



**MICHELIN**

HOW MICHELIN TAKES

**MINING**



**PRODUCTIVITY**

**TO A NEW LEVEL**





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## **INTRODUCTION:**

As the industry moves towards a more sustainable future, mines are seeking ways to achieve more while consuming less. The good news is that new technology makes it possible to do just that, particularly when it comes to mobility.

Tyres with advanced compounds and designs can help trucks run faster with greater load carrying capacity, plus increased longevity significantly reduces the tyres' total cost of ownership. This is further supported by a new generation of digital technologies that harness data to effectively enhance value and improve safety.

Cloud technology and the Internet of Things (IoT), along with high-speed connectivity, enable real-time remote monitoring of tyres and fleets that keeps personnel out of harm's way. A smart mine which has its operations guided by in-depth analysis of tyre and fleet data can improve efficiency, unlock unprecedented productivity gains and enable predictive maintenance – ultimately posing fewer risks to human beings, machines and schedules.



At Michelin, we bring these technologies to your mine operations and help you unlock their potential. Innovation underpins everything we do and is built into the fibre of our products. Our mining tyres have set the bar for performance, longevity and robustness, becoming the first choice for mines around the world. But tyres are only one part of the complete mobility solution we offer to our customers to extend value.

There has never been a better time to modernise the mobility component of your mining operations and capitalise on the benefits that follow, which we will explore in this paper. Using smart technology in conjunction with Michelin tyres can not only make mines safer and more productive, but also reduce waste and energy consumption.

To gain a complete picture of what Michelin can offer, read on.



## PART 1

### THE MICHELIN APPROACH TO ENHANCING PRODUCTIVITY

The technological advancements in Michelin mining tyres help unleash the performance capabilities of the vehicle. Further, many of these same tyres offer longer tyre life, meaning they continue to deliver these benefits over an extended period of time.

**A reliable tyre with enhanced capabilities enables a truck to meet its full productivity potential by giving it the ability to move greater volumes at higher speeds.**



In the past, the industry has measured a tyre's value by the total hours it is in use. However, this measurement does not take into account a tyre's impact on how much load the vehicle can carry or how fast the vehicle can run, which influences a mine's total productivity and profitability. Michelin applies a newer and more robust method of measurement using an equation through which we can determine a tyre's overall productivity value taking load and speed optimisation into account.



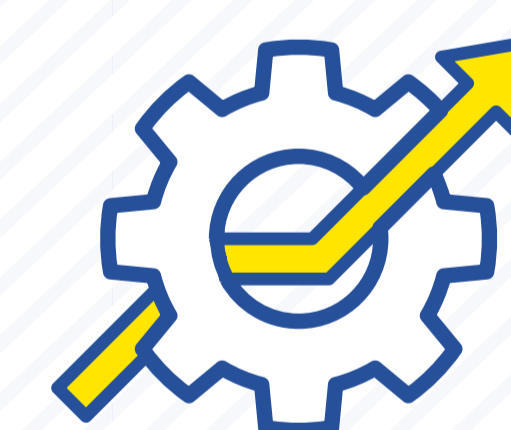
**PAYLOAD**



**DISTANCE**



**TIME**

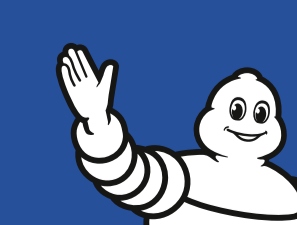


**PRODUCTIVITY  
(T.KM/H)**

Ultimately our aim is to increase the productivity value, with an optimised payload and reduced cycle time, while keeping the risks of tyre failure, tyre costs and the rate of fuel consumption to a minimum. That careful balance requires a combination of expertise, strategic thinking, science and technology in a multifaceted and holistic package. At its core, of course, are the products themselves.



