

# Annual Review 2017/18

Department of  
Mining  
Engineering



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Faculty of Engineering,  
Built Environment and  
Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en  
Inligtingtegnologie / Lefapha la Boetsenere,  
Tikologo ya Kago le Theknolotsi ya Tshedimošo

# EDUCATING AND LEADING MINING ENGINEERS TO BECOME **IMAGINEERS**

– PROF RONNY WEBBER-YOUNGMAN,  
HEAD OF THE UNIVERSITY OF  
PRETORIA'S DEPARTMENT OF  
MINING ENGINEERING

To be a leading, research-intensive mining engineering department in Africa, recognised internationally for its quality, relevance and impact, and for developing people, creating knowledge and making a difference locally and globally.

# VISION

# MISSION

To educate and lead mining engineering students to become **imagineers** by empowering them with technical and non-technical skills through the use of world-class education, research, leadership and related technology interventions.

To be a leading, research-intensive department

To pursue excellence in teaching and learning

To be recognised continuously for the quality of graduates delivered

To strengthen the Department's national and international profile through the establishment of sound, sustainable business and other relationships

To become financially independent in terms of the growth strategy of the Department

**STRATEGIC GOALS:**  
GUIDING OUR LONG-TERM TRAJECTORY



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

## SNAPSHOT OF THE FACULTY

### TOP 375

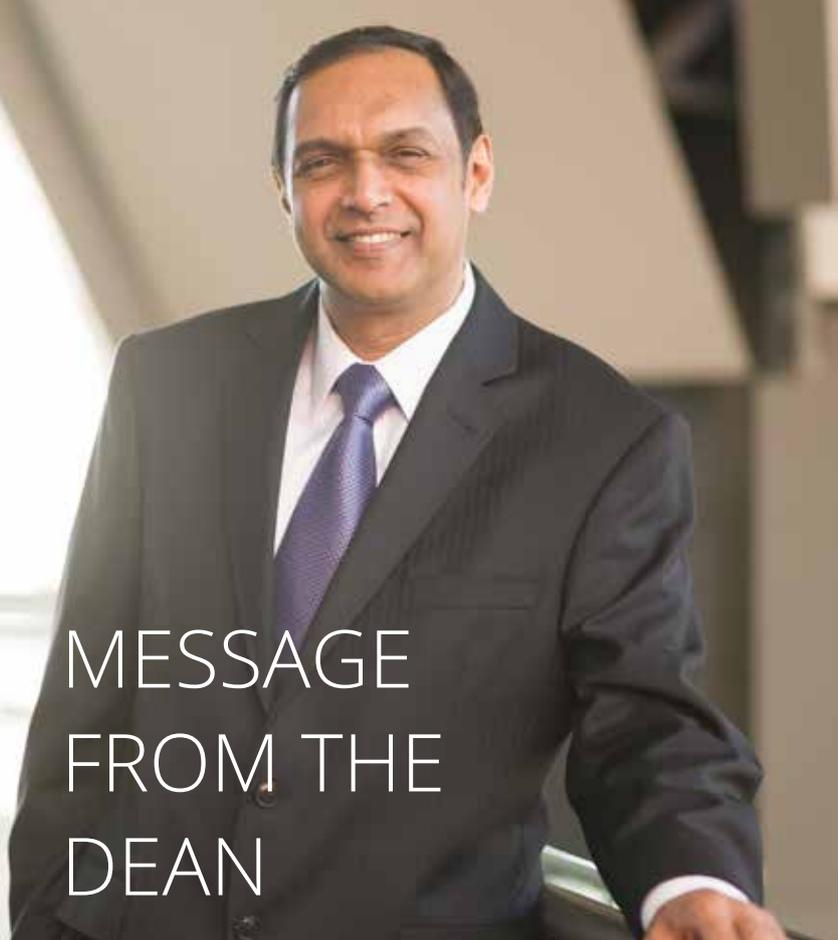
RANKED GLOBALLY  
FOR ENGINEERING AND  
TECHNOLOGY IN 2018 QS  
RANKINGS

### TOP 0.5%

OF ENGINEERING SCHOOLS  
IN THE WORLD IN 2018  
ISI ESSENTIAL SCIENCE  
INDICATORS

33

CUTTING-EDGE RESEARCH  
CHAIRS AND ENTITIES IN THE  
FACULTY OF ENGINEERING,  
BUILT ENVIRONMENT  
AND INFORMATION  
TECHNOLOGY (EBIT)



## MESSAGE FROM THE DEAN

Through its initiatives, EBIT has actioned the call to work together ('Tuma Mina') to build a new knowledge economy and better South Africa to position itself in the Fourth Industrial Revolution. EBIT's Department of Mining Engineering dedicated its teaching, learning, research and industry consulting efforts to this goal in the period under review.

Since its inception in 1961, the Department has contributed hugely to the mining industry by providing it with world-class mining engineering leaders. Under the leadership of the Head of Department, Prof Ronny Webber-Youngman, it has established a sound foundation for future developments.

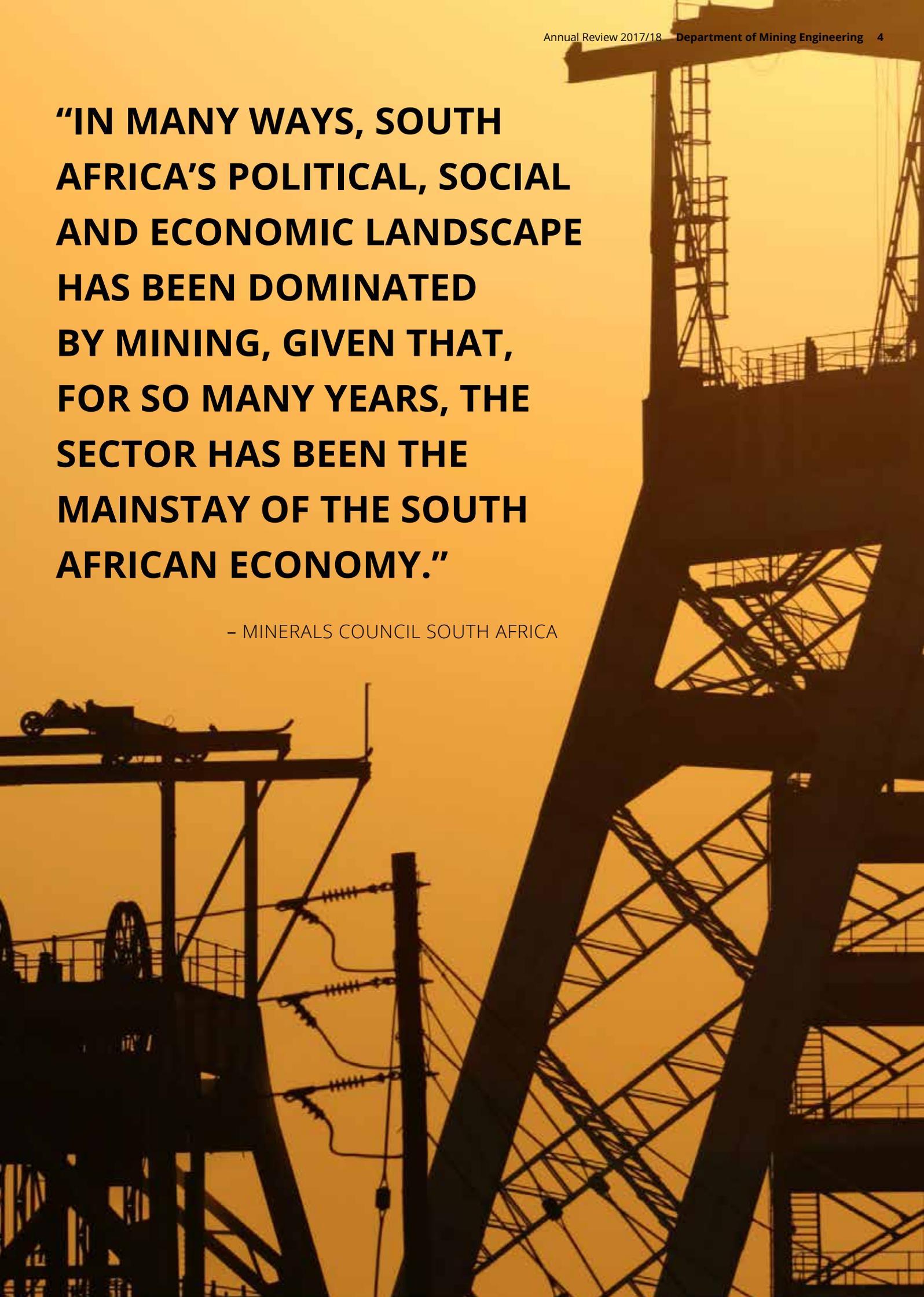
A key initiative, launched in August 2015, was the establishment of the Kumba Virtual Reality (VR) Centre for Mine Design. The Centre strives to be an innovative resource for bringing real-world scenarios to learners to enhance their exposure to their chosen industry, as well as allowing technical and other practitioners to simulate plans and designs in a risk-free environment with minimal time and resource allocation. In addition, the Mining Resilience Research Centre (MRRRC), established in the Department in 2016, continues to add value as a multidisciplinary research centre to contribute to solving the complex challenges facing the mining industry today. It is one of the first of its kind.

Because the South African mining industry is facing challenges on numerous fronts, it is essential for academia to facilitate a space for innovative problem-solving. Through industry partnerships, the Department continues to deliver work-ready graduates and real-world solutions to the benefit of this indispensable industry.

**Prof Sunil Maharaj**  
Dean: Engineering, Built Environment and Information Technology

**“IN MANY WAYS, SOUTH AFRICA’S POLITICAL, SOCIAL AND ECONOMIC LANDSCAPE HAS BEEN DOMINATED BY MINING, GIVEN THAT, FOR SO MANY YEARS, THE SECTOR HAS BEEN THE MAINSTAY OF THE SOUTH AFRICAN ECONOMY.”**

– MINERALS COUNCIL SOUTH AFRICA



# MESSAGE FROM THE HEAD OF DEPARTMENT

The current status of the mining industry continues to create uncertainty in terms of its long-term contribution as a major provider of employment in the country. The ongoing economic downturn in certain commodities has also affected the employment of mining graduates. The challenge for the Department is to increase its research capabilities in the sector, so as to improve on innovative, quality, research-based solutions for the demands of the industry.

