

Reducing rolling resistance

Among the things John Chadwick considers here are haul roads, advanced technologies for tyre management and a looming tyre shortage problem

Haul road maintenance is an essential task that should receive daily attention, both on surface and underground.

Good roads improve production, extend tyre life, reduce wear on mobile machinery and reduce overall operating costs.

Mark Senyard, Product Marketing Manager of Barloworld Equipment, South Africa's Caterpillar dealer notes "tyres are a key expenditure item to be preserved for as long as possible. However, despite this, approximately 80% of all large tyres fail before wear due to poor maintenance and operating practices. This statistic is underscored by a recent study at a major metal mine, which indicated tyre cuts (45%) and impact damage (20%) as the largest contributing factors towards premature tyre failure."

Rocks spilled from haul trucks are the main source of this damage, so motor-graders should be used to continually maintain haulage routes and remove loose debris.

Senyard goes on to explain: "Poor road maintenance practices also result in an increase in rolling resistance. Typically, for off-highway trucks running radial-ply tyres, a minimum rolling resistance of around 1.2% would be expected for a hard and well-maintained permanent haul road. However, if this figure increases by just 5%, the impact becomes disproportionately greater and could result in up to a 10% decrease in production, and a 35% increase in production costs.

"Essentially, there are three key factors that determine optimum haul road condition: material quality; design; and maintenance. It is equally important to note that haul roads begin at the loading face and end at the dumping point, and maintaining good floor conditions in both of these areas will definitely reduce tyre wear and fuel burn costs.

"Once a road deteriorates, assuming it was well constructed in the first place, it takes five times as long to repair it again to an acceptable condition. In this respect, it is important, in terms of maintenance, to match the right grader and water tanker units to the haul route.

"The size of the grader will depend primarily on the width of the haul road, but will also be influenced by the road's construction, and the [mine's] ongoing maintenance program. A neglected road will require more intensive remedial action and a larger grader to cut and grade final levels."

Typical blade loads are about one-third to half of full capacity to reshape haul roads. However, where large hauling units travel on softer materials, heavy loads may be required to reshape the road surface. Where there are roads with steep gradients or where very precise roadway elevations and slopes are desired, these considerations will determine which grader model best suits the job.

Caterpillar's 120M through 16M (26,060 kg operating weight) models provide a broad range of extended blade positions that are

particularly beneficial in mid-range bank sloping, ditch cutting and ditch cleaning. A long wheelbase permits an aggressive blade angle, allowing material to flow more freely and reducing power requirements.

"Of equal importance to having a well-constructed and graded haul road is the need for dust suppression," adds Senyard. "Dust thrown up by continuous haulage can reduce visibility and mobility, posing a safety hazard. Additionally, regular watering helps to maintain compaction.

As a guideline, the size of the water tanker should match the size of the haul trucks. Tanker size will also depend on factors such as the length of the haul road and the location of fill points. 'Spot' watering also works well for areas with limited water supply, and for safe travel, a 'checkerboard' or intermittent 'spot' pattern is recommended to reduce the slippage risk during retardation on gradients.

"The downside of over-watering should also be considered, as washing out the fines will lower the cohesive properties of the road, accelerating deterioration and causing potholes to form. These will grow rapidly if ignored, and soft and wet spots need to be completely refilled and compacted with good, dry material. Optimally, the slope of the road should adequately carry away storm water runoff, with minimal evidence of water entry into the road sub-base."

Tyre management

Tomy Szczypiorski, Vice President - Business Development for HSM Tire, explains that "as of early-mid 2010 we are seeing commodity strength returning with the momentum it had prior to the recession (coupled with a natural rubber shortage and OEMs shipping large quantities of trucks) and it has set the stage for an OTR shortage that could potentially be far worse than the last".

He told *IM* that he currently monitors pricing and availability data from various sources (major dealers, brokers, traders, mines, etc) and averages the figures for the major sizes that are in demand. "At the moment this is anything from the 63" to the 45" rim sizes, although we anticipate several additional sizes being added to the list very soon".