**MICHELIN  
MINING PRODUCTIVITY**



**MICHELIN**



**THE TECHNOLOGY BEHIND THE TYRES**

**A CLOSER LOOK AT**

**THE MICHELIN**

# **XDR3+ MB4 & MB COMPOUND**

The **MICHELIN XDR3+ MB4 & MB COMPOUND** for rigid dump trucks exemplifies these industry-leading capabilities and embodies a number of our value-driving innovations.



These include:

**1. Longer tyre life with:**

- At least **4%<sup>1</sup> more mileage** when fitting the MB4 Compound.
- At least **6%<sup>1</sup> more mileage** when fitting the MB Compound.

**2. New MICHELIN multilayer technology designed for optimised wear on the front and rear axles.**



**3. A second generation of revolutionary compounds with a more homogenous mix that leads to a slower wear rate.**



<sup>1</sup> Compared to the MICHELIN® XDR® 3 tyre. Average performance by mine site. Projected improvement in tyre life based on the result of 13 field performance placement customer mine sites. Actual results may vary.

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THE MICHELIN

# XDR3 EXTRA LOAD



The **MICHELIN XDR 3 EXTRA LOAD** is another revolutionary tyre for rigid dump trucks that is designed to increase your payload and boost your productivity.

It helps you achieve this with:

1. Our revolutionary compound that provides a slower wear rate thanks to a new mixing process.
2. Our revolutionary tread pattern with interlocking rubber blocks that create better load distribution.
3. Stronger cables, new plies and a robust structure that offer:
  - Increased robustness with steel encapsulated by rubber.
  - Better resistance to aggression and extra load conditions.
4. An increase in your maximum truck payload by up to 12.6%<sup>1</sup> vs the MICHELIN XDR 3 (TKPH = 15%<sup>2</sup>).



<sup>1</sup> Based on comparisons of maximum load capacity of the MICHELIN® XDR® 3 Extra Load to the MICHELIN® XDR® 3, size 53/80R63, as set forth in the 2018 Michelin Data Book, taking as a reference the technical data of the Komatsu 930-E4 truck. Actual results may vary, and may be impacted by many factors, to include road conditions, weather, environment, driving habits, tyre size, equipment and maintenance.

<sup>2</sup> Based on comparisons of the MICHELIN® XDR® 3 Extra Load to the MICHELIN® XDR® 3, as set forth in the 2018 MICHELIN® Data Book.