This also relates to the demands of the Fourth Industrial Revolution, which requires the Department to re-evaluate its approach to educating and training the next generation of mining engineers. As such, it is in the process of realigning its curriculum to meet future demands. These changes will commence from 2020.

**“WITHOUT THE SUPPORT AND CONTRIBUTION OF THE DEPARTMENT’S STAFF MEMBERS, IT WOULD NOT HAVE BEEN ABLE TO SUCCESSFULLY DEAL WITH ALL THE CHALLENGES THAT IT HAS FACED DURING THE PERIOD UNDER REVIEW.”**

– PROF WEBBER-YOUNGMAN





Over the years, an annual feedback report has been made available to members of the Department of Mining Engineering's Mining Advisory Board and the Minerals Education Trust Fund (METF). However, the Department decided to take this a step further this year. This will be the first annual review from the Department. It will be distributed nationally and internationally to further enhance the visibility of the Department in terms of its contribution in the mining industry.

Several innovative teaching and learning strategies have been employed during the period under review. The interactive, multimedia approach to teaching and learning, which incorporates group work, has been found to be very successful, and is in use in all the Department's own technical modules. The Department is also in the final stages of implementing an academic mobile application for its undergraduate students, with the long-term intention of rolling it out among postgraduate students as well.

Non-technical (soft) skills have been identified as an important component of the training of mining engineers, and form part of every module in the Department, with particular emphasis on management and leadership, which form part of the mine design process for final-year students. The plan is for Management and Leadership to be a standalone subject for final-year students in the future. The Department also has a Mining Engineering Leadership Academy for final-year students where they are exposed to various aspects of leadership and its application in the mining industry.

During the period under review, the Department also continued with its English Proficiency Programme. This is the fourth year that it has been included in each of the mining-related subjects in the Department's curriculum, and it continued to be well received by the students.

I wish to pay tribute to all my teaching and support staff members who continue to show their commitment in terms of their enthusiasm and involvement in the activities of the Department. Without the support and contribution of these staff members, the Department would not have been able to successfully deal with all the challenges that it has faced during the period under review.

**Prof Ronny Webber-Youngman**  
Head of Department: Mining Engineering  
University of Pretoria



## MESSAGE FROM THE HONORARY PRESIDENT OF MASUP

Communication in most spheres of life is absolutely essential, and in this day and age of indiscriminate mass media and fake news, accurate messaging is a *sine qua non* for any credible entity wishing to communicate effectively with its stakeholders.

Corporate entities make use of annual reports to their shareholders to ensure that their shareholders are accurately informed of the activities of the company over the past year and their plans for the future. These reports serve not only the shareholders, but also all other stakeholders and interested parties such as employees, analysts, suppliers, government departments, communities and reporters.

I applaud Prof Ronny Webber-Youngman for his initiative to take a leaf from the corporate book and from other institutions, as it were, to produce an annual review of the Department of Mining Engineering, of which this is the inaugural edition. University departments do not, and cannot, operate in a vacuum. I believe this report, and future reports, will serve to accurately inform a variety of stakeholders of the activities of the University of Pretoria's Department of Mining Engineering. These stakeholders include the mining industry, sponsors of academic chairs and research projects, other universities, government departments, alumni of the Department, potential students and many others. I am confident that it will generate interest and stimulate discussion with these stakeholders, promoting even better education of our students and more active and collaborative research among parties with common interests.

I applaud Prof Webber-Youngman for this groundbreaking initiative in the Department of Mining Engineering. I firmly believe that the review will achieve its intended purpose to the benefit of a multitude of stakeholders, both nationally and internationally.

**Prof Con Fauconnier**  
Honorary Professor and Member of the Advisory Board of the Department of Mining Engineering, University of Pretoria  
Honorary President of the Mining Alumni Society of the University of Pretoria (MASUP)



# MESSAGE FROM THE TUKS MINING SOCIETY

The Tuks Mining Society (TMS) is a student organisation that aims to provide socialisation opportunities and support to the students of the Department of Mining Engineering. The society is run by an executive committee (TMSEC) of 10 students that are elected to run the committee.

TMSEC provides a valuable opportunity for elected students to develop management and leadership skills. During 2018, TMS hosted a number of events that provided mining students with an opportunity for socialising outside the classroom.

The highlight of the year was the Alternative Careers in Mining evening. The event was hosted to highlight the various careers that exist in the mining industry outside of the traditional production careers with which students are acquainted. During the evening, various speakers from industry talked to students from the disciplines of mining engineering, metallurgical engineering and geology about their careers and how these careers impact on the mining industry. Speakers came from diverse backgrounds and included mining engineering consultants, accountants, bankers and industrial engineers.

Another event that was held for the first time in 2018 was the first-year Welcoming Quiz Night. This event was held to welcome new first-year students and to introduce them to the staff of the Department. A fun "bar trivia"-type quiz night was held that led to a friendly competitive atmosphere that was thoroughly enjoyed by students and staff alike.

The annual Smoker and Potjiekos Day was held again in 2018 and was a huge success. Mining students arrived in great numbers to spend some time together.

**Francois Nell**  
Chairperson: Tuks Mining Society



# DEPARTMENT PROFILE

Since its inception in 1961, the Department of Mining Engineering at the University of Pretoria has made a significant contribution to the mining industry by providing it with world-class mining engineering leaders. Its alumni have taken up leading positions in business and industry.

The Department has established a sound foundation for the future development of its teaching, research and community service initiatives. It is actively involved in the community, and its staff members participate in the activities of professional societies, as well as in expert consultation and community activities in the Faculty.

## Academic offering



**Undergraduate students** pursue the BEng Mining Engineering degree programme.

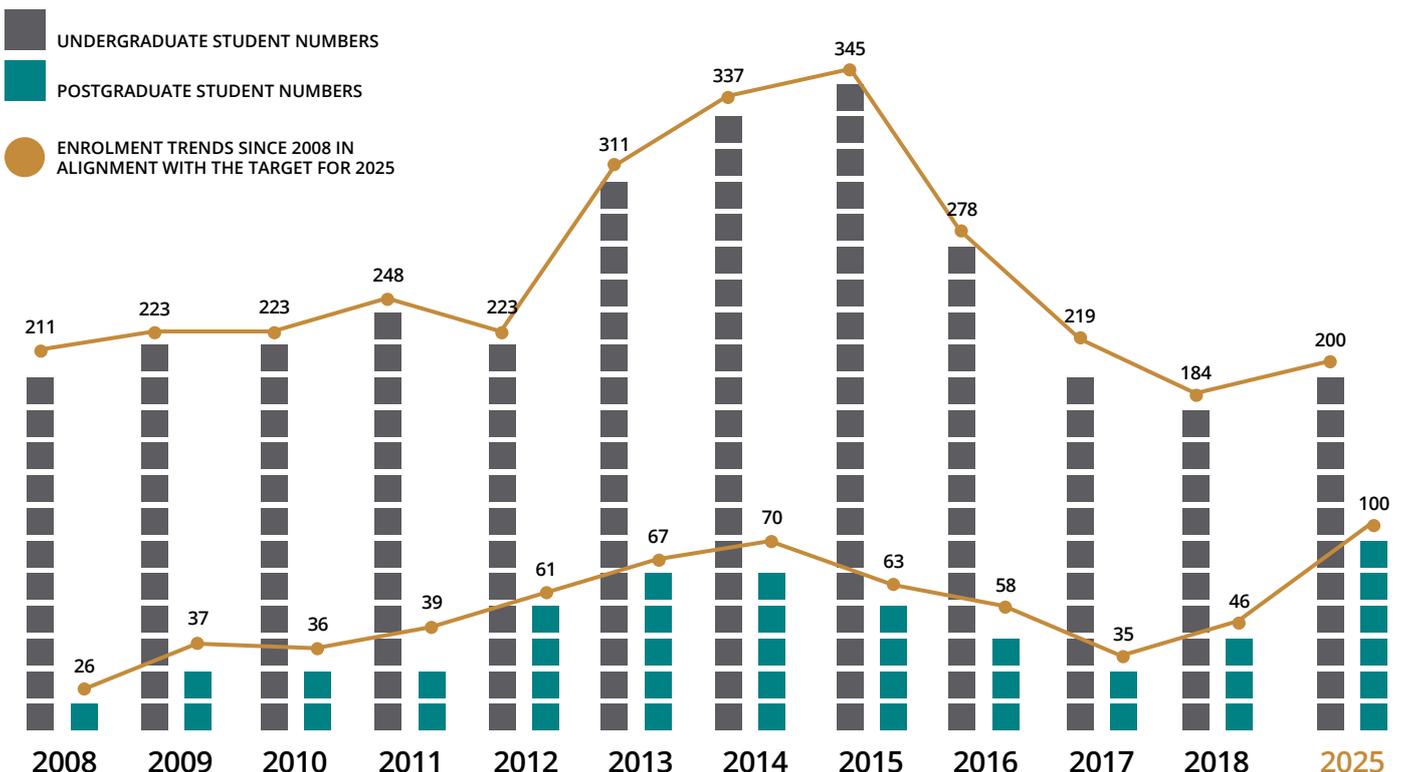
**Postgraduate students** can pursue honours, master's and doctoral degree programmes in mining engineering and applied science mining.