So, good tyre management is more important than ever as we head into another period of tight availability. HSM Tire, Szczypiorski explains, was formed "to assist the increasing demand for world-class technical service as well as expansive mine consulting with a focus on reducing operational expenses as they relate to haul roads, trucks, and tyres. Our goal is to protect a mine-site's most important assets, and as we continue into the next shortage, OTR tyres have been thrust to the top of that class."

HSM uses the latest analytical technologies to evaluate the current state of the mining operation and how it can be made more efficient. Using Pulsar MineTrac "our technical team is able to run real-time haul road analysis, target real-time critical forces affecting tyres, haul road condition/tyre life correlations, overall operations management, and most importantly we are able to utilise the data gathered to ensure issues are addressed before they become real and irreparable problems."

Pulsar MineTrac is a proprietary technology developed exclusively for Formula One and McLaren Racing to gain the most accurate readings of both the race track and the structural response of the car to the track conditions. This racing technology has now been further developed into a mining specific version to provide an OTR truck/tyre management system that provides both real-time and historical data on:

- Tyre performance and operator performance
- Truck performance (components)
- Haul road conditions - cycle efficiency, maintenance indicators
- Other variables affecting tyre/truck life – vertical, horizontal, lateral G-forces.

"By selecting the Pulsar MineTrac," Szczypiorski says, "mining companies and their



individual operations will be able to focus more time on ramping up production and less time on trouble shooting tyre problems and haul road concerns.

"Implementation of the Pulsar MineTrac also allows operations to establish a consistent baseline performance to monitor operational statistics as the mine-site evolves. HSM utilises baseline Key Performance Indicators (KPIs) to set the foundation for its on-site consulting and creation of an all-inclusive tyre program.

"By adding HSM (and the Pulsar MineTrac) as a partner alongside the current tyre management group, mines can", he explains:

- Implement a quantitative system for recommended decisions
- Encourage top performance from all companies on-site
- Create a natural accountability
- Offer the mine a larger pool of tyre experts from which to draw expert opinion
- Allow for old processes and thinking to be challenged in the pursuit of constant improvement.

HSM also uses 'value added studies' as part of the overall operational efficiency evaluation including: heat, cycle, and pressure studies, tyre repair analysis, and load carrying analysis.

The Pulsar Minetrac is a very comprehensive tool – much more than just tyre monitoring. It will provide data on haul road condition, poor operator practice and even serves as an anti-collision warning device where each unit in the individual trucks actually communicate to one another and notify the operator via a flashing beacon when they breach a pre-set distance.

Perhaps some of the most significant measurements it provides are the vertical, horizontal, and lateral accelerations. These data allow users to monitor how the truck and tyres are being affected at any given point on the haul road. With the use of this tool users

A sample lateral acceleration graph from the Pulsar MineTrac software. The problem area is circled where we see spikes in the reading. In the lower right graph we are able to pinpoint the exact location on the haul road where the spikes are occurring and what the specific G-forces are at that given moment. HSM technical representatives then analyse the data and alongside mine management/maintenance prescribe a solution

can measure the actual G-forces being applied to the truck as well as each tyre throughout the course of operation. As it pertains to tyres, this information is extremely valuable in prolonging operating life and maximising ROI.

Here is a brief look at how, when over-applied, G-forces can negatively affect tyre performance and overall life:

Lateral acceleration – most often experienced when travelling at high speeds or performing hard braking while cornering. Excessive lateral G-force causes rapid tread wear and undue stress to the bead area and shoulders of the tyre. This lateral force can also be attributed to a haul road turn that has been built with too small a radius (Pulsar MineTrac data will notify the user what an acceptable radius should be to eliminate the negative force).

