remove the dust. A truck-mounted vacuum cleaner, as is used on the diamond mines, is effective in removing the dust rather than displacing it. On a semi-permanent surfacing, which is the case when stabilisers are used on the surfacing, the maintenance procedures must be adapted, as a motor grader loosens the surface material which then no longer has a bond and generates loose material and dust.

A major problem on many mines that have a semi-permanent surfacing is that vehicles with tracks are permitted to travel on such haulroads. The tracks loosen the surface material and cause immense damage. The tracks initiate the formation of corrugations and the only solution is to rip the wearing course and reapply the stabiliser. Tracked vehicles should be moved on a low-bed; or if the need is to cross a haulroad, tyres or old conveyor belting should be used. In some cases, a special tracked vehicle haulroad is used, but this is often not possible because of restricted space.

Haulroads and loading areas in the pit have been found to be the most problematic in providing a truck-friendly environment. The reason is that drilling takes place at the pleasure of the drilling operator. The depth of a hole is defined from the surface (bonuses are defined by the number of holes), which may be uneven, rather than to a previously defined level. The result is that the floor is uneven, and the problem cannot be resolved by the use of a wearing course material.

The solution is to use modern technology such as GPS to guide the drilling operations, to use the electronic systems on dozers to provide an even floor, and to fill in hollows (invariably filled with water) with a rock layer, and to place a 100 mm wearing course layer. Inadequate provision of a suitable riding surface results in excessive truck damage, as shown in *Figure 7*. The poor road quality resulted in the tie bar being bent, unwarranted repair costs, and the loss of one vehicle in the fleet.

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Figure 7: Bent tie bar as a result of poor road quality.

Maintenance management

All types of infrastructure require restoration as a result of wear and tear from use or climate. Haulroads are no different. Typically, a motor grader is used and starts at one end of the network and completes the network without cognisance of traffic volumes or use. Initially a scheduled system of motor grader maintenance was proposed, where each road had a frequency of maintenance depending on the type of wearing course, climate and traffic.

Operations at a mine are generally highly dynamic with regular deviations from the planned production schedule because of loader unavailability or other reasons. This means that a planned maintenance regime is not the most effective.

Real-time monitoring of actual vehicle response to road conditions overcomes these limitations (Thompson et al., 2004; Hugo et al., 2007). This is shown schematically in *Figure 8*.

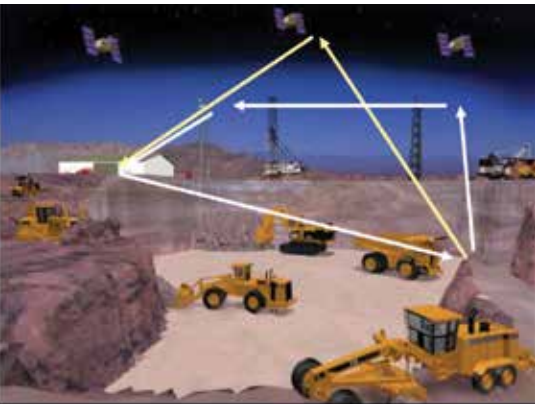

Figure 8: Real-time road maintenance system development and integration with existing mine-wide communication, location and truck monitoring systems (Thompson et al., 2003).

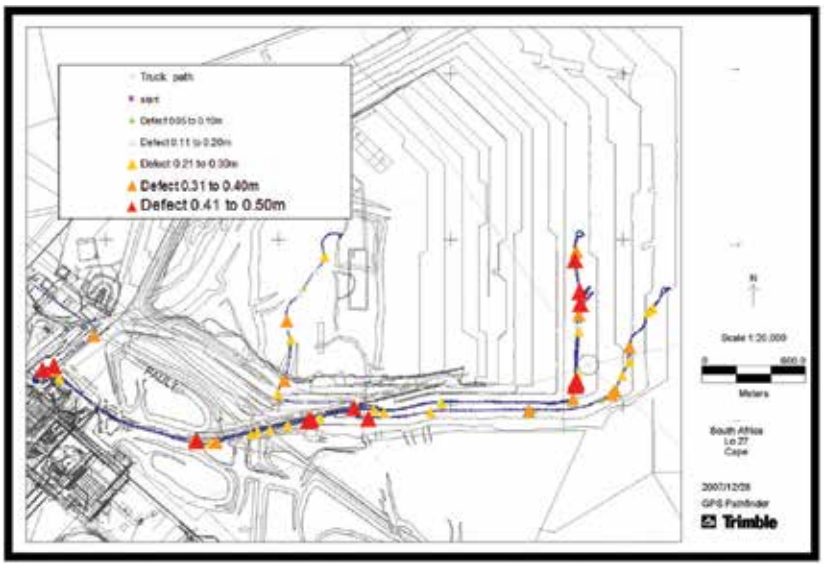

Figure 9: Road defect density map for field trials at Grootegeluk Mine. Symbols represent defect magnitude (depth or height) Marais et al., 2008).

Information on the conditions that a truck experiences is relayed to dispatch, where the type of result shown in *Figure 9* is provided. It is immediately clear which sections of the haulroad network are being used and where the most severe conditions are found and these should be targeted for maintenance. If the defects are such that a motor grader is able to rectify the situation, this would be used; otherwise a load of suitable material or other techniques are applied.

Technology has advanced significantly since the original work was performed. Electronic interfaces to a computer had to be built to capture the required information, but nowadays there are special plugs that allow extraction of the information from the onboard computer directly into a computer, and data is processed using standard software.

Conclusions and recommendations

The cutting-edge research that was conducted in the 1990s is valid and its effectiveness has been demonstrated in a number of applications. Focus on appropriate layout and geometry, structural capacity, a user-friendly wearing course material, and where necessary a semi-permanent riding surface through the use of chemical additives, and a real-time indication of road quality as sensed by the haul trucks has generated the anticipated financial benefits. Mining operations that use the principles have benefited by being more effective.

Of major importance is the application of opencast haulroad design principles to driverless technology vehicles in opencast and underground mining, where the road quality is not negotiable as there is no driver that can avoid obstacles or severe road deterioration.

This paper was presented at the Surface Mining and Metallurgy conference in 2014. It was subsequently produced in the Journal of the Southern African Institute of Mining and Metallurgy in November 2015. The original research was a team effort and the inputs provided by Professor Roger Thompson are gratefully acknowledged. Validation work was performed by PH van Rooyen, a final-year undergraduate student in the Department of Civil Engineering at the University of Pretoria. Should the reader require research references, please contact MQ directly.

The management of haulroads is based on three principles: the structural ability to support the ultra-heavy-duty truck loads, the selection of vehicle and environmentally-friendly riding surface, and an appropriate level of maintenance to counteract wear and tear.

Despite Aspasa's effort to formalise and professionalise the industry, illegal quarrying and borrow pits are still proliferating, threatening waterways and making vast tracts of land unusable for future generations (photo Dale Kelly).

Illegal mining – spiralling out of control

Illegal mining is on the rise in South Africa and presents challenges that need to be addressed from a range of perspectives. At the end of September, the Chamber of Mines and Mine Rescue Services (MRS) once again raised the issue on the R6-billion/year illegal mining sector, saying that it is spiralling out of control with recorded incidents being the tip of the iceberg.

Although this article focuses mainly on the larger mining industry, illegal mining is also a major issue in the quarrying sector, offering up many similar challenges. These include a loss of revenue, taxes, employment opportunities, capital expenditure and procurement generally led by legal mining entities.

According to Mine Rescue Services CEO Christo de Klerk, 90% of illegal underground incidents are unreported, and the organisation only receives reports or responds to 10% of these.

The challenges related to illegal mining are significant and a very recent tragedy was the illegal miners trapped in difficult and very dangerous circumstances in an abandoned mine in Langlaagte, south of Johannesburg. The MRS was involved in the rescue attempt for these individuals but the search was eventually called off with some Zama-Zamas remaining buried underground.

At that time, the *Daily Maverick's* Bheki Simelane reported that after working through the night to rescue the trapped miners from the disused mine, Johannesburg Emergency Services (JES) had suspended the search. This after two illegal miners who had been underground for several days were brought to surface; one alive and one dead. The day's highlight was at about 11:00 when two dust-coated figures emerged from the mine entrance, looking fairly strong considering that they had been holed up for two weeks underground.

One of these illegal miners was 17-year old Jeremiah Sithole and he and his older companion carried sacks of gold product on their backs. Sithole and his older more experienced friend both hail from Tembisa, and were not aware that other Zama-Zamas had died in the same mine.

Illegal mining is a very serious challenge in South Africa; it is dangerous with illegal miners risking their lives to open cemented shafts with explosives on abandoned mines. These miners enter the abandoned shafts, travelling as far as 4,0 km underground, where they live for several days at a time, risking their lives for an income.