## Strategic intent

### The Department aligns itself with the strategic objectives of the University of Pretoria:

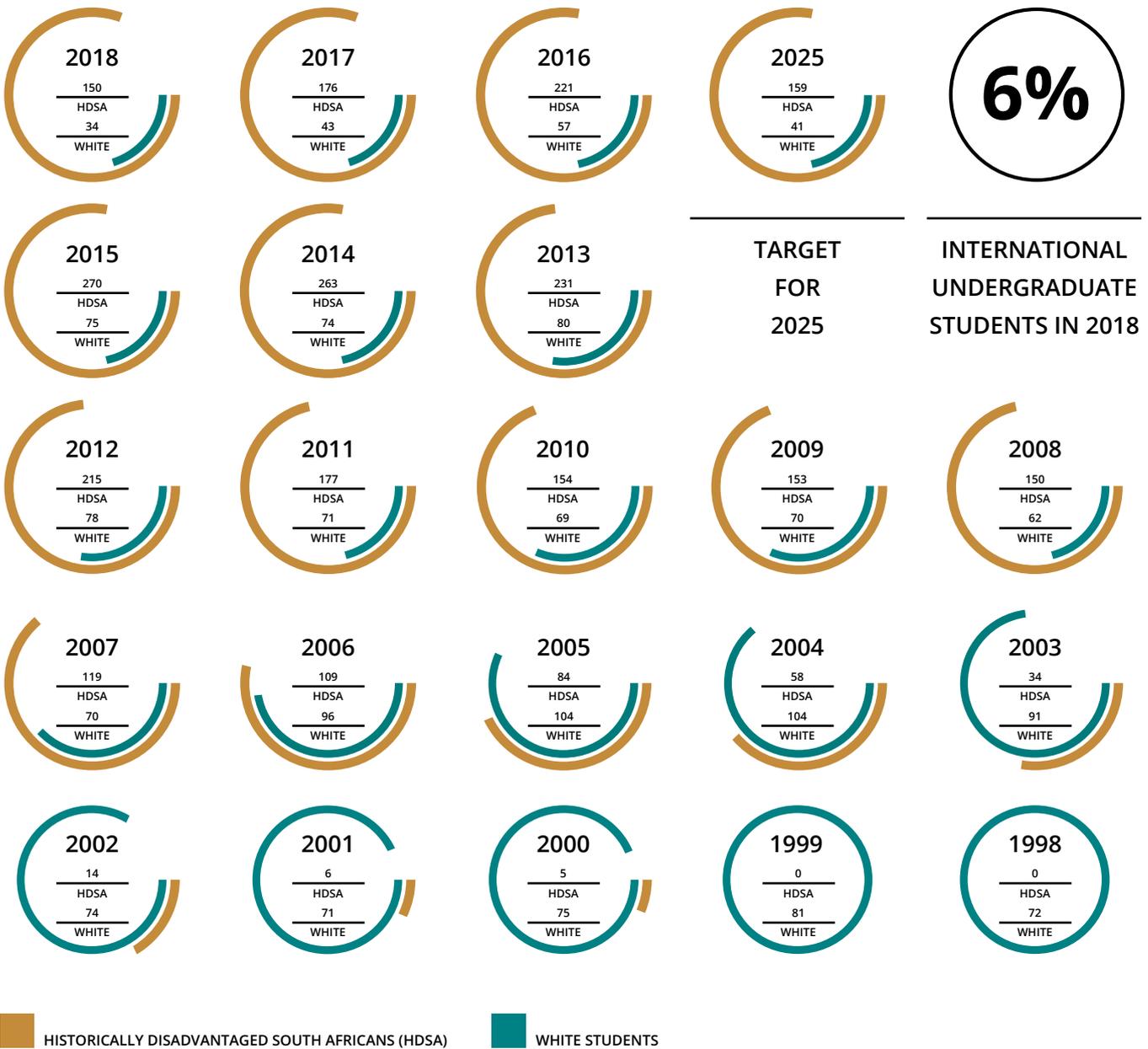
- Enhance access and successful student learning
- Strengthen the University's research and international profile
- Foster and sustain a diverse, inclusive and equitable university community
- Optimise resources and enhance institutional sustainability
- Strengthen the University's responsiveness and impact in society

After several years of significant growth in undergraduate student numbers, followed by a slump in mining student numbers worldwide, it was decided to reduce the Department's first-year intake. Its designed capacity is 50 final-year students, and its strategic intent is to have 200 undergraduate and 100 postgraduate students by 2025. This is informed by the current employment trends in the mining industry, which have a direct impact on the number of students who display an interest in pursuing mining engineering as a career. This is illustrated in the figure below.





## Undergraduate student demographics 1998–2018



The Department of Mining Engineering takes great pride in the fact that the demographic profile of its undergraduate students is representative of the South African landscape. The continued increase in the number of female students is also encouraging. The current demographic profile of the Department comprises 81% black students (of which 6% are international students and 75% are historically disadvantaged South African students), 19% white students, 75% male students and 25% female students.

# STAFF PROFILE

The Department has a staff complement of 33 members made up as follows:

ACADEMIC AND SUPPORT STAFF MEMBERS	
<b>FULL-TIME PERMANENT</b>	
Prof Ronny Webber-Youngman	Head of Department and Associate Professor
Prof Francois Malan	Director (MRRC) and Associate Professor
Mr Wolter de Graaf	Senior Lecturer
Mr Jannie Maritz	Senior Lecturer
Dr Bertie Meyer	Senior Lecturer
Ms Sezer Uludag	Lecturer
Ms Daleen Gudmanz	Departmental Administrator
Mr Wilson Magongwa	Messenger
<b>HONORARY AND EXTRAORDINARY PROFESSORS (RESEARCH AND POSTGRADUATE SUPERVISION)</b>	
Prof Con Fauconnier	Honorary Professor
Prof Bharath Belle	Extraordinary Professor
Prof Jan du Plessis	Extraordinary Professor
Prof John Napier	Extraordinary Professor
Prof William Spiteri	Extraordinary Professor and Chair: AEL Intelligent Blasting Chair in Innovative Rock-breaking Technology
<b>CONTRACT APPOINTMENTS SUPPORTED BY INDUSTRY</b>	
Mr Johan Hanekom	Director: Harmony Chair in Rock Engineering and Numerical Modelling
Mr Thabo Gazi	Researcher (MRRC)
Mr Eugene Preis	Junior Researcher (MRRC)
Mr Jónatan Jacobs	Junior Researcher (MRRC)
Ms Isabella Venter	Junior Researcher (English Literacy)
Ms Jennifer Sapsford	Academic Instructor
Mr Juan Ahlers	Academic Instructor
Mr Keaton Philo	Academic Instructor
Mr Carel de Jager	Contract Lecturer (Mine Financial Evaluation)
Dr Johann Uys	Contract Lecturer (Management and Leadership)
Mr Johann Hager	Contract Lecturer (Surface Mining)
Ms Danisa Baloyi	Mining Qualifications Authority Assistant Lecturer
Mr Mulisa Mukheli	Mining Qualifications Authority Assistant Lecturer
Mr Lindo Langa	Mining Qualifications Authority Assistant Lecturer
Ms Shadikie Mkonyane	Mining Qualifications Authority Assistant Lecturer
Ms Marietha Hicks	Instructional Designer and Postgraduate Coordinator
Mr Derick van der Merwe	VR IT Architect
Mr Zander Beest van Andel	VR Assistant
Ms Abea Kgatsea	VR Administrative Assistant
Ms Jeritha Maphoto	Administrative Assistant



# OVERVIEW OF ACTIVITIES

The period 2017/18 was characterised by several highlights. The purpose of this overview of activities is to summarise these highlights. A detailed discussion of the various components of the Department's activities is included in the sections that follow.

## Undergraduate and postgraduate enrolments

There is a decline in the number of first-year students in mining engineering worldwide. This is due to the current uncertainty in the mining industry, which has a direct impact on the number of students who are interested in a career in mining engineering. The current capacity in the Department is to accommodate 50 final-year students. This is in accordance with its strategic intent to have 200 undergraduate students and 100 post-graduate students by 2025.

It was encouraging to see the strategic growth in the Department in the postgraduate environment during the period under review. This will serve to enhance the research capabilities in the mining industry. The Department also aims to have 30% of all postgraduate students employed as full-time researchers in the Department by 2025.

## Academic capacity

During the period under review, 75% of the Department's staff members were contract appointments, made possible through contributions from industry in the form of academic chairs and the funding of short courses offered to industry, as well as industry donations. The additional appointments are categorised as administrative and technical support in the Kumba Virtual Reality Centre for Mine Design, as well as financial and academic administrative support. These staff members include assistant lecturers and academic instructors in the undergraduate academic programme, contract lecturers in the postgraduate academic programme, researchers and research supervision for the academic programme (master's and PhD students), and contract researchers in the MRRC, mainly in association with the Mine Health and Safety Council (MHSC), as well as the newly established South African Mining, Extraction, Research, Development and Innovation (SAMERDI) initiative. The additional contract appointments, along with the appointment of extraordinary professors, further enhanced the Department's research capacity and its capability to contribute to the mining industry.

## Management activities

Over the last two years, the Department has followed a balanced scorecard management system approach in terms of its related responsibilities. The objective of restructuring reporting procedures in this adopted management system was to enhance efficiency relating to all activities within the Department. Since the restructuring, meetings involved distinct focus groups that met on specific dates and at specific times. In this way, the Department succeeded in increasing the quality and relevance of meetings for all participants, and meeting deadlines.

## THE REQUIREMENTS TO THRIVE IN THE FOURTH INDUSTRIAL REVOLUTION FORCE THE DEPARTMENT TO RETHINK ITS APPROACH IN TERMS OF HOW IT EDUCATES THE NEXT GENERATION OF MINING ENGINEERS.

The Department's management activities include education (undergraduate and postgraduate teaching and learning), research (internal and external through the MRRC), student wellbeing, administrative support, the Kumba Virtual Reality Centre for Mine Design, community engagement and marketing activities. The abovementioned focus groups enhance the efficiency of the Department's operations, and this is expected to continue.

## Teaching and learning initiatives

The Department embarked on a new strategy during the period under review to ensure that it aligned itself with the needs of students, and incorporated a more all-inclusive approach to teaching and learning. It now uses several new strategies to improve the quality of the learning experience, which includes a more interactive approach to teaching and learning making use of multimedia. Students received this with great enthusiasm.

## Research activities

As part of the process to increase the quality of students' research projects, the subject Research Methodology is included as a registration prerequisite for the master's and doctoral degree programmes.