Vertical acceleration – most often experienced when the truck goes through an undulation on the haul road. When this occurs the entire weight of the truck and its load is compressed onto the tyres causing rapid casing fatigue and can result in a blowout.

Horizontal acceleration – most often experienced when a truck either accelerates or decelerates too quickly. Excessive horizontal G-forces can have the same effect as the above as well as rapid tread wear.

Pulsar MineTrac can pinpoint the exact location (via GPS) on the haul road where the

increased G-forces are occurring, providing maintenance with the information they need to avoid further damage and correct the issue as soon as possible.

Another tool that HSM is introducing to the market is a Tyre Pressure Optimisation System (TPOS). Tire Intelligence is a tool that is used to balance tyre pressures within dual positions by allowing free air travel between both tyres. Easily fastened to the rim assembly of the outside tyre this tool effectively connects to existing valve hardware and balances the pressures of both tyres simultaneously maintaining their appropriate range. If the pressure changes 0.55-0.69 bar between the

pair the balance circuit will be cut to keep the good tyre operable. In the event of a blowout almost no pressure is lost in the good tyre. Via its single valve system, Tire Intelligence allows for easy and consistent airing of both tyres, simultaneously eliminating downtime of airing both separately.

From Chile, Bailac's expertise in tyre maintenance and management in mining stretches back over 85 years, and its success has increased significantly in the last 10 years. This centres on the company's use of technology to deliver integrated services to maintain OTR tyres. By developing tools such as the UMAN® system, geared towards

operational safety and prolonging the useful life of the tyres, Bailac has had great success.

There are hard commercial benefits for mine operators for monitoring tyre pressures. A tyre's pressure and temperature can have a dramatic effect on its working life. Correct pressure and temperature can increase the useful life of the tyre.

Bailac's tyre management technology uses internal pressure and temperature sensors. The system prevents tyres from operating outside the ranges of pressure and temperature recommended by the manufacturer, reducing damage and maximising the tyre's useful life. Real-time monitoring of the pressure and temperature of the gas inside the tyre, coupled with alarms situated inside the cab or located remotely, provides warnings when a threshold value is exceeded that could indicate potential damage to the tyre and, consequently, the capacity for continued operation of the vehicle. The monitoring process is displayed on an easy-to-read display inside the cab of the vehicle. It can also be displayed remotely using a WiFi-enabled PDA mobile device, and on computer screens through Intranet/Internet.

Alberto Bailac, the brains behind the UMAN concept, explains: "UMAN was developed to replace the traditional procedure for the control and monitoring of tyres, which is still in use in the vast majority of the mining companies in the world. This technique uses basic tools including manometers, and these give rise to a number of issues. Because it is a manual procedure, it cannot give warnings as soon as a tyre starts to operate in conditions that endanger its structural integrity. Control measurements are carried out daily or every few days, this time frame greatly exceeds the average time for damage to occur, which is around three hours. UMAN has been designed to provide real time monitoring of all tyres on a vehicle, including six-axle vehicles."

In Chile there are now nine mines operating UMAN: Collahuasi, Anglo American's El Soldado and Mantoverde, SQM-Nva and Victoria, Antofagasta's Esperanza, Codelco's El Teniente, Mina Sur and Chuquicamata, and Pacific Steel's Los Colorados. The variety and range of vehicles carrying UMAN at these mines is as varied as it is long: 34 Komatsu 930E and seven 830E trucks, two Komatsu W900 wheel loaders, two Caterpillar 797B, eight 777 trucks and nine 785 trucks, three Letourneau L1850 wheel loaders, four Caterpillar 994 wheel loaders and five Sandvik 010 LHDs.

Bailac continues: "The success of Bailac is down to our customers receiving a service of such a high standard that it enables them to

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increase their operational safety, prolong the useful life of their tyres and increase the time that their vehicles are available, and this increases the productive capacity of the mining shift in tonnes per hour."