The surge in illegal mining is two-pronged:

- South Africa's socio-economic environment is troubled; there is an increase in unemployment, poverty and the entry of large numbers of illegal immigrants into the country.
- It was initially based on the surge in the gold price during the bull market of the first decade of this century. Despite the fall in the US$ gold price since 2011, the rand gold price has held sufficiently steady to keep illegal mining profitable.
- There are limited resources at the disposal of law enforcement agencies to stem illegal mining, such as police, immigration, border controls and prosecuting authorities.

According to the Chamber of Mines, 70% of all arrested illegal miners are illegal immigrants.

Illegal mining is often organised and carried out by organised crime syndicates. The Zama-Zamas are often heavily

armed and where trespassing on operating mines, set ambushes and booby traps for employees, security and rival groups of illegal miners.

Because they are serving organised criminal bosses, the miners taking these risks are not seeing the real value of their labour.

The illegal mining market is a well-managed five-tier system:

- 1st Tier: The underground workers, most illegal immigrants do the physical mining. Many have worked in the mines previously. They use chemical substances to primitively refine the product.
- 2nd Tier: The buyers on the surface around the mines. They also organised the level one illegal miners and support them with food, protection and equipment.
- 3rd Tier: The regional bulk buyers who usually are entities which, in most cases, have permits issued in terms of the Precious Minerals Act to trade in precious metals.
- 4th Tier: Those who distribute nationally and sometimes internationally, through front companies or legitimate exporters.
- 5th Tier: The top international receivers and distributors, usually through international refineries and intermediary companies.

The Chamber has recognised that the only way to deal with the problem is to focus on both the supply and demand side of illegal mining, ie, all five levels of the syndicates need to be addressed.

While local police and mine security deal with level ones and twos, the Chamber of Mines, the South African Police Service, the National Coordinating Strategic Management Team and the Department of Mineral Resources are working to identify and deal with the level threes, fours and fives that constitute the buyer market. This work is undertaken hand-in-hand with international agencies such as the United Nations Interregional Crime and Justice Research Institute, European police, Interpol and international embassies.

The Chamber of Mines has a long-established Standing Committee on Security, where its members deal with all issues relating to security and product theft at mines. The Standing Committee on Security led the establishment of the multi-stakeholder National Precious Metals Forum over a decade ago. The NPMF consisted of representatives of mining companies, the Chamber of Mines, South African Police Service (various branches in the forensic science laboratory), the South African Precious Metals and Diamonds Regulator, Rand Refinery and the National Prosecuting Authority.

Illegal mining has a range of negative social and financial impacts:

Many illegal miners have lost their lives in accidents, often being buried alive.

They tend to use extremely environmentally-unfriendly and unhealthy refining methods.

Where they trespass on operating mines to do their work, it results in loss of revenue, taxes, employment opportunities, capital expenditure, exports, foreign exchange earnings and procurement generated by legal mining.

Mining communities suffer as they become riddled with related crime such as bribery, violence against workers and management, and child labour.

No single stakeholder can address the challenge of illegal mining on its own and collaboration is key, both from the large mining industry and the aggregate and sand sector. The Aggregate and Sand Producers Association of Southern Africa (Aspasa) puts in a lot of effort and hard work towards ensuring that member companies are compliant with local legislation, and able to measure themselves against international standards for environmental protection and sustainability.

Yet despite Aspasa's effort to formalise and professionalise the industry, illegal quarrying and borrow pits are still proliferating, threatening waterways and making vast tracts of land unusable for future generations. While Aspasa member companies spend a lot of time and revenue on ensuring compliance, informal operations have no such worry and simply do as they please to the environment, impacting on local communities and the environment.

Borrow pits run by municipalities, road building operations and other organisations do not fare much better and are held to far less vigorous requirements. However, the end result of polluted waterways or scarred environments are devastating and should not be encouraged nor should aggregates unearthed in such a manner ever be used on sites anywhere in South Africa.

Aspasa director Nico Pienaar says that in the last decade especially, the quarrying industry under direction of the Association has undergone a massive transformation from an essentially unregulated free-for-all to a stage where it is among the leaders worldwide when it comes to human and environmental issues.

"Our About Face Environment Programme for continual environmental performance improvement, guides and measures our members to perform according to international standards. If they don't, they are given a chance to take corrective action; if they do not then comply they cannot be members of Aspasa.

"As a result, quarries belonging to Aspasa are required to have far-reaching environmental plans that span from planning and conception of the quarry, through its operation and entire lifecycle through to the rehabilitation and eventual closure of the quarry. In addition, land use plans that extend well beyond the operational life of the quarry are also being drawn up to ensure that surrounding communities are not left with a scar, but rather with a positive and enriching legacy for the future," Pienaar says.

"For this reason we urge the road building community, municipalities, government departments and construction companies to only procure sand and aggregates from compliant members that are members of Aspasa and that have undertaken to protect the environment and give back to surrounding communities. Aspasa quarries subscribe to being accountable, transparent and credible and it pays to support companies that are looking after our future.

"We are all citizens of this country and our actions today will have a direct impact on our children and their children for years to come. We sincerely hope that the next time decision makers specify materials for construction sites that they insist of aggregates being procured only from Aspasa-accredited quarries," he adds.

Report by Dale Kelly

De-registration and the MPRDA

The Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) ushered in an approach to mining/prospecting rights which aimed to strike a balance between economic efficiency, sustainable economic and social development and equitable access to mineral resources. Beyond these broader objectives, however, both pieces of legislation regulate the mechanics of establishing and running mining and related operations.

by Janine Howard, Associate and Nina Braude, Candidate Attorney, Baker & McKenzie

It is essential that this legislation provides certainty as to the processes and procedures relating to the entities engaged in mining operations, their legal obligation and the consequences thereof.

One of the obligations of all companies under the 2008 Act is to file an annual return with the Companies and Intellectual Property Commission (CIPC). Failure to do so for two or more successive years is grounds for CIPC removing the company from the companies register. This obligation is designed to confirm the company's continued existence and that it remains in business and/or trading. There is an underlying presumption that only companies which serve a legitimate economic purpose should remain recognised as juristic entities.

If then, a mining company fails to submit its annual returns for two consecutive submission periods, fails to remedy the omission and cannot provide good reasons for such failure, it will be subject to deregistration by CIPC. The effect, due to Section 56(c) of the MPRDA is that such company's mining/prospecting rights, permits or permissions will automatically lapse. The difficulty with this is that Section 82(4) of the 2008 Act provides that in the event of deregistration by CIPC for, amongst other reasons, failure to comply with the obligation to submit annual returns, 'any interested person my apply … to reinstate the registration of the company'.

Two issues become relevant on reinstatement of registration, namely, whether the re-registered mining company can have its lapsed mining/prospecting rights restored; and the implications for the property rights of third parties who may be adversely affected by the restoration of such rights. This article considers only the first issue. The possible implications of a company's re-registration on third parties are therefore not considered.

The court's response

The question of the impact of restoration of mining/prospecting rights on reinstatement recently came before the Supreme Court of Appeal (SCA) in the case of Palala Resources v Minister of Mineral Resources and Energy (479/15) [2016] ZASCA 80 (30 May 2016) (Palala). However, this case dealt with Section 73(6A) of the Companies Act, 61 of 1973. The proposition in this article is that Palala read with the earlier case of Newlands Surgical Clinic (Pty) Ltd v Peninsula Eye Clinic (Pty) Ltd [2015] ZASCA 25; 2015 (4) SA 34 (SCA (Newlands), provides a limited response: where a company has been de-registered through failure to file its annual returns and has its registration reinstated by CIPC, it will be revested of its mining/prospecting rights.

Background to Palala

Palala concerned a prospecting right which was granted to Palala Resources Pty Ltd (Palala) on 20 May 2009, and was valid until 19 May 2011 (Prospecting Right). As a result of a failure to pay annual returns, Palala had its company registration cancelled in terms of 73(5) of the 1973 Act on 16 July 2010. Through the mechanisms provided in section 73(6A) of the 1973 Act, Palala was able to restore its registration just over two months later – a period during which the Prospecting Right remained valid.

Towards the end of 2010, a third party known as Hectocorp (Pty) Ltd (Hectocorp) lodged an application for prospecting rights relating to the piece of land over which the Prospecting Right was held. Notwithstanding Palala objecting to this application, it was accepted by the Department of Mineral Resources (DMR) on the basis that Palala's Prospecting Right had lapsed at the time of its deregistration. On a strict reading of Section 56(c) of the MPRDA, this was correct. However, the DMR failed to address the consequence of Palala having been re-registered in terms of Section 73(6A) of the 1973 Act.