The Harmony Chair in Rock Engineering and Numerical Modelling entered its second three-year cycle under the leadership of Mr Johan Hanekom. It will continue to function with the financial support of Harmony Gold until 2019. The Kumba Virtual Reality Centre for Mine Design concluded its third year of operation. It has received a lot of interest from the general industry, not only mining. It is now envisaged that the more structured involvement of other departments on campus, such as the Department of Multimedia in the School of Information Technology, will lead to such departments becoming key partners in visual design-related activities in the virtual reality centre. A digital platform project was also established with the financial support of Kumba Iron Ore. It was managed by Prof Francois Malan, Director of the Mining Resilience Research Centre, and IT architect, Derick van der Merwe.

## OVER THE LAST TWO YEARS, THE DEPARTMENT HAS FOLLOWED A BALANCED SCORECARD MANAGEMENT SYSTEM APPROACH IN TERMS OF ITS RELATED RESPONSIBILITIES. THE OBJECTIVE OF RESTRUCTURING REPORTING PROCEDURES IN THIS ADOPTED MANAGEMENT SYSTEM WAS TO ENHANCE EFFICIENCY RELATING TO ALL ACTIVITIES WITHIN THE DEPARTMENT.

A new research chair was established during the period under review with the support of AEL Intelligent Blasting. This chair in innovative rock-breaking technology was established in January 2018, and will be supported until the end of 2020. It is managed in collaboration with the Department of Electrical, Electronic and Computer Engineering, with multidisciplinary research inputs provided by Prof Johan Joubert and Mr Hans Grobler of this department. Prof William Spiteri, who is also an extraordinary professor in the Department of Mining Engineering, was appointed as interim chairholder of this new research chair.

The number of research publications recorded for 2017 showed a slight increase in comparison to 2016. This provided a healthy pipeline for 2018, which was also expected to increase. However, the small number of permanent, full-time lecturers poses a challenge to increasing research outputs on a year-by-year basis. Contract research appointments are an important initiative to build the Department's research capacity. Another challenge is the identification of suitable high-impact journals in the field of mining research.

### Mining Resilience Research Centre

The MRRC experienced growth during the period under review by successfully obtaining new research contracts and delivering quality work. A particular highlight was its involvement in the South African Mining, Extraction, Research, Development and Innovation (SAMERDI) initiative. This is a collaborative initiative among the Council for Scientific and Industrial Research (CSIR), the University of Pretoria, the University of the Witwatersrand and the University of Johannesburg, which is coordinated by the Mining Precinct, a division of the CSIR. The MRRC spearheaded the engagements and coordination of the University in SAMERDI and contributed significantly to the collaborative project planning and proposal development. The MRRC also continued its excellent relationship with the Mine Health and Safety Council (MHSC). External research funding through the MHSC for projects undertaken under the MRRC will further assist in maintaining the current research momentum.

### Leadership and literacy training

The Department's Mining Engineering Leadership Academy (MELA), which was established some five years ago, was further expanded during the period under review under Dr Johann Uys. The Academy's leadership programme for final-year Mining Engineering students was presented for a full day once a month in the first semester, followed by its inclusion

as part of the Mine Design module in the second semester. During these sessions, students are exposed to the various activities related to non-technical skills, particularly as they pertain to their future role as a manager and leader. Non-technical skills such as management and leadership skills will, in future, become critically important to thrive in the Fourth Industrial Revolution. This notion emphasises the need to continue with this very important initiative.

Another initiative that cemented the Department's role as a pioneer in mining education is its English literacy training programme. Initiated in 2015, it continued to form an important part of the Department's teaching and learning strategy. The benefit of this training is evident in the students' commitment to it and the difference it makes in their performance. Undergraduate students participate in this training, which concentrates on writing, communication and presentation skills. This programme received a boost during the period under review with the support of the METF, which enabled the appointment of an English literacy coordinator, Ms Isabella Venter.

**THE DEPARTMENT ENJOYS SUBSTANTIAL SUPPORT FROM THE MINING INDUSTRY. WITHOUT THIS SUPPORT, IT WOULD HAVE BEEN EXTREMELY DIFFICULT TO DELIVER THE SATISFACTORY SERVICE THAT IT CONTINUES TO DO. MOVING FORWARD, THE DEPARTMENT PLANS TO INCREASE ITS RESEARCH CAPABILITIES TO DELIVER INNOVATIVE, QUALITY, RESEARCH-BASED SOLUTIONS FOR THE DEMANDS OF THE MINING INDUSTRY.**

## Funding strategy

The presentation of short courses in conjunction with Enterprizes University of Pretoria (E at UP) forms an important part of the Department's funding strategy. These courses not only contribute to the Department's third-stream income activities, but also elevate its visibility in the mining industry. They make the expertise of the Department available to members of industry for purposes of skills development and capacity building. They also enable individuals in the mining sector to become more effective in the development of smart, long-lasting solutions for society.

The courses that are presented would not have been possible without the support of industry. They furthermore enable the Department to supplement its Development Fund.

During the period under review, the Department continued to present short courses in risk management for the mining industry based on the Safety Risk Management Programme (SRMP) that was established by Anglo American in 2008, and was further developed and enhanced over the last decade. The period under review marked the Department's 11th year of active involvement in risk management for the mining industry. The following lecturers were actively involved in presenting the course: Mr Albert van der Vyver, Prof Krige Visser, Mr Gordon Olivier, Mr Hannes Koekemoer, Mr Paul Maré and Mr Mike Gouws. It is envisaged that this will continue in 2018/19.

The Department also continued its delivery of a short course in mining for non-mining. The Virtual Reality Centre, presented by Prof Ronny Webber-Youngman, was included as part of the offering, and was well received by all delegates.

Sasol was instrumental in establishing a blasting engineering short course for the mining industry, which was presented for its fifth year by Mr Wolter de Graaf in 2018.

Two new courses were developed for presentation in 2019. These are a course in dewatering, which will be presented by Dr Kym Morton, and a course in surface mining excellence, which will be presented by Mr Johann Hager and Mr Henk Fourie.

A short course in tunnel engineering that was presented by Christian Heili in 2017 will also be continued in 2019. A major value addition in terms of the involvement of the mining industry in the short courses presented by the Department was the establishment of the Leadership Capacity-building short course for Harmony Gold under the guidance of Prof Ronny Webber-Youngman and Dr Johann Uys. Other courses that also form part of the Department's funding strategy include a short course in rock engineering, presented by Mr Jannie Maritz, and a course on safe and efficient drilling and blasting for underground mines, presented by Mr Wolter de Graaf.

## Industry support

During the period under review, the Department continued to enjoy substantial support from the mining industry, both in terms of financial contributions and lecturing assistance. In this regard, the Department was guided by the Department of Mining Engineering Advisory Board, which comprises several industry leaders. Without the support of the Minerals Education Trust Fund (METF), MASUP, the Southern African Institute of Mining and Metallurgy (SAIMM), the Association of Mine Managers South Africa (AMMSA), the South African Colliery Managers' Association (SACMA) and the Mining Qualifications Authority (MQA), it would have been extremely difficult to deliver the satisfactory service that it continues to do.

## The way forward

The challenge faced by the Department moving forward is to increase its research capabilities in the sector by increasing innovative, quality, research-based solutions for the demands of the mining industry. This will contribute to an improvement in the Department's international ranking, which will have an effect on its sustainability through additional funding.

The MRRC will play a significant role in this regard, and needs to be expanded further in terms of its visibility on campus and in the mining industry in general. The requirements to thrive in the Fourth Industrial Revolution force the Department to rethink its approach in terms of how it educates the next generation of mining engineers in terms of subject content and delivery mode in general.



# RESEARCH PROFILE

As a leading academic institution, which strives to be a leading, research-intensive department of mining engineering, the Department has an important role to play in enhancing the research capabilities of the mining industry. It is able to conduct cutting-edge research through two industry-sponsored research chairs. Contract research for the MHSC and SAMERDI is conducted through the MRRC, a leading centre that conducts multidisciplinary contract research for industry.

## International recognition

**Members of the MRRC and the Harmony Chair in Rock Engineering and Numerical Modelling have received several accolades for the quality of their research.**

In 2017, Prof Francois Malan was invited to present the Franklin Lecture of the International Society of Rock Mechanics (ISRM). This lecture recognises members of the ISRM who have made a significant contribution to rock mechanics.

Dr Michael du Plessis was awarded the prestigious ISRM Rocha Medal for 2018. This international award is presented for the best PhD in Rock Mechanics for that particular year. Of particular interest is the fact that Prof Malan, who had supervised Dr Du Plessis' research, was awarded the Rocha Medal in 2001 for his own PhD research.

In 2018, Prof John Napier was elected as a foreign member of the National Academy of Engineering in the USA. The mission of this academy is to promote a vibrant engineering profession by marshalling the expertise and insights of eminent engineers to provide independent advice to the federal government on matters involving engineering and technology. Only 262 foreign members are elected.



## Mining Resilience Research Centre

**There are many cross-cutting research initiatives in the field of mining. The MRRC coordinates these initiatives within the various faculties on campus (where mining is applicable), as well as the contract research activities of the Department. It also incorporates the activities of the Kumba Virtual Reality Centre for Mine Design.**

The importance of resilience as a research focus area can be identified by examining the definition of this term: it is the quality of always first considering the impact on others and striving for the best result for all concerned before deciding on a course of action. Research in this regard is essential for the sustainability of the industry.

The vision of the MRRC is to establish the Centre as a leading international contributor to solutions for complex problems in the mining industry. Its mission is to increase the resilience of the mining industry by contributing towards practically implementable solutions through rigorous, integrated, scientific research.

It has the following strategic goals:

- To be a leading, research-intensive centre
- To conduct relevant research through the employment of a sound science and technology approach to generating solutions, continuously improving quality
- To strengthen the Centre's national and international profile through the establishment of sound sustainable business and other collaborative relationships
- To become financially independent in establishing the Centre as a sustainable research centre



MR EUGENE PREIS AND MR JÓNATAN JACOBS, RESEARCHERS IN THE MRRC.