At the heart of the UMAN system is the tyre pressure monitoring system (TPMS), which can facilitate the early detection of faults. The data provides historical analysis of the collected information (behaviour versus distances and loads, selection of tyres, maintenance schedules), and can be used to manage shift patterns and mine operations.

The UMAN TPMS includes the Tyre Monitor System (TMS), which is manufactured by AM Bromley. TMS delivers a solution for monitoring the internal pressure and temperature of a tyre, and Bailac relies on its quality, efficiency and effectiveness for accurate measurement of pressure and temperature.

Rodolfo Zalavari, Project Engineer for Bailac explains: "Delivering reliable data from the tyres is key to the development and marketing of UMAN. When it came to selecting the



Bailac's success centres on its use of technology to deliver integrated services to maintain OTR tyres. By developing tools such as the UMAN® system

technology provider, we found that AM Bromley had the sensors and the kit for storing information on pressure and temperature, but would it work in the mines of Chile? After conducting on-site tests, we were able to verify that TMS could be integrated into UMAN, and was able to deliver measurements

under diverse environmental and operational conditions, such as operating in extreme temperatures including snow, operating at sea level and at an altitude of 5,000 m and operating on tyres covered with steel chains. Fortunately, the R&D period was not very long – AM Bromley was the second supplier of TPMS sensors that we tried, and the results speak for themselves."

Because the Bromley TMS sensor transmitter is mounted on the inner wall of the tyre, one of the main challenges faced was whether Bromley's TMS receiver inside the driver's cab would be able to read the RF signals through the steel mesh in the tyres, or through tyres

covered in steel chains. However, after exhaustive tests, the results were successful and the system proven to work. It also works underground, as demonstrated by El Teniente's LHDs.

"Following the successful trials and implementation, Bailac developed a new version of UMAN which was launched in October 2010. In 2011 we expect to extend across a significant number of mining sites in Chile, and to consolidate international

EUROTIRE

business, with a plan to penetrate mining markets such as those of Australia, South Africa, Peru, Colombia and Bolivia." added Zalavari.

Mining companies that rely on UMAN have seen positive changes in operation management. This includes redirecting the work of maintenance staff to tasks of greater overall value and avoiding the risk of accidents when bringing samples to site, because this is now automated by the system. Operators become aware at an early stage of a tyre condition that could endanger integrity, and the companies see an increase in the performance of the tyres of at least 10%, Bailac reports.

Bailac concludes: "Bailac is fortunate to possess a great deal of knowledge about tyres and about their usage in the mining. Thanks to the aptitude and flexibility of AM Bromley, we have been able to develop a series of improvements aimed at the automation of current manual operations that will clearly differentiate UMAN from its competitors. Because of this, in October 2010, AM Bromley developed a new generation of sensors that correspond to the first stage of improvements agreed between the engineering departments of both companies. The future of the TMS and UMAN, in our opinion, could progress to the point where it acts not only to gather

information, but also take corrective action in real time."

In another tyre pressure monitoring development, International Telematics (ITC) and Advantage PressurePro have set up a partnership and integrated the TPMS/telematics solution for tyre operators worldwide. The integrated systems will allow users to receive tyre pressure alerts both in-cab through ITC's ibright® user interface and remote to an office or smart phone. In addition to the new TPMS capabilities, the systems will offer ibright's full range of telematics capabilities as well as allow tyre pressure and temperature alert levels to be configured for specific vehicles, groups of vehicles or tyre sets.

ITC says "the unique architecture of the ibright telematic system brings substantial computing power to the vehicle. This vehicle-based processing power, together with substantial connectivity and communication options (GPRS, WiFi, Bluetooth, Ethernet), has substantial advantages in terms of accuracy, flexibility and breadth of functionality. Driver performance and g-forces can be monitored and alerted from the truck [for example] and users can also select from a wide range of optional features including hours of service, driver vehicle inspection reports, wireless temperature, humidity, door and other sensors, pulp temperature sensors, tyre pressure sensors, engine status and diagnostics, and others."