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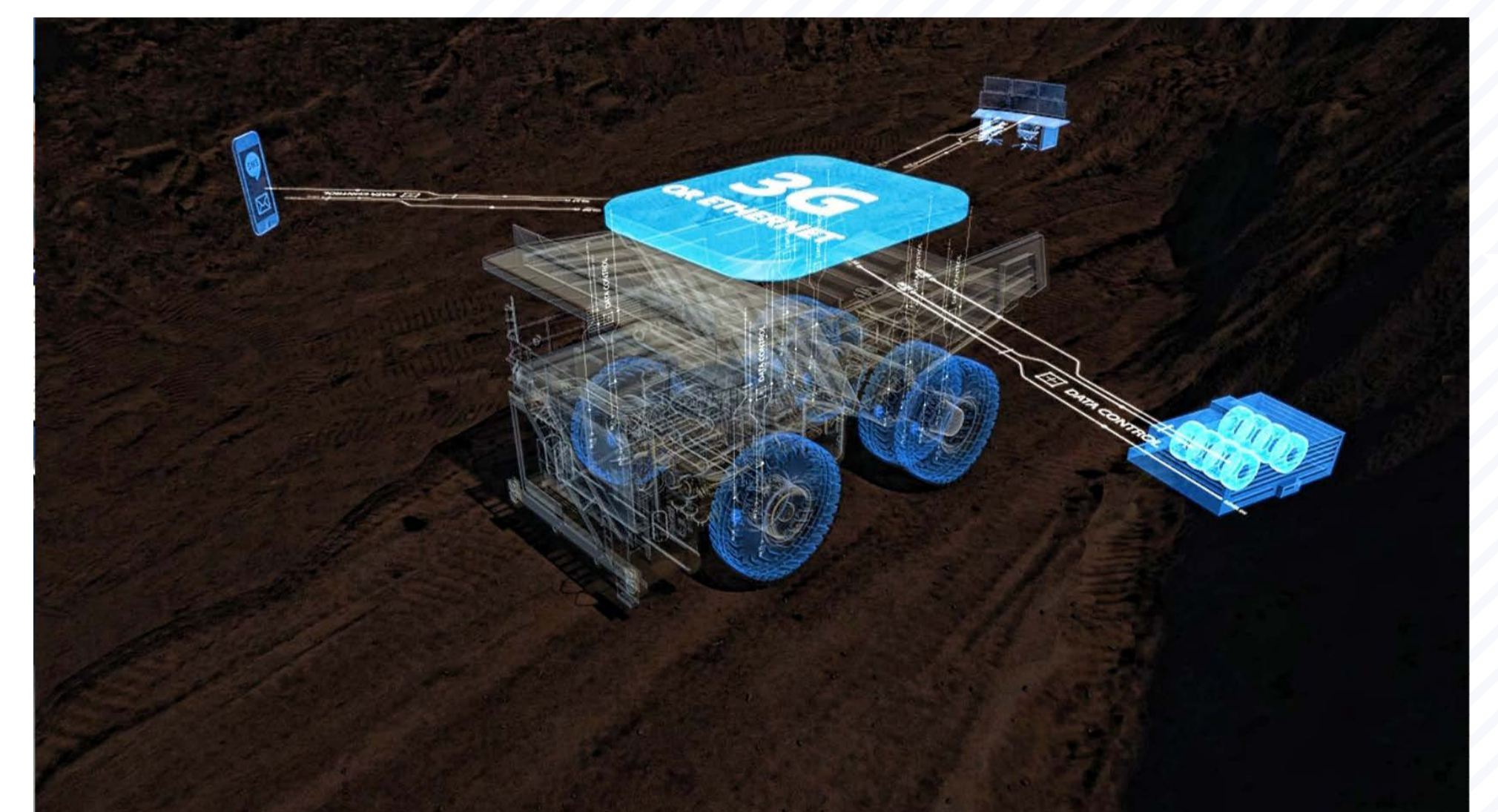
## PART 2

### SUPPORTING TYRES WITH DIGITAL TECHNOLOGY:

## MICHELIN® MEMS® 4

By unlocking the benefits of digital technology, mines can maximise the value of their tyres and optimise their fleets and operations in different ways.

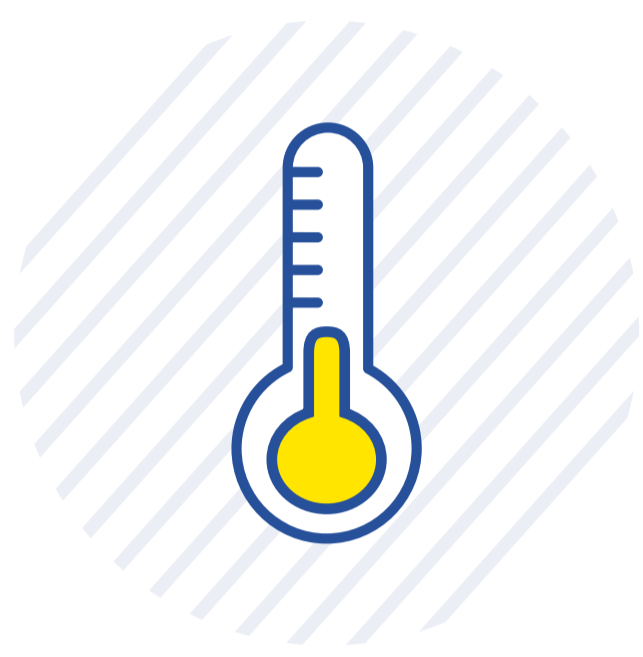
Digital technology and high-speed networking are a boon for productivity across every industry, and mining is no exception. Industry 4.0 – which is defined by technologies like cloud and IoT – is all about harnessing the power of data and the technology that enables the real-time exchange of information.