The following research contracts that were secured during the period under review involved several departments within the Faculty and the University:

- Upgrading sound analysis facilities with the addition of an acoustic camera (Department of Mechanical and Aeronautical Engineering)
- Establishing a test and simulation capability and standard verification methods to evaluate collision management systems (Department of Mechanical and Aeronautical Engineering)
- Developing an underground and surface communication system (Department of Electrical, Electronic and Computer Engineering)
- Developing rock mass condition assessment tools (Department of Mechanical and Aeronautical Engineering)
- Assessing the feasibility of reducing diesel particulate matter exposure through replacement or conversion of all Tier 0 with Tier 2 or 3 engines (Department of Mining Engineering)
- Developing mining illumination standards for mobile equipment operating in open-pit and underground mines in the South African mining industry (Department of Mining Engineering)

The MRRC was involved in the following projects under the SAMERDI initiative, which was established in 2017:

- The mechanisation of gold and platinum group metals (PGM) mines using drilling and blasting
- The non-explosive rock-breaking of gold and PGM mines
- Real-time information management systems
- Determining the longevity of current mining through best-practice analysis
- Real-time information management systems for underground mining

External research funding through contract research work with SAMERDI and the MHSC will assist the MRRC in maintaining the Department's current research momentum. Through these efforts, it is envisaged that the MRRC will continue to grow its footprint in mining research globally.

**EXTERNAL RESEARCH  
FUNDING THROUGH  
CONTRACT RESEARCH WORK  
WITH SAMERDI AND THE  
MHSC WILL ASSIST THE  
MRRC IN MAINTAINING THE  
DEPARTMENT'S CURRENT  
RESEARCH MOMENTUM.**



## MAKING VISION VISIBLE

### Kumba Virtual Reality Centre for Mine Design

**Virtual reality presents an environment for “immersive” experiences that are destined to change the face of education, research and design in mining and beyond.**

The Department’s Kumba Virtual Reality Centre for Mine Design was launched in August 2015 and comprises a 3D 360° cylinder that can accommodate 25 students at a time. It is supported by a state-of-the-art 76-seat lecture hall and a 3D cinematic theatre that seats 47 people.

The vision of the Kumba Virtual Reality Centre for Mine Design is to be a world-class virtual reality centre that enhances education, training and research in operational risk across industries through an innovative approach to information optimisation and visualisation. Its mission is to develop a fully integrated mine design process in the virtual reality domain with the optimisation of mine designs, incorporating all immersive-related technology, such as augmented virtual reality and other relevant and related technologies. It is anticipated to revolutionise the way industries create solutions to complex challenges.

The strategic goals of the Kumba Virtual Reality Centre for Mine Design are as follows:

- To be a leading virtual reality centre to the benefit of the mining industry
- To strengthen the virtual reality centre’s national and international profile through the establishment of sound sustainable business and other collaborative relationships
- To explore and contribute significantly in terms of the drive towards immersive technologies used in teaching and learning activities in the Department
- To further explore the use and implementation of virtual reality- and augmented reality-related technologies in the mining industry for teaching and learning

- To become financially independent in establishing the virtual reality centre as a sustainable virtual reality-related business unit in the Department

The virtual reality centre strives to be an innovative resource for bringing real-world scenarios to learners to enhance their exposure to their chosen industry, and allowing technical and other practitioners to simulate plans and designs in a risk-free environment with minimal time and resource allocation.

Operational benefits to be gained from interpreting and portraying actual data in the high-quality and realistic visual format offered by the virtual reality centre include the following:

- Operational productivity and overall effectiveness can be achieved by playing out different scenarios before committing resources to a particular course of action.
- Engineers, planners and other stakeholders are better placed to make choices that take into account the long-term and socio-economic consequences of their financial and technical decisions by first considering these in a virtual environment.
- Incidents that may pose an operational risk can be minimised when one can simulate activities without actually exposing people or equipment to harm.
- Virtual reality allows multiple data sets to be converted into strategic business information. Once decision-makers are exposed to an immersive experience that portrays their data visually, it becomes easier to make decisions and improvements on their project design and other activities that operationalise their strategies.

#### Current projects

In 2018, Kumba Iron Ore also established a digital platform project in the Department to continue its support of virtual reality-related research initiatives.

**HOLOGRAMS ARE THE FUTURE WAY OF COMMUNICATING. THE DEPARTMENT OF MINING ENGINEERING IS READY TO EMBRACE ALL THE OPPORTUNITIES THAT TECHNOLOGICAL INNOVATION PROVIDE. IT INTENDS TO ESTABLISH ITSELF AS A PROMINENT PLAYER IN THE FOURTH INDUSTRIAL REVOLUTION BY PRODUCING WORK-READY IMAGINEERS, CAPABLE OF DEVELOPING CUTTING-EDGE SOLUTIONS TO INDUSTRY PROBLEMS.**



# COLLABORATIVE AND CROSS-CUTTING RESEARCH FOCUS AREAS

Many collaborative and cross-cutting research capabilities have been created within the Department. This contributes to enhancing the Department's profile as a leading, research-intensive department that pursues excellence in teaching, learning and research, and is recognised for the quality of the graduates it delivers.

## Rock mechanics and undergraduate mine design

Pillar design and extraction methodologies have featured in the mining industry for a long time. A huge body of research has been focused towards the establishment of a design methodology for the stability of pillars, especially in the coal mining industry. In recent years hard rock mines adopted these methodologies with some adjustments to the input

parameters with varying levels of success. This research is directed at understanding the complex loading environment of pillars at various depths and dip angles, as well as establishing how mining layouts and rates affect these loading conditions. The optimisation of mineral resources is imperative when one considers the sustainability of the South African mining sector.

## Rock-breaking and surface mining

The importance for improved safety standards, cost-effectiveness and productivity has driven technical mining personnel to examine all facets of their operations. Through technically advanced projects, efficient drilling and blasting programmes impact positively throughout the mining operation

and invariably lead to an increase in overall profitability. The safe, efficient and innovative use of explosives for rock breaking contributes positively to the overall mining operation. Surface mining excellence, through its various parameters, now also forms part of the Department's research capabilities.

## Mine ventilation engineering

Providing adequate ventilation to dilute pollutants such as gases, dust and diesel particles in mines, remains the primary focus of a ventilation engineer. In recent years, the importance of providing a healthy and safe environment in which workers can perform their duties has grown within the legislative framework, as well as in the media. Areas requiring continued focus and research efforts include improvements

in coal mine face conditions to reduce dust exposure and dilute methane, and a reduction in sources of noise, the intensity of sources and, ultimately, the improvement in the occurrence of noise-induced hearing loss. Research capabilities include the development of energy-efficient components within the network, as well as research into improved networks and the control of networks.

## Risk management

A multitude of factors contribute to the overall mining process. Risk management is an essential component of the mining engineer's job. Some of the topics examined include legal liability, safety, health, and operational risk management

techniques such as mitigation methodologies, change management, behaviour-based safety and safety leadership. Each of these topics is of vital consideration when establishing a safe and healthy working environment.

## Immersive technology

In the period under review, the Department further investigated the potential of the full-scale adoption of immersive technology in research projects, where applicable. This specifically refers to visualisation as an important aspect of the implementation process for research projects. The active involvement of future role-players as part of this initiative, such as the Faculty's School of Information

Technology, which incorporates the departments of Computer Science, Informatics and Information Science, is envisaged. This is an ongoing initiative towards insourcing rather than outsourcing solutions for needs, and will be explored further in 2019. The current digital platform project for the Kumba Virtual Reality Centre for Mine Design that was initiated in January 2018 forms the basis of this investigation.

## Research into change management models for Mining and Mining Equipment Manufacturers of South Africa (MEMSA)

This research aims to develop appropriate change management models and options for the gold and platinum industries that will enable and support companies in their acceptance and management of the uptake of automation and innovation, as well as the technologies that stem from the various technology initiatives. The main obstacle is that the resource industry, as well as the implementation of new technology and processes, must overcome a well-established culture and mindset of resistance to change and acceptance of technology by employees.

Thus, the development of change management processes and models will have to be in tandem and integrated with technical research progress on the one hand, and human factors that play a role during change on the other. This specifically refers to resistance to change, perceptions of threat during and after change, as well as the age-old adage: "What is in it for me?".

The Department foresees that the fieldwork, as well as the research and development, will be based on a consultative data-gathering process in the mining houses, and by mining engineering manufacturers. In this regard, two parallel streams of process outcomes are envisaged:

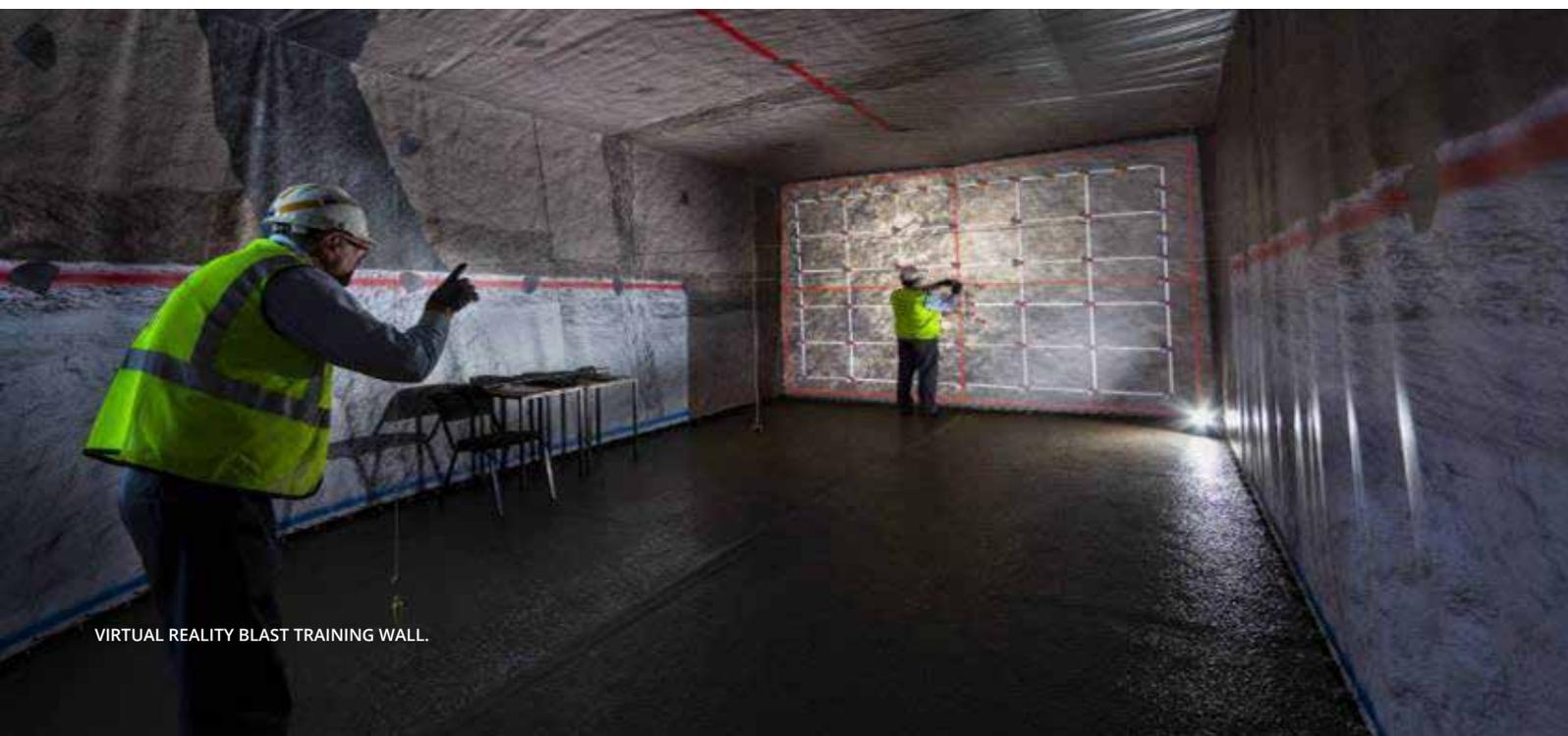
- A mining house-specific change management "template" with the associated customisation situational indicators.
- A manufacturer's change management "tool" that goes with their technological research outcomes – thus the accompanying change management (and associated management of change) model for the specific new technology.