"We are pleased to add another prestigious member to the PressurePro family of integrated TPMS options, and are thrilled to add our tire pressure monitoring capabilities to the ibright system's already impressive range of functionality," stated Vanessa Zaroor, Director of Marketing for PressurePro. "Together, we provide a very complete monitoring and management system that assists fleets of all types in reaping significant additions to safety, savings, efficiency and production."

Underground roads

Glen Wolfenden, Business Development & Marketing Manager with Bearcat Tyres in Australia offers *IM* readers some interesting tips on tyre management underground.

Often a great deal of water is used to keep dust down and flush out drill holes. "In one sense it is good for cooling but it also impacts heavily on tyre damage with more exposed rock due to the 'dirt' washing away haul road surface and also working as a lubricant for sharp rocks to slice through tyres.

"Underground haul truck tyres are subject to excessive amounts of stress, strain and

INFOMINE

damage," particularly if they are used to haul ore out of mines on a ramp system. He made a number of general observations after an extensive tour of Western Australian mines:

- Tyres such as 35/65R33 E4 tyres are used and abused past their capabilities
 - Due to the application, little can be done to maximise tyre life
 - Heat is a major factor due to the loaded incline gradient (1:6/1:7) and tramming distance
 - Sidewall heat buildup occurs due to the consistent one-way turning of the corkscrew design of ramps
 - Wheels are subject to high amount of heat during operation transferring to the tyre
 - Operators treat tyres with no respect as the quick haul of ore is more important
 - Tyre pressures are not regularly checked or monitored satisfactorily resulting in low pressure, also there is a lack of consistency of tyre checks or inflation checks between mines or different staff
 - Haul road surfaces are fair, however loading areas are poor with sharp loose rocks
 - Tight turning, screw pivots and reversing cause tread tear
 - Trucks often run up against rock walls causing impact damage and cuts.
- In a specific example, watching an LHD

Big horsepower, sharp turning and uneven loads can quickly eradicate underground haul roads

loading a truck, he noted "the loader hitting the side of the rock wall on all three occasions going back and forth to load a bucket. Although the tyres were subject to sidewall damage, more concern was for the tyres running over the sharp rocks which lay at the foot of the walls."

In another example he notes "the articulated trucks have an offset cabin. The driver is always more aware of the objects on his left side. Also the driver is more able to judge the distance on his left hand side than the right hand side. Because of this, drivers tend to stick much closer to the driver's side wall to allow enough room on the opposite side of the truck when driving underground.

"The result is that the tyre outside shoulder on the driver's side front and rear wear much quicker.

"When following a truck to the surface, I



also noticed that the truck was travelling the majority of the way in the gutter. Gutters are created to allow water to run down the mine without washing across the road surface. These gutters greatly minimise the available flat road area and the drivers actually drive partly in them when they hug the driver's side wall. This places far more strain on radial carcass, sidewall and tread areas of the driver's side tyres."

He also has some interesting observations about wheel and rim damage. "Mine sites have very limited storage area which means wheels and rim components are left outside and exposed to the elements. Rain, salt and

FLOTATION

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other types of corrosive dust result in the rapid deterioration of new wheels and components.

"Wheels are subject to high amounts of impact while working underground. From my experiences the main cause of wheel damage is running against wall faces and driving over large rocks."

"I have concerns over the ability for wheels to seal and hold air once damaged. The majority of the damaged wheels were on the LHDs however a number of trucks also had signs of major impacts.

"Looking over most of the fitted vehicles it seemed that the damage was localised to the wheels and did not tear or chuck the area of the tyre. However, I would suggest this area may become a weak spot for the tyre due to flexibility of the bead area and impact damage may have also occurred."

He also notes tests that have been conducted on LHDs to gauge how the tyre reacts to stress (loading on front axle) at full bucket load lifting at maximum distance

Bearcat is now providing specialised onboard OTR TPMS units to help create better awareness for tyre management.