What followed the DMR's decision was a series of appeals by both Palala and Hectoprop, first in terms of the MPRDA's administrative appeals provisions and later in the courts. In the first round of appeals, Palala was successful in overturning the DMR's decision – the Acting Director-General finding that there was insufficient proof of final deregistration. Hectoprop was successful at the second stage, where the Minister of Mineral Resources overturned the Acting Director-General's decision on the basis that finding 'lack of finalisation of the deregistration process' was unfounded.

The third round saw Palala taking the matter on review to the Gauteng Division of the High Court, Pretoria. Here, Palala was unsuccessful: the court holding that Palala's Prospecting Right had lapsed upon deregistration and not been retrospectively revived by re-registration. Round four, which gave rise to the judgment discussed in this article, was a further appeal by Palala to the SCA.

Findings of Palala and revesting of prospecting rights in terms of the 1973 Act

Majiedt JA, for the SCA found, in Palala's favour, that the re-registration of a legal entity in terms of Section 73(6A) of the 1973 Act has retroactive application as a result of the deeming provision contained therein. This provides that where the registration of a company is restored

'the company shall be deemed to have continued in existence as if it had not been deregistered'. Therefore, when Palala was re-registered, its assets, including the Prospecting Right, reverted to it as if it had never been de-registered.

Majiedt JA went on to state that there is no conflict between Section 56(c) of the MPRDA and Section 73(6A) of the 1973 Act, as they contemplate different events at different moments in time. The first moment is that of de-registration of a company. At that point, Section 56(c) of the MPRDA provides that rights, permits or permissions held by the entity lapse. This is logical in that a 'non'-entity cannot in law hold mining/prospecting rights. The second moment is that of re-registration of a company. Not catered for in the MPRDA (a potential lacunae), the legal consequences are determined by Section 73(6A) of the 1973 Act. In other words, re-registration of a company should automatically result in revesting of such company's property.

Taking the aforegoing into account, the SCA upheld the appeal and found that the Prospecting Right had reverted to Palala upon its being re-registered. Accordingly, the SCA ordered that the application to renew the Prospecting Right, lodged previously by Palala, be remitted to the Minister to be considered anew. It should be noted that in this case, no rights had been awarded to any third parties in the interim. It was therefore relatively easy for the SCA in Palala to provide a pragmatic solution.

Implications under the 2008 Act

Section 82(3) of the 2008 Act is, broadly, the equivalent of Section 73(6A) of the 1973 Act. Critically, however, the 2008 Act's provision for re-registration has excluded the 'deeming' provision which lay behind the Palala decision. It is, however, possible to apply Majiet AJ's reasoning to the 2008 Act if regard is had to the Newlands case.

Newlands expressly considered whether Section 82(4) of the 2008 Act had retroactive application in the context of corporate activities during the period between deregistration and re-registration. Notwithstanding, the narrow scope of Newlands, the SCA addressed the question of retroactive implications of re-registration with reference to property (which would include mining/prospective rights).

The Newlands court found that, despite the absence of the deeming provision from Section 82(4), the section has the effect of re-vesting the company's property automatically on reinstatement of the company to the companies' register.

In the case of a re-enactment of a provision which has language inserted or omitted, it can be presumed that any such additions or omissions are deliberate expressions of legislative intent.

Brand JA, writing for the SCA, rejected this approach on the grounds that the 2008 Act was not an amendment or re-enactment of the 1973 Act, but rather an entirely new scheme governing South African company law. The presumption regarding legislative intent, could thus be discounted.

Secondly, Brand JA noted that the 2008 Act provided for reinstatement of registration, and not merely re-registration. Accordingly, he reasoned that the effect of Section 82(4) should be substantive, and not merely administrative. This reasoning was supported by the practical implications of reinstatement. Reinstatement would have no purpose, reasoned the court, if it did not have the effect of 'revesting the company with title to its property'.

The effect of reading Palala together with Newlands is that the consequences of a re-registration of a company in terms of Section 73(6A) of the 1973 Act may be extended to a company which is re-registered in terms of Section 82(4) of the 2008 Act – at least insofar as this applies to its property. Consequently, if a company is de-registered in terms of Section 82(3) of the Companies Act (reasons for deregistration including failure to file annual returns) and if such company is subsequently reinstated in terms of Section 82(4), it will automatically regain its property, including its mining/prospecting rights.

Discussion

In many respects, the above reading of the effect of re-registration of a company which holds a mining/prospecting right is a pragmatic one. However, it does appear to give effect to the objects of both the MPRDA and 2008 Act.

Section 82(4) of the 2008 Act (and Section 73(6A) of the 1973 Act), as interpreted by Palala and Newlands, apply in the very limited circumstances of de-registration for failure to submit annual returns and subsequent reinstatement on application by the company itself. The annual lodging of returns is a requirement designed to ensure that CIPC is able to adhere to its statutory mandate to maintain an accurate register of companies. This, in turn, ensures economic efficiency and protects persons engaging in business activities by providing for a verification process regarding the legitimacy of a prospective business partner.

The companies' legislation, however, acknowledges that it is possible that non-submission of annual returns may

The Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) ushered in an approach to mining/prospecting rights which aimed to strike a balance between economic efficiency, sustainable economic and social development and equitable access to mineral resources.

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be a matter of administrative error (or non-compliance) and thus provides for reinstatement as a remedy. Such remedy furthers the objective of facilitating economic activity and preventing regulation from being unduly obstructive. The prejudicial effects on economic activity as a whole if reinstatement was not also substantive would, arguably, be far greater than the potential prejudicial effect of restoration on third parties.

From a mining law perspective, it is necessary to juxtapose the notion of economic efficiency with the MPRDA's 'use it or it lose it' approach. The Palala matter concerned a very short period of time between de-registration and re-registration. However, at least two scenarios bear consideration. The first is where, notwithstanding non-submission of annual returns, a mining company, ignorant of its deregistration, continues its operations. These inevitably involve extensive capital investment, provide employment for large numbers of persons and support multiple secondary industries.

Automatic divesting of the mining/prospecting right which is foundational to such operations without automatic revesting on reinstatement, would certainly undermine any notion of continuity in operations and economic efficiency. It would also, arguably, counter the practical implications of using such a right to contribute to economic development.

The converse is where de-registration persists for an extended period of time, another entity applies for and is granted a mining/prospecting right, commences operations and is then divested of such rights on reinstatement of the original entity. This would undoubtedly counter the objectives of both the companies' legislation and MPRDA. However, in practice, it is very unlikely that such a situation would arise. Palala is a case in point – and one in which the problem of de-registration was identified long before Hectoprop had got anywhere near an operational stage.

It is arguable that in a case where a company persists in its default, notwithstanding being alerted to its de-registration and non-compliance, it should be penalised. Whether the penalty of being divested of its property is proportionate to the default is perhaps debatable (and may well fall foul of the constitutional prohibition on arbitrary deprivation of property). However, if the MPRDA is understood as not providing for unqualified property rights, a case can be made for rights-holders having to demonstrate 'responsible use'. This might well include proper adherence to all relevant legislation designed to regulate and promote economic activity.

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Such legislation would include the 2008 Act and therefore, on this approach, failure to intervene and ensure prompt reinstatement might well justify permanent divestment of a company's property. The rationale behind such divestment of property rights would be that responsible use of rights is required where such rights are awarded by the State who holds the related (critical) resources in trust. Such rationale would almost certainly not prove arbitrary.

In this regard, it is worth noting that the MPRDA provides for interventions, not only for failure to mine mineral resources 'optimally' but also in instances where mining operations show consistent lack of profitability or require scaling-down of the labour force. This recognition of the importance of sustaining mining operations as going concerns, and the potential economic and social impact if this is not the case, is supported by the parallel requirement in the companies legislation, to file annual returns (as discussed above).

Conclusion

As the law currently stands, a rights-holder that is de-registered through failure to submit its annual returns to CIPC should, on reinstatement, be revested of its rights under the MPRDA. The effect is to permit continuity in mining and/or prospecting operations and thus to give effect to the objects of economic sustainability which are common to both the MPRDA and 2008 Act.

It remains to be seen whether, in the future, if confronted with more complex scenarios, the courts will opt for the same pragmatic approach. Palala has offered a temporary solution – and one which, because of the narrow factual grounds on which it was decided – may not be particularly robust.

A more complex case, which might involve third-party rights, a prolonged period of deregistration, third-party expenditure or a combination of the aforegoing, may well require greater interrogation of the notion that re-registration must entail revesting of property rights. In such a situation, the courts may find themselves unable to rely on Palala and will instead have to develop an approach which is not only pragmatic, but also gives effect to the overlapping objectives of both South Africa's minerals' and companies' legislation. Should such an approach be taken, it is possible that the mining/prospecting rights in question will not revert to the re-registered company and the recourse available to such company may not be commiserate with the revesting of such rights.