These two streams must be integrated and dovetailed to offer a comprehensive solution for industry.

## System dynamics value determination in mining engineering

The determination of value generated due to disruptive technologies, such as the automation of drills, is an important aspect in surface mining. The objective of this research is to establish the causal relationship of the value chain, and to model the dynamic behaviour of an iron ore mine for the prediction of impact of change. This model considers the revenue generated in a simulated environment with multiple variables. Primarily, this study will create a system dynamics model applied to mining cost modelling that will simulate cause and effect relationships. The output will be comparable of before and after scenarios due to disruptive technologies introduced in the existing system. The objective is not to replicate the uniqueness of an existing project, but to simulate sufficient elements

that can simulate the specific case study, as well as other similar changes in the mining environment. The model that is created needs to predict the impact of changes introduced in mines during their life without having to go through large data generated by the mines that is often not visual and visible. The model should be generic enough to be adopted in a typical large open-pit mine. The simulation is done by using an industrial engineering tool called VENSIM. Many researchers have adopted value-based management (VBM), but, most importantly, the research fulfills the need for analytical tools that can accommodate operational realities by describing the development and deployment of the major operational resources of the business, and the interactions between them.



VIRTUAL REALITY BLAST TRAINING WALL.



RESEARCH IN A TYPICAL DEEP GOLD MINE STOPE SHOWING THE INSTALLED SUPPORT.

# RESEARCH CHAIRS

## Harmony Chair in Rock Engineering and Numerical Modelling

Established in January 2014

**In establishing the Harmony Chair in Rock Engineering and Numerical Modelling, the Department created a vehicle that assists the South African mining industry to conduct research in rock engineering, particularly the use of numerical modelling techniques in the field.**

This vehicle in many ways already serves the whole mining industry and elevates substantially more rock engineering issues than originally intended through the related publications that have already emanated from this research. The chairholder is Johan Hanekom.

The objectives of this chair include promoting study and research in the field of rock engineering, further education and learning in the field of rock engineering at both undergraduate and postgraduate levels, research and development, and furthering interaction between academic institutions and the mining industry.

### RESEARCH PROJECTS IN THE HARMONY CHAIR IN ROCK ENGINEERING AND NUMERICAL MODELLING

- **The calibration of numerical modelling** (Prof Francois Malan and Prof John Napier): Case study closure measurements were utilised to calibrate the code. A simplified geometry was used to illustrate the code's behaviour. The results correlated well with expected closure profiles.
- **Grid size effects in simulating closure** (Prof Francois Malan and Prof John Napier): The impact of grid size on the closure profile was confirmed and indicated that very small grids provided good results, but large grid sizes create jumps in the closure profiles as elements yield or fail.
- **Strategies to address numerical grid size effects in simulating time-dependant stope closure** (Prof Francois Malan and Prof John Napier): The partial failure runs at larger grid sizes correlated well with fine grid, discrete element failures for failed region and closure profiles, but not for fracture zone depth as a discrepancy appears when the grid size edge is passed.
- **Evaluation of proposed partial element fracturing algorithm** (Prof Francois Malan and Prof John Napier): Fracture zone size is affected by grid size for discrete element failures and fine grids are similar to partial failure at larger grids. The closure profile is not substantially affected by partial, discrete and grid size.



## AEL Intelligent Blasting Chair in Innovative Rock-breaking Technology

Established in January 2018

**This research will pave the way for future investigations in innovative rock-breaking technology. It is set to establish the University as a centre of excellence for emerging rock-breaking technologies. The Chairholder is Prof William Spiteri.**

Research will focus specifically on three-dimensional blast simulation and the visualisation of new research, as well as incorporating research into blasting engineering practices.

Multidisciplinary research is conducted in collaboration with the Department of Electrical, Electronic and Computer Engineering.

## RESEARCH PROJECT IN THE AEL INTELLIGENT BLASTING CHAIR IN INNOVATIVE ROCK-BREAKING TECHNOLOGY

- **Determination of safe blast clearance radii for blasting operations at Glencore coal mines in the Witbank area:** It is proposed to research and develop a methodology to accurately measure and record fly rock during a blast in order to gain a sufficient sample size or data set to make additional and more reliable recommendations to the mine. The methodology should also be applicable to measuring the effect of the various drilling and blasting parameters on fly rock and therefore assist in developing a new and accurate predictive model to improve blasting performance and eliminate the risk of fly rock.
- **AEL Intelligent Blasting training project**  
This training project for trainers incorporates a virtual reality component, which follows a gamification approach. This is a unique intervention to assist in assessing training blasters' readiness to perform a live blast and solve work-related problems. Through the virtual reality project's scenarios, trainees will be "immersed" in the work situation, and make decisions and solve the problems in real time.
- **3D simulations**  
Research in the Department of Electrical, Electronic and Computer Engineering focuses specifically on the visualisation of mining environments using virtual reality. This includes three-dimensional (3D) blast simulation and the visualisation of new research. In order to visualise mining environments, data from 3D laser scans, videos, images and geological surveys will be used to create a 3D virtual-world representation of the environments under investigation.

## RESEARCH OUTPUTS (2017)

### Journal articles

1. Alejano, L.R., Arzua, J., Castro-Filgueira, U. & Malan, D.F. 2017. Strapping of pillars with cables to enhance pillar stability. *Journal of the Southern African Institute of Mining and Metallurgy* 117(6): 527-540.
2. Gomes-Sebatiao, G. & De Graaf, W. 2017. An investigation into the fragmentation of blasted rock at Gomes Sand. *Journal of the Southern African Institute of Mining and Metallurgy* 117(4): 321-328.
3. Grobler, H. & Maritz, J. 2017. Status of the phasing out of the Chamber of Mines of South Africa Certificate of Competency. *Journal of the Southern African Institute of Mining and Metallurgy* 117(8): 793-802.
4. Jacobs, J. & Webber-Youngman, R. 2017. A technology map to facilitate the process of mine modernisation throughout the mining cycle. *Journal of the Southern African Institute of Mining and Metallurgy* 117(7): 637-648.
5. Ngwenyama, P., Preis, E. & De Graaf, W. 2017. Factors and challenges affecting coal recovery by opencast pillar mining in the Witbank coalfield. *Journal of the Southern African Institute of Mining and Metallurgy* 117(3): 215-222.

### Conference papers

1. De Graaf, W. & Ngwenyama, P. 2017. The application opencast pillar mining for the secondary extraction of pillars from previously mined bord-and-pillar operations, Third Youth Professionals Conference, 9-10 March, Pretoria, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 277-292.
2. Du Plessis, M. & Malan, D. 2017. Mining with crush pillars, AfriRock 2017 ISRM International Symposium, "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 109-121.
3. Essrich, F., Hanekom, J. & Bouwer, J. 2017. Technology transfer for minimising seismic risk in South Africa's platinum mines, AfriRock 2017 ISRM International Symposium "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 377-389.
4. Esterhuysen, J.C. & Malan, D. 2017. A study of multi-reef pillar extraction in the Ventersdorp Contact Reef, AfriRock 2017 ISRM International Symposium "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 471-483.
5. Hanekom, J. & Okhuis, B. 2017. Is face-bursting imminent in deeper South African mines? Third Youth Professionals Conference, 9-10 March, Pretoria, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 253-262.
6. Hanekom, J. & Okhuis, B. 2017. Numerical model calibration: process of luck? AfriRock 2017 ISRM International Symposium "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 753-767.
7. Hanekom, J. & Rajpal, Y. 2017. An empirical and numerical approach to quantifying raisebore-hole stability, AfriRock 2017 ISRM International Symposium "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 427-438.
8. Hanekom, J. 2017. Fundamental understanding of underground pillar design processes and methods, AfriRock 2017 ISRM International Symposium "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 1081-1093.
9. Malan, D. & Napier, J. 2017. Reassessing continuous stope closure data using a limit equilibrium displacement discontinuity model, AfriRock 2017 ISRM International Symposium "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 441-454.
10. Maritz, J. 2017. Preliminary investigation of the effect of a real shape on pillar strength, AfriRock 2017 ISRM International Symposium "Rock Mechanics for Africa", 3-5 October, Cape Town, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 143-154.
11. Preis, E. & Webber-Youngman, R. 2017. Identification of cost factors relating to mining incidents, Third Youth Professionals Conference, 9-10 March, Pretoria, South Africa, The Southern Africa Institute of Mining and Metallurgy, pp. 89-105.