Downloadable data can also help to uncover problem areas and whether they may be tyre/wheel related, machine orientated, operator fault or haul road design. "This is a

Sandvik's tyre pressure monitoring system can prevent tyre failures caused by incorrect pressures or over temperature. It also saves time in maintenance as pressure checks can be made via the in-cab display. No third party add-ons as this system is fully integrated into the Sandvik control system



great tool to help lower total maintenance costs through reportable systems," says Wolfenden.

Bearcat is part of the Solideal Group, serving tyre, wheel and rubber track needs, which was acquired last year by Camoplast. The integrated company is now Camoplast Solideal, operating R&D and manufacturing facilities in North America, Europe and Asia.

"Camoplast and the Solideal Group will together offer customers a more value-added solution to mobility challenges," said Paul Gaines, CEO of Solideal Group. "The pooling of our two companies' strengths will add value

to our stakeholders: customers, employees, shareholders and suppliers."

Nokian, which provides tyres for underground machines, stresses that "uneven ground and rough surfaces call for absolute tyre durability. Developed particularly for mining tyres, its CCR (cut and crack resistant) rubber compound "enhances demanding transportation and mining tasks and increases tyre reliability and operating life. This compound has been developed and tested in close co-operation with machine manufacturers."

PASTE 2011

The company warns that users should “always comply with machine manufacturers’ pressure recommendations! Careful and frequent pressure maintenance is the most secure way to achieve the expected life-span of the tyre. Low pressure can lead to sidewall damages and abrasion against the rim and, consequently, even premature breakage of the tyre.”

Sandvik has introduced a new tyre pressure monitoring system for underground LHDs and trucks. Prevent one tyre failure, caused by incorrect pressures or over temperature, and the system has paid for itself, the company says. The system will check tyre pressures on your machines. It gives warnings and alarms for the operator to take corrective actions, but only when needed.

It is available for all Sandvik LHDs with a colour display and trucks with a display. Four pressure sensors are integrated into the tyre vent caps, there is a wiring adapter and radio receiver.

The procedure is to inflate tyres to the correct pressure and put on the pressure sensor vent caps. The operator can then see the tyre pressures on the cabin display and will be warned of air leakage, pressure or temperature problems and alarms.

The value can be great. Tyre failure in a



The Champion M786 C Mine Grader is only 2.13 m high and was completely designed from the bottom up to meet underground requirements

production area could stop production for several hours, for the affected unit at the very least. It could easily take two men one shift to change the wheel.

Underground graders

Champion Motor Graders has a new line of low-profile compact graders specially developed for work underground. The new M786 mine grader is a modified variant of Champion’s popular all-wheel drive C86 C-Series compact grader. The low profile cab has been lowered to give the M786 a maximum

height of 2.13 m. The grader is also reinforced in critical areas to withstand the added shock loads and long duty cycles of mine operations.

According to Bryan Abernathy, Executive Vice-President of Champion Motor Graders, the M786 is the product of an extensive engineering review of previous models working in mines.

He notes that, in more typical operations, the daily duty cycle of a grader may total 3.5 hours. In the mines, however, graders can run continuously for as much as two full shifts. The M786 was given a more robust frame using thicker material and extra welding passes. In the early stages of development, Champion simply adopted improvements driven by mine operations as upgrades to standard C86

PRESSURE PRO



Finnish manufacturer Veekmas has received an order for two of its low-profile FG 5 C graders which will be delivered to AngloGold Ashanti in Ghana in July 2011. AngloGold Ashanti already has one Veekmas FG 5 C in a mine in Ghana. The FG 5 C has been especially designed for continuous use in arduous underground conditions. This machine is less than 2 m high, has all-wheel drive and exceptionally good reversing visibility because of the declining design of the engine bonnet (hood). Veekmas says "it has been manufactured paying attention to its high performance and low operating costs. Veekmas has developed its underground motor graders based on its own long experience as a motor grader contractor"

models. As a result, once the decision was made to establish a new model with special mine features, the basic model required relatively little change. "By strengthening and improving the C86 as we went, we were able to keep Champion's manufacturing process simple and economical, while letting us remain responsive to customer requests."