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Pre-owned Bells find new home at Transkei Quarries

A leading Eastern Cape quarrying company has been expanding its capacity due to demand from clients and in so doing, is depending on a trusted original equipment supplier to help it meet increased production targets.

Transkei Quarries has a long history with Bell Equipment, having owned and operated ADTs from the B, C, D and E-series for a number of years.

Transkei Quarries is situated just outside Mthatha and has been in the present owner's hands since 1986. At the helm is general manager Ernst Putter, a man who worked himself up through the company after starting as a driller and blaster. Along with a strong management team, he has steadily grown the company and with it, its fleet of earthmoving and crushing equipment.

"We're currently in a strong growth phase and despite the doom and gloom of the economy in other parts of the country, we're blessed with strong and sustained demand from our many clients for our products and services," Putter says. "Our second crushing plant had been contracted out for a while but since that contract had been concluded, we've erected a third crushing plant due to demand especially from road construction companies working in a radius around Mthatha."

The recently construction of a large shopping mall in Mthatha also called for much fill material and aggregate. "Having additional crushing plants is one thing," he says, "but to then effectively feed them continuously, calls for a reliable mining, haulage and material handling fleet."

Transkei Quarries has had a long relationship with Bell Equipment since the company first bought three Bell 1206 haul tractors with nine m^3 dump trailers back in the 1980s. These stalwarts served the operation well and led the company to later acquire four Bell B18A articulated dump trucks (ADTs). Even though they were used machines, they too still clocked up between 10 000 and 12 000 hours, which did much to cement the company's trust in the Bell brand.

More and bigger Bell ADTs followed and the company saw its mined rock hauled by Bell B20B, B20C, B20D, B25D and B30 ADTs, the latter bought new in 2014.

Transkei Quarries operates on the basis of drill and blast, load and haul and as its pit has become deeper, so its ramps

have become longer and more challenging for the haul fleet. Bigger loads have demanded bigger engines but the company's faith in the Bell ADTs powered by Mercedes Benz power plants, still equate to lower products costs/ton through frugal fuel consumption.

"We have, over the years, traded some of our older Bell ADTs in on newer models but we've somehow hung onto our one Bell B20B ADT, and it is still going strong," Putter says. "In early 2016, we took delivery of three pre-owned Bell B30E ADTs and we would have taken four, had there been an additional one available. This must tell you a lot about our faith in the brand."

Transkei Quarries has, for a long time, trusted machines from Bell Equipment for its in-pit loading, using Bell HD1430 excavators. In the plant area where there is a constant movement of products such as various-sized aggregates and crusher dust, Bell wheeled loaders have been relied upon. Various models of the legendary Bell C and C-Plus series gave way to models in the Bell D-series and most recently, the new E-series of wheeled loader. Some of its older Bell wheeled loaders have been relocated to Transkei Quarries' Butterworth operation.

"We have just ordered a Bell L1806E wheeled loader and even though it is a pre-owned machine with some 7 000 hours on the clock, it comes with an extended warranty to 9 000 hours, which gives us the assurance that we're buying a reliable piece of equipment," Putter confirms.

"This loader will work around 200 hours/month and given that all our Bell machines are maintained by Bell Equipment mechanics from their Customer Service Centre here in Mthatha, we sleep very well at night."

Bell Equipment's foresight of elevating its former depot in Mthatha to that of a Customer Service Centre, under the able leadership of Skungo Gxididi, is paying dividends as customers such as Transkei Quarries can rely on technical support and parts back up on their doorstep.

The National Department of Water Affairs and Sanitation is planning to construct five dams in the Mthatha area to supplement the city's water supply. With its new crusher plant being fed by reliable machines from Bell Equipment, Transkei Quarries is confident that there won't be any delay when it comes to supplying this important project with rock fill and aggregate material.

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A Bell L2106E loads one of three pre-owned B30E trucks that Transkei Quarries added to its fleet earlier this year.

Bell Mthatha Customer Service Centre team leader Skungo Gxididi with Leon de Lange, Transkei Quarries' quarry manager.

Aspasa drives the industry to **new heights**

Afrisam's Peninsula quarry in the Western Cape (photo Dale Kelly).

From a relatively rag-tag bunch of operators in years gone by, the South African quarrying industry has transformed itself into a well-managed and responsible industry that is recognised globally for its standards. In many ways, this has been the result of the efforts of the Aggregate and Sand Producers Association of Southern Africa (Aspasa), which was formed from within the industry to self-regulate and guide individual operators to become a professional and sustainable industry.

For the most part this has already been achieved, and throughout evolving legal and social requirements in the mining sector, Aspasa plays an important role for the entire mining sector. Simultaneously, the quarrying industry has remained buoyant throughout the recent commodity price-induced downturn and continues to provide investors with above-average earning opportunities. When one considers it, aggregate and sand is the mineral most mined throughout the world.

Since the turn of the century, the man behind Aspasa – Nico Pienaar – has given direction and played a significant role in the success of the Association. As director, his keen administrative ability combined with unique relationship-building skills and astute legal mind, has made Aspasa a force to be reckoned with in the mining industry.

Pienaar has become a well-known personality within the mining and construction industries. He grew up in small towns in and around Swaziland where the many different social classes and people taught him to become an astute listener and an above-average communicator. As the son of a butcher, this was a requirement as he often found himself dealing with a diverse array of people.

His easy-going personality has been a feature of his career but he is no push-over. His broad knowledge of business, combined with legal training, makes him a tough negotiator as well as being highly capable of pushing his organisation's agenda. Having spent a period as a trade unionist in South Africa has also assisted him in seeing both sides of the story.

This stems from Pienaar's early days studying law at RAU and later studying industry relations, human resources and labour law at Unisa; all of which were done on a part-time basis and paid from out of his own pocket, spurring him on to make the best possible use of his qualifications. During this time, he held many positions starting with his first job as a legal clerk, banking, industry and human relations practitioner, as well as a trade unionist, before finally finding his passion as the head of Aspasa, and later also Sarma.

"When I took up the reins at Aspasa, I had no experience in the quarrying industry and very few, if any, contacts in the industry. But I was undeterred and with the help of a number of industry stalwarts, I learned the ropes and realised the path we needed to take to achieve the goals set down by our industry roleplayers," he says.

"We needed to unite the industry and form an association that would fight for the common good of our industry and our members. Next, we set about formalising the industry through the

establishment of strict health, safety and environmental ground rules that would need to be followed for companies to become members of our Association. This had the effect of dramatically raising the overall standards of our industry and has made it far easier to customers to do business with us."

He says it is a team effort. "I have been supported by the Aspasa board, as well as by my right-hand-woman and long-serving member of Aspasa's administrative team Mary-Ann Sutton, with whom we have engaged roleplayers in the industry to establish workable boundaries that ensure sustainability and the wellbeing of all within the industry. At the top of our agenda, we have sought fair trade and profitability for all our members with the Association; and levelling the playing field.

"After 17 years at the helm of Aspasa, I believe the Association has made great progress and we will continue fighting for our industry, until such time as we are free of challenges," Pienaar says.

His lead-from-the-front approach to driving Aspasa, supported by his passion for fairness, sound administrative and planning abilities, has led the organisation into becoming one of the most highly-regarded associations in the country and a recognised leader globally. His efforts have also seen him occupy one of the longest-standing executive seats on the Chamber of Mines.

Tougher environmental audits

Aspasa has amended its environmental compliance audits to keep track with changes in the environmental law, as well as new ISO standards.

The Association has been largely responsible for the professionalism of the quarrying industry in recent years, with the result that quarrying practices have become dramatically safer and kinder to the environment. Since 1994, the Aspasa's About Face Management Programme has led the formal quarrying industry into becoming one of the safest and most sustainable in the world.

Pienaar explains that the About Face Programme was originally implemented to stop the damage that was being caused by quarrying practices and to work with members to implement and optimise environmental and management plans on the quarries. An annual audit programme was also devised to ensure member quarries adhered to the strict requirements, which has moved environmental compliance to a very high standard. With the Mining Charter demanding environmental compliance, Aspasa members have been in the forefront.

"Since then, the audit requirements are regularly updated to measure changing requirements of the programme. This time, it not only conforms fully to ISO 14001:2015 but goes further in including features particular to the aggregate and sand producing industry in Southern Africa. These include the requirements of South African environmental law most pertinent to the industry and international best practice," he says.

Through the participation of members in the programme, the Association can provide assurance to stakeholders that its members are practicing environment stewardship at each operation and implementing world-leading management systems.