# MINING ENGINEERING LEADERSHIP ACADEMY (MELA)

**The Department of Mining Engineering makes a significant contribution to the mining industry by providing it with world-class leaders in mining engineering. Its students are the future leaders of the industry. As such, the Department is aware of the challenges its graduates face in the transition from students to managers and leaders. This is particularly relevant in the complex, rapidly changing world of cyber-technology, Internet of Things and Industry 4.0.**

While students are generally well educated in technical mining engineering skills, they need to work with and lead people once they enter the world of work. To this end, the Department realises that students who enter the workplace often lack sufficient levels of self-awareness, interpersonal communication skills and the ability to work in multidisciplinary settings and diverse groups that span many generations.

MELA is currently under the sanction of Head of Department, Prof Ronny Webber-Youngman. All its activities are run by Dr Johann Uys, a senior lecturer in the Department, and a psychologist with decades of leadership experience in mining



SNAPSHOT FROM THE MELA WORKSHOP AT MATLAPENG BUSH CAMP.

and related industries. MELA's main objective is to groom students to be the best that they can be before leaving university.

During the period under review, all final-year students were enrolled in the six-month MELA programme at the beginning of each year. This builds up to the second half of the year, in which students are divided into teams for their Mine Design course (PMZ 422).

The programme entailed the following process:

- MELA Phase 1 introduces students to leadership as future alumni of the University and the Department. It aims to establish an awareness of the stewardship of being a Tukkier and a future mining engineering leader. The programme differentiated between management and leadership, as well as the balance between these two roles. This phase is concluded with psychometric assessments that, in conjunction with academic performance, commodity and biographic profiles, are used to divide the students into teams of four diverse members for PMZ 422.
- MELA Phase 2 takes place during the autumn of each year. It commences with these four-person teams embarking on an experiential outward-bound weekend where they work together. Seasoned facilitators and MELA staff accompany students to hone their skills. This constantly makes them aware of the experiential learning application in their academic programmes, as well as vocational preparation and application.
- The final phase of the leadership programme comprises a number of practical management workshops in which students take part in topics such as planning, leading, organising and control. Intrapersonal and interpersonal workshop topics cover conflict management and developing new intelligences, such as emotional intelligence (EQ). Other topics are leadership and relationship, as well as future planning, together with career and goal awareness as a mining engineer.

In 2017, Dr Uys also introduced a Women in Mining Day, which covered the current status of women and challenges for women in the industry. These seminars end with an alumna from industry sharing her career experience with the students. This is particularly beneficial for all students as it goes beyond gender issues. It also addresses career departure challenges and ways for the students to learn from the world of work.

In future, MELA will be expanded to all students in the Department, and a wider range of leadership topics will be included, such as the mine as an organisation, the community and communication, as well as contact sessions and discussions with industry leaders.

**THE DEPARTMENT OF MINING  
ENGINEERING PROVIDES THE  
MINING INDUSTRY WITH  
WORLD-CLASS LEADERS.**



# EDUCATION INNOVATION

## Instructional design

All the technical subjects in the Department are being instructionally designed so as to enhance the learning experience. This strategy incorporates an approach that involves the following aspects:

- Analysis of the learning outcomes, and enrichment of the content with media elements for better understanding
- Design of the content to enhance understanding
- Development of the design in an electronic format by creating links to the media and journal files
- Implementation of the material by providing the opportunity for student feedback
- Evaluation of what worked, what did not work and what needs to be improved for the next offering

The multimedia presentation of the learning material includes the use of high-quality pictures and illustrations, animations showing concepts in mining that are difficult to grasp, and video material to make the images come alive. This will further be enhanced with the establishment and finalisation of the iMineUP teaching and learning app to form part of each and every technical mining subject. The Kumba Virtual Reality Centre for Mine Design is also being incorporated into the undergraduate curriculum as part of the learning experience.

## MAKING COURSE NOTES COME ALIVE

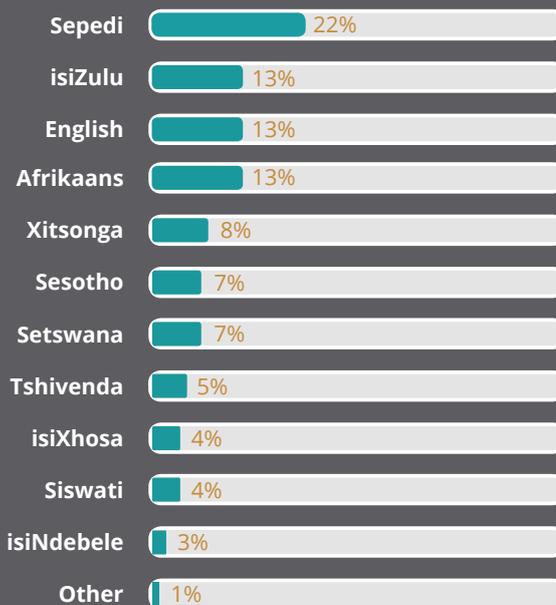


## English literacy training

Excellent communication skills are essential for students' success in their academic endeavours and the workplace. One of the significant challenges in the Department is the English language diversity of the different students who enrol. Only 13% of all the students in the Department have English as their first language, which means that 87% of all the students in the Department are taught in their second language.

The largest number of students in the Department has Sepedi as their mother tongue, followed by English, Afrikaans and isiZulu. The Department places great emphasis on ensuring that all students fully comprehend the information presented to them and can reproduce it successfully.

In an effort to help students whose home language is not English cope academically, the Department has appointed an English literacy coordinator. She assists undergraduate students with writing, communication and presentation skills, and mark assignments with specific reference to improving students' English writing. Academic lecturers can now concentrate on the technical subject matter.



LANGUAGE DISTRIBUTION ACCROSS ALL STUDENTS IN THE DEPARTMENT (2018)



## STUDENT WELLBEING

In accordance with its value-driven framework, the Department focuses on the wellbeing of its students. The aim is to ensure that it can lend support in order to avert any anxiety that students may experience during their studies. Confidentiality is guaranteed and all cases are handled on merit.

The Department strives, in particular, to assist all final-year students who are in some form of need. It has assisted several students by sponsoring prescription glasses and daily meals. Accommodation and registration fees were also sponsored and the Department now has a loan laptop that it can lend out to students. The financial support of industry is highly appreciated and the funds are put to good use.

Students in the Department also benefit from the services of the wider Faculty support structures in the form of the Faculty Student Advisors, who provide ongoing assistance with study and examination skills, time management and other co-curricular issues. These professionals guide students through various challenges and show them how these influence their academic performance. They also have professional qualifications in counselling, which means that they can identify issues and refer students to the correct support structures.

## DEPARTMENT OF MINING ENGINEERING VALUES

RESPECT

CARE

HONESTY

INTEGRITY

TRUST

## Alternative careers in mining

The Tuks Mining Society held a career evening at the end of the period under review to introduce students to alternative careers in mining. The event was attended by students from the Department of Mining Engineering, as well as the Department of Materials Science and Metallurgical Engineering, and attracted students studying geology-related degrees.

The event originated following a need that was identified by students who wished to know more about the type of careers that were available in the mining industry. Speakers included individuals from various academic backgrounds, including mining and industrial engineers, accountants and other professionals related to business.





# COMMUNITY ENGAGEMENT

**The Department prioritises developing its students to become future managers, leaders and technical specialists. Students are actively encouraged to hone their life skills and responsible leadership abilities by participating in the Community-based Project Module (JCP).**

The JCP module is an essential part of the curriculum for all undergraduate programmes in the Faculty, as it accommodates the need for community service and service-learning projects in a higher education environment.

During 2018, mining engineering students participated in two projects to paint classrooms at day care centres and another project to restore benches at Bramley Children's Home.

The students learnt much about teamwork, time management in a group and managing resources. They have become more aware of personal, social and cultural values that will benefit them throughout their lifetime. Students are also encouraged to work with team members from other disciplines. They also learnt to improvise when they encountered challenges and improved their communication skills.

The vital skills they learnt will add to their becoming excellent mining engineers who can function effectively in diverse teams and in multidisciplinary environments.

*"I am pleased with the module since the project provided me with awareness of personal, social and cultural values that will benefit me throughout my lifetime."*

*"It felt fulfilling to assist someone else, and to serve the community. Having to work with people from a different field from mine was quite interesting, especially with the enhancement of communication. I learnt that work cannot stop, one should rather improvise if one has reached a dead end."*

*"Giving back is not just about money, a simple task of giving back can make a difference in someone's life."*

*"The project gave me an opportunity to be an active member of the community."*



**COMMUNITY  
ENGAGEMENT PROJECTS  
MAKE STUDENTS  
MORE AWARE OF  
PERSONAL, SOCIAL AND  
CULTURAL VALUES THAT  
WILL BENEFIT THEM  
THROUGHOUT THEIR  
LIFETIMES.**



## **FACULTY-WIDE PARTICIPATION IN THE JCP MODULE**



**19 862**

STUDENTS

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**5 857**

PROJECTS

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**794 480**

SERVICE HOURS

# THE INVOLVEMENT OF INDUSTRY

**External funding from industry represents 63% of the Department's total income, which highlights the significance of industry involvement and support.**

Support from industry for the presentation of short courses also provides an important source of third-stream income for the Department.

A major initiative that commenced in October 2017 was the introduction of a leadership capacity-building short course for Harmony Gold. This short course covers leadership capacity building for three levels of management: junior or emerging managers, senior managers and executives. The first delegate graduation of approximately 100 Harmony Gold employees will take place in November 2018.

In the year under review, the METF once again honoured its staff salary subvention commitment. Without this, it would have been very difficult to attract and retain quality lecturing staff for the Department. Capital and discretionary funds received from the METF also contributed to the establishment of the academic app for teaching and learning, as well as an electronic blast wall to enhance teaching. It also supported the acquisition of physical display models and other tools to support teaching and learning, such as a 3D printer, and made the appointment of a staff member for English Literacy possible.