Getman has made some improvements to its underground grader, the RDG 1504. The highlights are a new dual joystick design and upgraded wiring package. This four-wheel drive machine lets you drive easily over broken ground. The hydraulic system for steering and all blade adjustment functions automatically adjusts to increase power and operating cost efficiency. The full reversing powershift transmission lets operators match speeds to conditions. The articulated frame (30° in each direction) and front wheel steering allow operators to comfortably manoeuvre into cross cuts and lets them choose grading positions. The forward facing, centre position operator station gives a clear view of the grading action.

The blade produces more than 7,120 kg of tractive effort while applying more than 6,575 kg of working effort into the 3.7 m Caterpillar 120H moldboard blade, "enough to move more dirt than any motor grader available in the US," Getman says. The moldboard blade is wear-resistant, high-carbon steel with replaceable wear inserts for long life. The unit also features 50° wheel-turn and 18° wheel lean, which allows blade levelling and

manoeuvring around pillars. Other features include drawbar and full circle with hydraulic drive worm gear with slip clutch and 30o angle adjustment to efficiently create and clean drainage ditches.

Hermann Paus Maschinenfabrik offers the PSF 200, a machine that was specially designed for underground roadway maintenance. It combines the functions of 'dinting' and 'grading' in one unit.

Equipped with a cross-cutting head, made by Eickhoff, the Paus PSF 200 easily copes with hardened roadway surfaces up to 500 mm. The dinting-head is designed for rock hardness up to a maximum of 80 MPa. A dust suppression system installed above the cutter ensures good visibility during the work.

A dozer blade at the front is used to level the roadway and fill potholes with loose rock. The blade turns hydraulically and can be lifted and displaced for 360 mm. A 360-mm extension of the scraper blade on each side provides additional working range. This

Getman recently sold an RDG 1504 underground motor grader to Mt. Isa mines in Australia, the first sale into a non-North American hard rock mine

feature allows grading of loose rocks right to the side wall, removing potentially tyre cutting material.

The hydrostatic drive is important for an essential feature of the machine: dinting while driving at low speeds with high torque. The engine power is transferred to the front and rear axle by variable displacement pumps. The speed of the machine is continuously adjustable both forward and in reverse at a maximum of 14 km/h. The maximum climbing ability is about 40%.

Choosing the right tyre

The OTR tyre market is biased to the radial tyre design. Without a doubt the radial design is a safe, value adding design and extremely cost effective when used in the correct applications. The same can be said for the bias ply tyre design. Just as one size does not fit all, one tyre design does not fit every application. Selecting the wrong tyre design for an application can be costly for a mining operation. Here's why, according to Eurotire ...

Bias design OTR tyres have been available to the industry for many years. In fact, OTR bias design tyres are the original work horses of mining and they continue to be widely used today. In many applications the bias ply design will provide a lower cost solution and a better value when compared to radial tyres in the same application.

Simply put, the radial ply OTR tyre is a more expensive tyre than the bias ply design of the same size. Certain advantages provided by the radial design, such as greater heat dissipation and heightened steering control are of benefit only when haul roads are long and winding. If mine site conditions do not require a radial design, a user may be paying a higher price than necessary for a radial product that is not needed for the application. A bias ply tyre may be just as effective and will cost less. Eurotire field engineers are trained to perform a detailed mine site evaluation to determine, not



which radial size to purchase, but which tyre design will provide the greatest and most cost effective benefit to the customer.