Avoiding accidents

In its ongoing effort to mitigate risks on quarries, Aspasa has just released a comprehensive Best Practice Guideline on dealing with vehicle management in quarries. Historically, these are among the leading causes of deaths and injuries on our quarries and the practice guideline is aimed at identifying, managing and mitigating these risks.

Pienaar says the primary focus must always be on ensuring effective, proactive controls are in place to prevent accidents occurring. "While every quarry is different in respect of size and nature, a number of common controls have been identified by the industry, which should be considered as part of the risk management process when developing a site's vehicle management strategy.

The document provides comprehensive guidelines on requirements and vehicles on site. It includes information relating to effective quarry design and layout, site geology, property boundaries, access, as well as production rates/constraints, quarrying development, size and type of mobile equipment (haul road gradient/width). This needs to be taken in context with the location of plant, infrastructure, stockpiles, weather, etc.

The guideline also deals with the selection of equipment including contractors and hired equipment, as well as inspection and testing, OEM specifications and minimum site requirements.

"The idea of the guideline is to give our members as comprehensive a tool as possible to manage vehicles on site and to eliminate the risk of these machines injuring people on or off site," Pienaar says.

The guideline is available from the Aspasa office.

Recruiting new blood

The excavation, crushing and screening of aggregates can hardly be regarded as a sexy job and as such, doesn't receive much attention from scholars and graduates who rather look towards more 'glamorous' roles in other industries. Yet the industry needs new blood and new thinking to take it to the next level.

"For this reason, every effort should be made to attract newcomers," Pienaar asserts. "With a little branding and explanation, the 'shiny side' of aggregates can be exposed and younger generations can be shown the valuable role it plays in our daily lives.

He says the industry, as well as individual companies, needs to effectively communicate the benefit of employment within the industry if it wants to attract potential employees in the future.

"The process of branding therefore needs to be taken to a recruitment level if the industry is to thrive in future. The value of our industry's brand should therefore reflect the needs of potential employees.

"Employers and industries that have 'high employer brand value' are perceived by potential employees as more attractive than those with lower brand values. A potential employee's appraisal of an employer brand is therefore prompted by factors including their awareness and perceptions of the employer brand, which may be developed by word of mouth, personal experience and marketing strategies."

He says branding theory and practices should therefore be expanded to differentiate firms and the industry to make them desirable from an employee perspective. Just as traditional advertising communicates characteristics of a product to consumers, so too should employer branding be applied to recruitment, and jobs should be regarded as products to attract current or potential employees."

Pienaar suggests that the aggregate industry apply the following methodology to attract new blood:

P Provide a positive work environment
R Recognise, reward and reinforce the right behaviour
I Involve and engage
D Develop skills and potential
E Evaluate and measure

"Under the final E, we need to conduct employee satisfaction surveys at least once a year; initiate interviews and surveyor concerning the real reasons people come to and leave an organisation; and improve hiring processes to create a better match between the individual's talent and job requirements.

"Also to provide flexible work arrangements for working parents and older workers; hold managers responsible for retention in their departments; start measuring the cost of turnover; and focus on the key jobs that have the most impact on profitability and productivity," Pienaar says, adding that it is also worthwhile to examine those departments that have the highest turnover rates and design an effective employee orientation programme.

He says that big changes are happening on the technology front and that it is dramatically changing the way companies work and the way we do things.

In his recently published book *The Fourth Industrial Revolution*, which formed the backdrop for discussions at the World Economic Forum (WF), Klaus Schwab, founder and executive chairperson of the WEF argues that: 'Of many diverse and fascinating challenges we face today, the most intense and important is how to understand and shape the new technology revolution, which entails nothing less than a transformation of mankind. We are at the beginning of a revolution that is fundamentally changing the way we live, work and relate to one another. In its

In its ongoing effort to mitigate risks on quarries, Aspasa has just released a comprehensive Best Practice Guideline on dealing with vehicle management in quarries (Photo Dale Kelly).

The man at the helm of Aspasa, Nico Pienaar (photo Dale Kelly).

scale, scope and complexity, what I consider to be the fourth industrial revolution is unlike anything humankind has experienced before.

'Consider the unlimited possibilities of having billions of people connected by mobile devices, giving rise to unprecedented processing power, storage capabilities and knowledge access. Or think about the staggering confluence of emerging technology breakthroughs, covering wide-ranging fields such as artificial intelligence, robotic, the internet of things, autonomous vehicles, 3D printing, nanotechnology, biotechnology, materials science, energy storage and quantum computing, to name a few'.

And this is echoed by Aspasa member Andries van Heerden, CEO of Afrimat: "Today business is different to what it was yesterday. Just look at how things have changed in our industry over the last five years. For example, the local construction industry was dominated by the Big Five; today, it is completely the opposite. Though many of the big construction contractors may talk tongue-in-cheek about the small players, they have just been blown out of the water with the exception of one or two."

Van Heerden continues: "The industry has changed a lot. Tomorrow, it is going to be different to what it is today. There are new factors driving the economy and new things that are becoming more important. It is all about strategic management; looking at the current environment and where we want to be; where the opportunities

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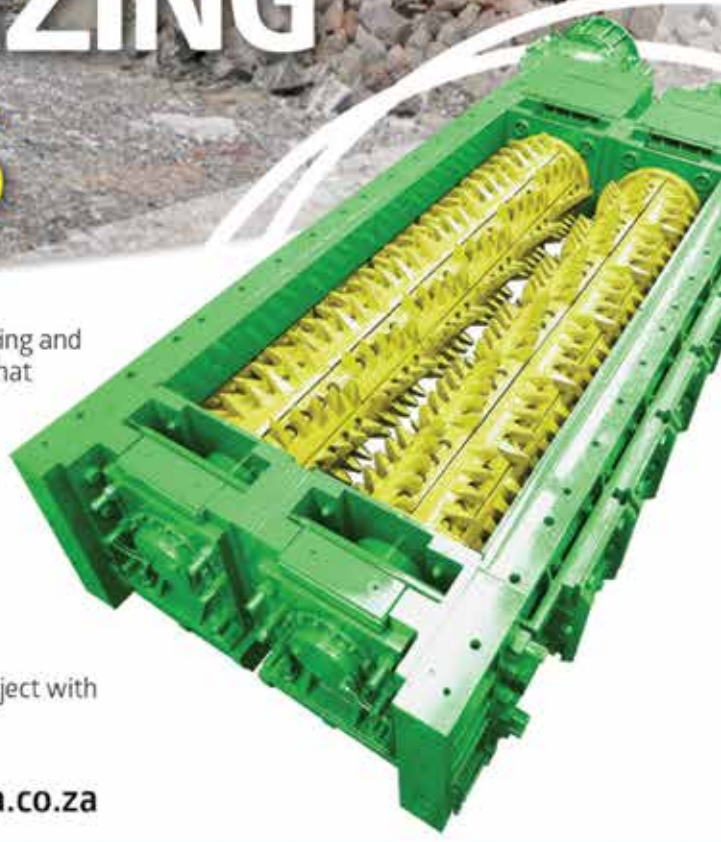