Industry experts provide support to lecturers with full-time lecturing, as well as on a part-time basis to provide undergraduate and postgraduate support. These industry specialists are involved in a number of designated academic programmes and research-related activities, and many of them are alumni of the Department of Mining Engineering.

The full list of professional development courses is available at [www.up.ac.za/en/mining-engineering/article/48890/short-courses](http://www.up.ac.za/en/mining-engineering/article/48890/short-courses).

## Advisory Board

The Department also benefits from the expertise of the following leaders from industry and academia who serve on the Mining Engineering Advisory Board:

- Prof Sunil Maharaj, Dean: Faculty of Engineering, Built Environment and Information Technology, UP
- Prof Josua Meyer, Chairperson, School of Engineering, UP
- Prof Ronny Webber-Youngman, Head of Department of Mining Engineering, UP
- Mr Ben Bruwer, President of the Mining Alumni Society of the University of Pretoria
- Mr Riaan van der Merwe
- Mr Wilco Uys
- Prof Con Fauconnier
- Mr Bernard Swanepoel
- Mr Don Turvey
- Dr Gys Landman
- Mr Francois Uys
- Mr Gerhard Potgieter
- Mr Chris Griffith
- Mr Pierre Jordaan
- Mr Joshua Ngoma
- Mr Peter Steenkamp
- Mr Johan de Vos
- Mr Rowan Karstel
- Mr Chris Sheppard
- Dr Gordon Smith
- Mr Ken Matthysen
- Mr Rassie Alberts
- Mr Corné Strydom
- Mr Dick Kruger
- Dr Nombasa Tsengwa

## Prominent alumni

The Department boasts with several alumni who have reached the highest ranks of business, not just in the mining industry. The names of prominent alumni are regularly brought to the attention of the Department, but that does not mean that the following alumni (listed alphabetically) are the only industry leaders who have gained recognition on the basis of a degree obtained from this Department. We therefore also acknowledge those alumni whose achievements have not been brought to our attention as well.

- Mr Rassie Alberts, COO
- Mr Theo Bothoulas, CEO
- Mr Johan de Vos, MD
- Prof Con Fauconnier, CEO
- Mr Hennie Faul, CEO
- Mr Klaus Fischer, MD
- Mr Dirk Fourie, COO
- Mr Chris Griffith, CEO
- Mr Rikus Grimbeek, COO
- Mr Johan Heystek, CEO
- Mr Johan Jansen, CEO
- Mr Koos Jordaan, CEO
- Mr Pierre Jordaan, Head of Mining
- Mr Rowan Karstel, CEO
- Mr Manie Kriel, CEO
- Mr Dirk Kruger, MD
- Mr Henry Laas, CEO
- Dr Gys Landman, CEO
- Mr Jaqco Lottering, MD
- Mr Nico Muller, CEO
- Mr Byers Nel, COO
- Mr Gerhard Potgieter, COO
- Mr Peter Steenkamp, CEO
- Mr Bernard Swanepoel, CEO
- Mr Hugo Tukker, MD
- Mr Don Turvey, CEO
- Mr Francois Uys, CEO
- Mr Wilco Uys, CEO
- Mr Riaan van der Merwe, COO
- Mr Riaan Vermeulen, Head of Mining

# INDUSTRY PARTNERS

## UNIVERSITIES



Clausthal University of Technology



University of Exeter, Camborne School of Mines



The University of New South Wales, Australia

## INDUSTRY PARTNERS



Minerals Council South Africa



Sasol



Harmony Gold



Assmang Proprietary Limited



Murray & Roberts



Minerals Education Trust Fund



New Concept Mining



Kumba Iron Ore: Anglo American



African Rainbow Minerals (ARM)



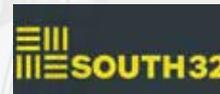
Anglo American



Glencore



AEL Mining Services



South 32



I-Cat-CAT Environmental Solutions

## PROFESSIONAL ASSOCIATIONS



Association of Mine Managers South Africa



The SA Colliery Managers' Association



The Mine Ventilation Society of South Africa



South African National Institute of Rock Mining



Engineering Council of South Africa



Southern African Institute of Mining and Metallurgy

## SCIENCE COUNCILS



Council for Geoscience Applied Geoscience Solutions

Council for Geoscience



Council for Scientific and Industrial Research



CSIR Mining Precinct



Mintek

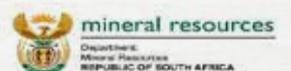
## GOVERNMENT INSTITUTIONS



Mining Qualifications Authority



Mine Health and Safety Council



Department of Mineral Resources

# EVENTS GALLERY

## Oversight visit of the Portfolio Committee on Mineral Resources



MEMBERS OF THE PORTFOLIO COMMITTEE ON MINERAL RESOURCES WITH THE STAFF OF THE DEPARTMENT OF MINING ENGINEERING. THE DELEGATION INCLUDED THE FOLLOWING MEMBERS OF PARLIAMENT: CHIEF ZMD MANDELA, MS HV NYAMBI, MR M MATLALA, MR I PIKININI, MR J LORIMER, ADVOCATE J SCHMIDT AND MR S JAFTA, AS WELL AS THE COMMITTEE SECRETARY, MS A BOSS, THE CONTENT ADVISOR, MR N KWEYAMA, AND THE COMMITTEE ASSISTANT, MS S SIKHOSANA.

The Portfolio Committee on Mineral Resources visited the Department on 29 January 2018. The delegation was led by His Honorable Member of Parliament and Chairperson of the Committee, Mr Sahlulele Luzipo. Mr Luzipo concluded the meeting, which included a presentation delivered by Prof Ronny Webber-Youngman, by commenting on the quality facilities in the Department, with specific reference to the Kumba Virtual Reality Centre for Mine Design. He also commended the enthusiasm and passion within the Department in terms of its capability to add value in the mining industry. The Department was honoured to host the members of Parliament.

## Launch of the second term of the Harmony Chair in Rock Engineering and Numerical Modelling



The launch took place on 31 October 2017. The second term of the Harmony Chair in Rock Engineering and Numerical Modelling was inaugurated by Mr Mashego Mashego (Executive Director, Harmony), Mr Beyers Nel (COO: SA Operations, Harmony), Mr Peter Steenkamp (Group CEO, Harmony), Prof Cheryl de la Rey (Vice-Chancellor and Principal, University of Pretoria), Mr Johan Hanekom (Chairperson, Harmony Chair in Rock Engineering and Numerical Modelling), Prof Sunil Maharaj (Dean of the Faculty of Engineering, Built Environment and Information Technology at the University of Pretoria).

## Launch of the AEL Intelligent Blasting Chair in Innovative Rock-breaking Technology



Mr Edwin Ludick, CEO of AEL Intelligent Blasting, addressing the audience at the launch of the AEL Intelligent Blasting Chair in Rock-breaking Technology that took place on 3 October 2017.

## MASUP Annual General Meeting: 25 May 2018



ROGER BAXTER, CEO OF THE MINERALS COUNCIL SOUTH AFRICA, ADDRESSES MEMBERS OF MASUP.



PROF CON FAUCCONNIER CONGRATULATES DR FRIK DE FREY ON HIS MASUP GOLD MEDAL ACHIEVEMENT AWARD.

## Roll-out of the Leadership Capacity-building short course for Harmony Gold



JUNIOR MANAGER DELEGATES WITH HARMONY GOLD COO, MR BEYERS NEL, AND COURSE FACILITATORS, PROF RONNY WEBBER-YOUNGMAN AND DR JOHANN UYS.



EXECUTIVE GROUP MEMBERS WITH HARMONY GOLD COO, MR BEYERS NEL, ANTON BUTHELEZI AND SYLVIA SELEKA.

## Impala HSER Board meeting



MEMBERS OF THE IMPALA HEALTH, SAFETY, ENVIRONMENT AND RISK (HSER) COMMITTEE BOARD AT THE MEETING HELD AT THE DEPARTMENT OF MINING ENGINEERING ON 21 AUGUST 2018.



### MELA Women in Mining

The guest lecture on Women in Mining was instituted in September 2017 as an annual event for all final-year students.

Dr Johann Uys shared the current status of women in the mining industry. The guest speaker was Ms Sylvia Seleka, Harmony Talent Manager, who highlighted the advantages and challenges facing women in mining. She also discussed operational and strategic benefits for organisations who actively support the advancement of women in mining.

# DEPARTMENT OF MINING ENGINEERING: THE FINAL-YEAR CLASS AND STAFF OF 2017



**Front row from left to right:**

Wolter de Graaf, Marietha Hicks, Jannie Maritz, Daleen Gudmanz, Prof Ronny Webber-Youngman (Head of the Department), Dr Bertie Meyer, Sezer Uludag, Eugene Preis, Jónatan Jacobs.

**Second row from left to right:**

Isabella Venter, Wilson Magongwa, Larrance Ngwenyama, Dr Johann Uys, Johan Hanekom, Zander van Beest van Andel, Juan Ahlers, Ramashau Elphus, Keaton Philo, Abea Kgatshe, Mulisa Mukhelo, Danisa Baloyi, Jennifer Sapsford.

**Third row from left to right:**

Boitumelo Rapoo, Ipeleng Motsogi, Nomfundo Ngcobo, Mariaan Loots, Shadikle Mokonyane, Lindokuhle Langa, Maanda Tharage, Mmoloke Ndlovu, Mothusi Letsie, Tebogo Mokoatleng, Grace Motloun, Hlalefang Maseru.

**Fourth row from left to right:**

Tsebiso Motjopi, Otto Pasch, Modike Mankuru, Athenkosi Jojo, Lisa Lizwane, Kenneth Sibiya, Lesetja Mothwa, JP Labuschagne, Thabo Mathabatha, Vukwetsimi Ngobeni, Sphamandla Mthembu, Khodani Madzhasi, Pieter Lee.

**Fifth row from left to right:**

Sakhile Mnisi, Linda Magwete, Wandile Nobela, Kamogelo Mogodiri, Travis Mitchell, Drikus Erasmus, Herman Mans, Christopher Mahanye, Neo, Maruping, Ramoitoi Raleie, Fezile Habile.





**Department website**

<http://www.up.ac.za/mining-engineering>

**Enquiries**

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