Eurotire's OTR bias and radial tyre products represent robust, state of the art technology. "We have taken the additional step of combining this technology with our unique service and support approach. Known as EuroCARE, this service approach allows OTR tyre users to enjoy the added value of service and support direct from the manufacturer regardless of the tyre design, bias or radial, without the need to pay a premium to third party service providers," explains Kent Henschen, Eurotire's VP, MarCom.

"Select the correct tyre for the application: save money, improve efficiency and reduce tyre related down time."

The Bias Ply Advantage:

- They are the solution to minimising tyre costs in short haul operations
- They are a reliable solution for providing greater stability for wheel loaders
- They are a cost effective, reliable solution for tyres on auxiliary mine equipment such as water trucks and heavy maintenance trucks
- They provide lower replacement cost solution in applications where there are high accidental tyre damage rates.

The Radial Ply Advantage:

- They provide excellent traction characteristics
- The radial design affords a flat footprint resulting in greater flotation characteristics in soft floor conditions
- The design reduces detrimental heat build-up in long haul applications
- The design provides heightened steering control in higher speed and winding haul road applications.

"Eurotire OTR tyres is capable of providing a cost effective solution for all haul trucks and wheel loaders used in modern surface mining applications. Furthermore, Eurotire is committed to assisting the customer in

The Paus PSF 200 combines dunting and grading. It can be equipped – depending on customer needs – with an air-cooled or liquid-cooled engine, has a fully hydrostatic drive and Kessler axles



selecting the products and services which are the most cost effective, value adding solutions for the customer's application. A case in point: In operating conditions with high accidental damage rates, the cost of using premium radials increases significantly. Eurotire bias tyres will provide a better operating cost to performance balance in these applications due to their lower repair and replacement costs. There are two key factors to attaining full value from OTR tyres: the first is in correctly matching the tyre to the application; the second is ensuring that the tyres are properly maintained."

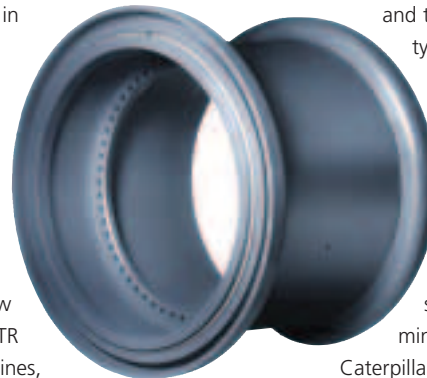
Changing wheels faster

Titan claims to be "the only company with ability to design, test, and produce both wheels and tyres" — delivering a complete package. Its tyres range in size from 6" to 72.5" in diameter.

When the decision was made to expand the product line into the large-diameter OTR tyre market; the decision was also made to undertake total review of the large-diameter OTR wheel and rim product lines, focusing on three key aspects:

- Improvements based on feedback from mining community
- Increased performance
- Cost savings for clients.

This resulted in the development and release of two new wheel products; the Super-duty



Titan Machined Taper (STMT Series) and Accelerated Change Technology (ACT Series).

The ACT wheel/rim assembly consists of two bead bands and side rings, a unique two-piece lock ring, and one standard lock ring. It was developed as a position-sensitive outer dual so the inside tyre can be easily mounted or dismantled without removing outer wheel/rim base. It is designed for use on the outer rear wheel position. Once installed, there is no need to remove nuts or clamps to rotate tyres off and on.

A service technician simply slides the tyre and any parts across the outside wheel as necessary. It has been engineered with safety and time in mind, allowing for tyre changes to be completed in a fraction of the time compared with conventional wheels.

To demonstrate the increase availability and profitability, Titan undertook a time and cost savings analysis at a US gold mine. The truck was a

Caterpillar 793 with 29 x 57 wheel assembly –40.00 R57 tyre. A dual tyre change before ACT took five hours, and with ACT took just 2.7 hours. The overall effect says Titan is a total potential increase in production for one year valued at: \$1,271,900 per haul truck, based on hours saved x hourly earnings. **IM**

DURATRAY