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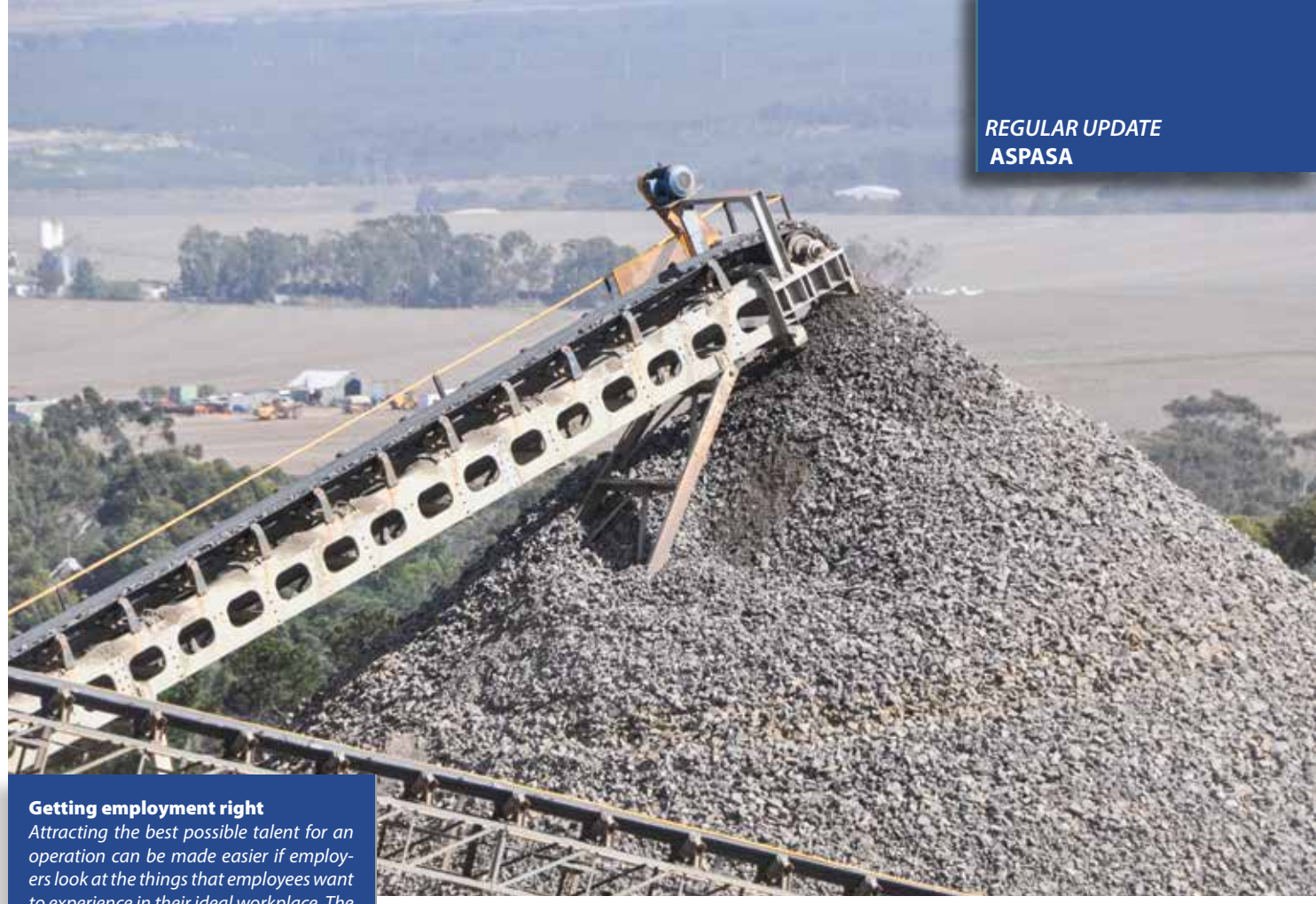

The quarrying industry has remained buoyant throughout the recent commodity-price induced downturn and continues to provide investors with above-average earning opportunities. When one considers it, aggregate and sand is the mineral most mined throughout the world (Photo Dale Kelly).

Getting employment right

Attracting the best possible talent for an operation can be made easier if employers look at the things that employees want to experience in their ideal workplace. The 10 most attractive attributes listed by job seekers are:

1. *An employer's or industry's reputation for looking after and valuing employees.*
2. *Challenging and/or engaging work.*
3. *Training and development.*
4. *A fun, positive and vibrant working environment.*
5. *Career development and progression.*
6. *An attractive salary or financial incentives.*
7. *Recognition of performance.*
8. *Understanding the importance of family or life outside work.*
9. *Fair pay for a fair day's work.*
10. *Definitive and strong company with industry value.*

and where the threats are. What was good that is not good anymore? It's all about considering those factors and playing that game over time."

What then are some of the skills needed in the aggregate industry? The following are the most obvious:

- Environmental
- Safety and health
- Accounting and finance
- Information technology
- Manufacturing operations
- Sales and marketing
- Human resources
- Mining, civil, mechanical and industrial engineering geology

"So how do we get the right people and motivate and retain them without paying abnormally high wages," Pienaar asks. There are many ways but top of the list has got to be the provision of safe, satisfying, challenging work with fair remuneration and a good chance of advancement and reward for hard work. Then there are people issues such as providing employees with responsibility and empowering them to be better every day. Give recognition where it is due and provide them with coaching to do their jobs better.

Who is Aspasa?

The Aggregate and Sand Producers Association of Southern Africa is a voluntary membership, private sector producers association.

Aspasa represents its members with regard to policy positions, through various organs of the national and provincial governments.

Contact and interaction also takes place with other relevant-forming entities. Contact is kept with other similar associations overseas.

The support that Aspasa gives its members is on the strategic and advisory side of business.

A great deal of work is put into promoting the industry and the Association to the outside world; but also to ensure interaction among other companies/producers in the industry. Consultation and cooperation within Aspasa occurs on a voluntary basis without encroaching on the managerial prerogative of individual companies.

Aspasa is constantly striving for clarity and certain principles to be developed to ensure the sustainability of the industry. These include:

- A sound and comprehensive regulator authority.
- A financially sound and sustainable industry.
- An environmentally responsible industry.
- An empowering and developing industry.
- An industry that embraces the transformation imperatives.

www.aspasa.co.za

BME evolves its technology to new levels

This issue's Spotlight goes to BME, a company that is a leading supplier of explosives and services to the African mining, quarrying and construction industries. Focusing on safety, supply security and value-adding technical services, the company supplied and blasted over 4 000 t of HEF emulsion on St Helena Bay island, and is currently tackling nitrate mine water contamination – addressing the issue of water quality and conservation.

BME operations manager Neil Alberts.

Delivering high quality bulk emulsion to a remote island in the Atlantic Ocean – and ensuring problem-free blasting for a two-year project – has proved BME's ability to design and manufacture a safe and reliable product suited to the most demanding conditions.

"Supplying and blasting over 4 000 t of HEF emulsion for the building of the airport on St Helena island was a demanding task for a number of reasons," says Albie Visser, BME's general manager for South Africa. "But the experience showed what could be achieved by our commitment to innovation and quality."

Situated over 2 200 km from the Namibian harbour town of Walvis Bay, St Helena is one of the world's smallest inhabited islands – measuring only 8,0 km by 16 km and inhabited by just 5 000 residents. In a step towards making the island more economically self-sufficient, the British government announced in 2005 that an airport would be built on the island – which traditionally could only be reached by the mailship *RMS Saint Helena*.

The construction of the airport was an ambitious plan that would require substantial blasting and earthmoving, involving 8-million m^3 of material in a dry-cut fill operation.

"BME had to design an emulsion so stable that it would withstand the long sea voyage, in addition to the road trip of 1 700 km to Walvis Bay," says Visser. "It would also have to endure multiple re-pump events, and widely varying ambient temperatures between 3,0 degrees and 34 degrees."

Most emulsions tend to become thicker the longer they stand or the colder the surrounding temperature; variations in temperature can also lead emulsion to break down. However, manufacturing the product on site in St Helena proved unviable due to the lack of infrastructure and insufficient energy supply; hence the

Delivering high quality bulk emulsion to a remote island in the Atlantic Ocean – and ensuring problem-free blasting for a two-year project – has proved BME's ability to design and manufacture a safe and reliable product suited to the most demanding conditions.

decision to locally manufacture a product of remarkable resilience, and transport it in its emulsion state.

"We went the extra mile to ensure that all the materials were of the best possible quality, including the used oil, so that the emulsion remained fluid throughout its six-month life-cycle, from manufacturing in South Africa through to blasting on St Helena," he says. "This meant extending our already stringent quality standards, and applying them to every tonne of the approximately 4 000 t of HEF that the project required."

From the factory in Fochville, BME transported the emulsion by tanker to its silos near Swakopmund in Namibia, and then into ISO-containers (isotainers) for loading onto the ship bound for St Helena. To deal with the steep gradients up to the work site on the island, emulsion was pumped from the isotainers into a converted water bowser before transportation to site – where it was re-pumped back into the isotainers.

"With this number of pumping events, the potential for emulsion breakdown becomes significant," Visser explains, "but our product maintained its integrity even beyond our target levels. In fact, looking at how well the product withstood these conditions, we can confidently say that it would still be usable after a year."

The first BME truck was on site and ready to go in October 2012, and in November the first blast – consuming 74 t of bulk explosive – was detonated on St Helena.

"Over the roughly two-year period from November 2012 to August 2014, the operation consumed about 200 t of HEF 100 emulsion a month," he confirms. "We supplied the contractor with up to 18 blasts per month, totalling some 54 000 holes in total; each hole was 89 mm in diameter and averaged 12 m deep."

According to Visser, the key to a good emulsification process is the right surface active agent (or surfactant) – the emulsifier. "Our in-house experts developed the emulsifier specifically for the St Helena project, in the same way that we develop emulsifiers to suit the raw materials in whichever environment we operate."

He emphasises BME's use of a dual oxidiser – or 'double-salt' – system, which gives more stability to the product than a single-salt solution. "We were pleased that our emulsion had the long shelf-life that we required and was extremely tolerant to multiple pumping cycles – proving highly resistant to breakdown even under excessively stressful conditions."

This was achieved through a demanding regime of testing over a number of months leading up to the project's commencement – using elevated temperatures, for instance, to accelerate the ageing of the products and to ensure it could last the long periods on the road, at sea and standing on the island awaiting use.

"Our product standards ensured that every tonne manufactured was the same high quality – whether it was made the next day or the next year," he says. "We made sure there was no variability in the quality."

BME pioneered the use of cold emulsion explosive in South Africa over 30 years ago, and is today a market leader in blasting solutions for the mining, quarrying and civil engineering sectors.

Tackling nitrate contamination

In South Africa's increasingly water-scarce and environmentally-regulated mining industry, BME's emulsion explosives help keep nitrates out of mine water, preventing possible groundwater


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contamination and allowing optimal recycling of water on site.

According to BME operations manager Neil Alberts, recent international studies suggest that up to 28% of nitrates from traditional ammonium nitrate fuel oil (ANFO) explosive can leach into water draining through underground mine workings during a blasting campaign. "These levels can be reduced to as little as 2,0% by applying best practice, but the long-term solution lies in explosives that do not release nitrates into water sources."

"Among the characteristics of our emulsions range is its excellent water resistance, which means that the explosive material does not dissolve readily in water," he adds. "This reduces the amount of nitrate leaching to negligible levels."

Tests conducted by BME indicated that, after being immersed in water for a month, its emulsion released only about 0,7% of its nitrate content.

"The key factor here is the effectiveness with which the oil in the emulsion – the fuel phase of the mixture – surrounds and isolates the small droplets of saturated oxidizer salt, preventing them from dissolving in water," says Alberts. "On the other hand, our tests confirmed that ANFO dissolves completely when it comes into contact with water."

High levels of wastage of ANFO – the mining sector typically accepts that about 30% of ANFO delivered to a blast site is not consumed in blasting – suggest that it may be a contributor to nitrate levels in water passing through mine workings.

Another advantage of emulsions highlighted by the tests was that no oil was released, ensuring that water contamination by oil is also prevented; both the nitrate and the fuel phases of the mixture are bonded tightly by the emulsifier.

"BME emulsions have already contributed to environmental sustainability on mines by incorporating and consuming previously used oil in its emulsion products, helping mines to dispose of these liquids safely and cost-effectively," he says. "The way we have evolved the matrix also ensures that no oil is released when our emulsion comes into contact with water at the stope face."

As mines work to prevent or mitigate environmental damage, pollution or ecological degradation, the levels of nitrate in water are usually monitored – as high nitrate levels can render water unsafe for drinking.

"By removing the possibility of nitrate leaching from blasting chemicals underground, mines can reduce the risk of groundwater contamination as water drains out of working areas," Albert confirms. "At the same time, where mines are making efforts to recycle water from underground, lower nitrate levels will enhance the overall quality of recycled water and increase its applications on and off the mine site."

Emulsion explosive is part of a growing range of underground services being innovated by BME, including up-hole blasting technology, vertical pipelines to convey emulsion direct from surface to working levels, mobile chargers and pumps, and control systems to facilitate real-time communication between underground operations and surface systems.

www.bme.co.za

As the pioneer in cold emulsion explosives in South Africa, BME has evolved this technology to new levels over the past three decades.

Quality spares, repairs and service in demand

By tailoring its structure and strategy to meet the changing needs of customers, equipment supplier Osborn is not only weathering the current rough times, but growing some areas of its business. This is according to national parts manager Brian Frost, who says that while many customers have put new capital equipment on the back burner, the number of spare parts quotations that Osborn is responding to is on the rise.

The restructuring of the company's product sales division has contributed to this growth, he believes, with product sales staff given more responsibility for parts, sales, service and repairs, as part of Osborn's strategy to focus on the more buoyant areas of its business.

The company has also responded to customers' increasing scrutiny of their budgets with reviews of its own prices, and is committed to being as cost-competitive as possible. To this end, it is supplying OEM spares as well as alternate parts.

The company has added a new dimension to its field service offering. "A dedicated engineer has been added to the team to offer site and machine evaluations to customers," explains service and repairs manager Andre van Tonder. "With mines and quarries downsizing, they have fewer in-house resources, so Osborn is able to assist with assessments of equipment and sites."

This is in addition to its after-sales service and service contracts, as well as the installations, commissioning, complete erection, on-site repairs, maintenance and training.

Van Tonder says that with a technical trainer on board, Osborn offers on-site training for customers' staff.

www.osborn.co.za

Osborn's parts sales team, from left: Brian Frost, Sharon Deczy, Annelize Moore, Christina Pais, Ashley Rajcoomar, Angela Dobson, Debbie Roux and Luqman Ebrahim.

Slurrybuster hydro mining solution

Rapid sediment build-up in acid ponds can have dire results for mines as the reservoirs gradually lose their ability to store solution, impacting on both upstream and downstream processes.

This is exactly what happened at a copper mine in the DRC when two of its acid ponds silted up completely resulting in no solution capacity whatsoever. Previous attempts at solving the issue were not successful due to the abrasive nature of the silt and solution that needed to be removed from the ponds.

Focused on providing effective pumping and hydro mining solutions in the most challenging environments, Integrated Pump Rental was able to apply its latest technology and resolve the issue for the mine.

Lee Vine, MD of Integrated Pump Rental says that the company's Slurry Blaster hydro mining equipment solution was deemed the most appropriate for this harsh application. This locally-developed and manufactured equipment offers optimum performance coupled with reliability, and this, according to Vine, was exactly what was required to hydro mine the slime out of the ponds.

"Not all applications are the same and for this reason, and after assessing the specific requirements on site, we custom built a SlurryBlaster unit for this particular task," Vine says.

All stainless steel components including pumps were used for the pontoon mounted SlurryBlaster. The system comprises a 90 kW feed pump with float, two 30 kW slurry pumps for the removal of the slurry, a 200 mm heavy-duty hose and electric control panels for protection for the pumps.

The two acid ponds are identical; each 100 m by 50 m and 6,0 m deep. The unit operated at a 7,0 bar pressure and discharged material at 80 ℓ/second with a concentration by volume of 70%. It took a month to clean each dam.

In addition to the SlurryBlaster hydro mining solutions, Integrated Pump Rental operates an extensive pump rental fleet which includes Grindex submersible drainage and dewatering pumps, diesel driven pumps and accessories. Value-added services such as dam cleaning and pontoons, pump flotation modules and pipe floats are available. All products used by Integrated Pump Rental are ISO 9001-certified.

www.pumprental.co.za

Integrated Pump Rental's Slurry Blaster hydro mining equipment solution was deemed the most appropriate for this harsh application at a copper mine in the DRC.

Fit-for-purpose wear solutions

Pressure on maintenance budgets coupled with the need to increase productivity while reducing unplanned downtime in the mining, quarrying and power sectors of the market, presents a unique set of challenges.

One of the most obvious ways to cut costs is to look at areas in the plant where excessive wear is occurring and to then apply best practice wear solutions technology to address these issues. This is according to Roland da Silva, global product line manager, Wear Solutions at FLSmidth, who recently visited the company's South African operation.

Da Silva says that excessive wear can be caused by a myriad of reasons and it is essential to identify the cause before applying a solution. "Different wear technologies cater for different causes within a plant and it is essential to apply a fit-for-purpose solution to ensure the customer will benefit from the intended increase in wear life," da Silva says.

He points to the obvious differences between wear caused by sliding abrasion and that caused by high impact. "Rubber is capable of handling high energy and impact, while ceramic is best for sliding abrasion, however there are instances where both impact and sliding abrasion occur," he says.

The Ludoliner from FLSmidth is ideal for this scenario where there is high material flow with moderate impact forces.

Waynne Martin, product manager, Wear Solutions says the Ludoliner is an easy–to-fit system of bolt-on wear panels that combines the properties of alumina ceramics and rubber resulting in exceptional wear and impact resistance. "Alumina ceramic is well proven in materials handling applications where abrasion is present, and the ceramic/rubber combination means the panels absorb impact and offer the noise reducing properties of the rubber," Martin says.

Significantly, the locally manufactured Ludoliner is available from FLSmidth's Meshcape® Screen Media business. The manufacturing facility based in Edenvale, Johannesburg, South Africa supports FLSmidth's greater market, with its primary focus on South and Sub-Saharan Africa This offers end users shorter lead times as well as a reduction in cost; both of which will be major advantages.

www.flsmidth.com

The Ludoliner from FLSmidth is ideal for a scenario where there is high material flow with moderate impact forces.

AfriSam cares

Leading concrete materials company AfriSam has sponsored concrete to the value of R100 000 for the construction of a skate park in central Johannesburg. The skate park forms part of a unique Skate School built by the award-winning non-profit organisation Skateistan, which provides programmes combining skateboarding and education to empower youth.

The objective of the Skateistan Skate School is to provide at-risk youth, between the ages of five and 17 from low-income families with a safe place to learn and play. The Skate School offers students the opportunity to play and learn as part of the Skate and Create programme, or to access homework help and career advice as part of the Back-to-School programme. Exceptional youth will have the chance to join the Youth Leadership programme to help organise events and assist with sessions.

The Skateistan Skate School is open to registered students from August this year, and offers weekly programmes to over 300 students in 2016, and more than 400 by the end of 2017.

www.afrisam.com
www.za.skateistan.org

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AfriSam has sponsored concrete to the value of R100 000 for the construction of a skate park in central Johannesburg.

Blast technology in focus

Modern technologies to boost operational efficiency – helping mines to survive the extended commodity slump and position them from stronger growth – come under the spotlight at BME's 24th annual Drilling and Blasting Conference at the CSIR in Pretoria on 3 November.

Among the exciting line-up of expert papers is news of ground-breaking progress in applying emulsion explosive to the underground mining environment – including a portable charging unit, a pump controller information system, and a vertical feed system direct from surface.

This is a conference not to be missed.

www.bme.co.za

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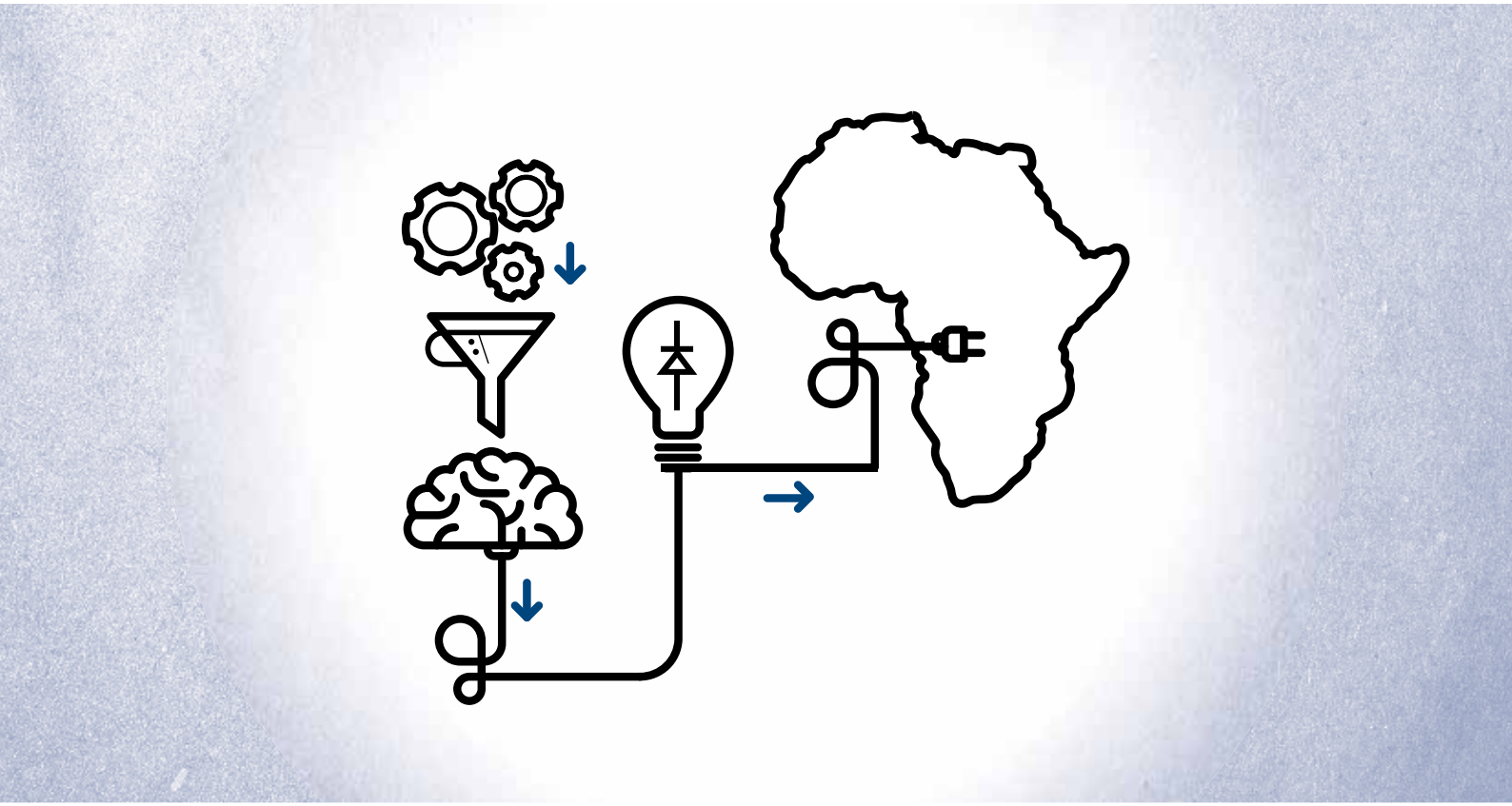

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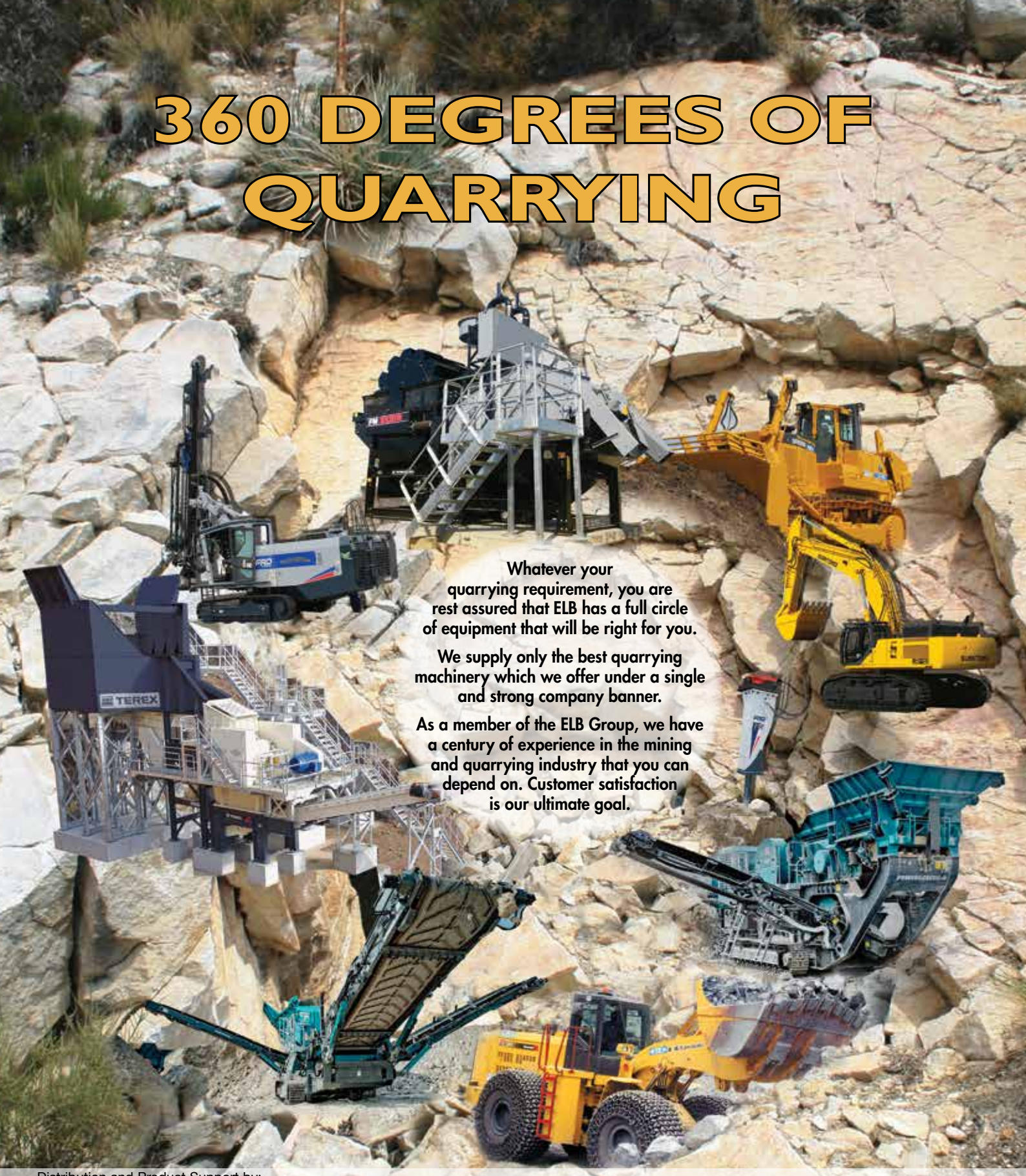

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