Michelin introduced surface mining's first Tyre Pressure Monitoring Solution (TPMS) – MICHELIN MEMS – in 2006. Michelin's TPMS allows mines to monitor tyres and their usage conditions without the manual intervention of site personnel. Now in its fourth generation, MICHELIN® MEMS4 brings the key benefits of Industry 4.0 to mining. MEMS4 is more than a TPMS – it can be called a comprehensive and evolutive package of advanced monitoring features for tyres and around tyres.



## **WITH MICHELIN® MEMS® 4 YOU CAN:**



Monitor pressure and temperature throughout the tyre's lifespan with durable sensors mounted inside the tyre.



Track vehicle location, routes and speeds with GPS mapping and geofencing.



Analyse data to optimise tyre usage.

MEMS4 connects seamlessly with a mine's network and popular fleet management systems, including Modular, Wenco, and Hexagon Mining (Jigsaw).

The information it gathers is transmitted to a user-friendly dashboard on connected handheld devices to give dispatch and maintenance teams real-time insights without having to put themselves at risk with manual inspections. Alerts can also be easily broadcast via text message and email.

All data is accessible on a local server or the cloud and is therefore also available to engineers and planners, the tyre shop and Michelin support.

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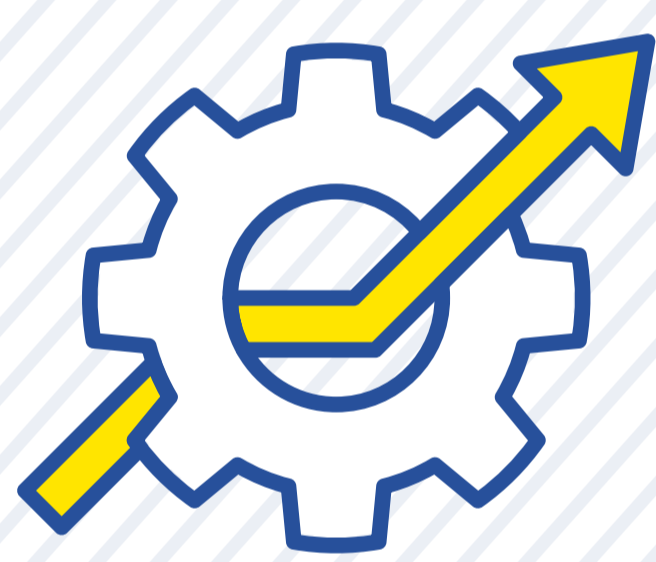
**WHAT**

**MEMS<sup>®</sup>4**

**MAKES POSSIBLE**

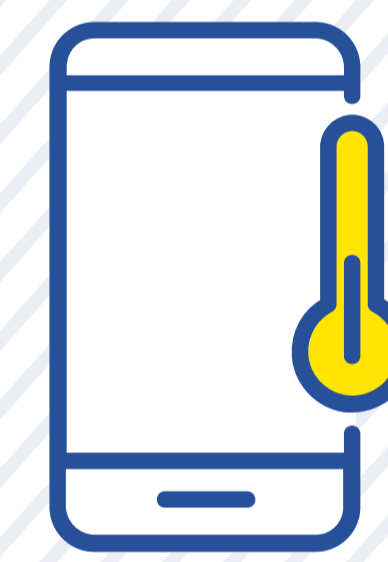


The benefits of this game-changing technology can be broken down into **four categories or pillars**.



**A productivity boost**

Improved downtime anticipation and fewer stops for unscheduled maintenance keep machines moving and productive.



**A safer working environment**

Remote pressure and temperature monitoring and alerts help to prevent accidents and keep personnel out of harm's way.



**A cost-saving solution**

Time and resources saved with remote monitoring, reduced downtime and longer tyre lifespans all add up to significant cost savings.



**A sustainability improvement**

Longer tyre lifespans mean fewer resources are required to perform the same work while good pressure management optimises fuel consumption.



## **INTRODUCING A NEW ENTRY-LEVEL TPMS:**

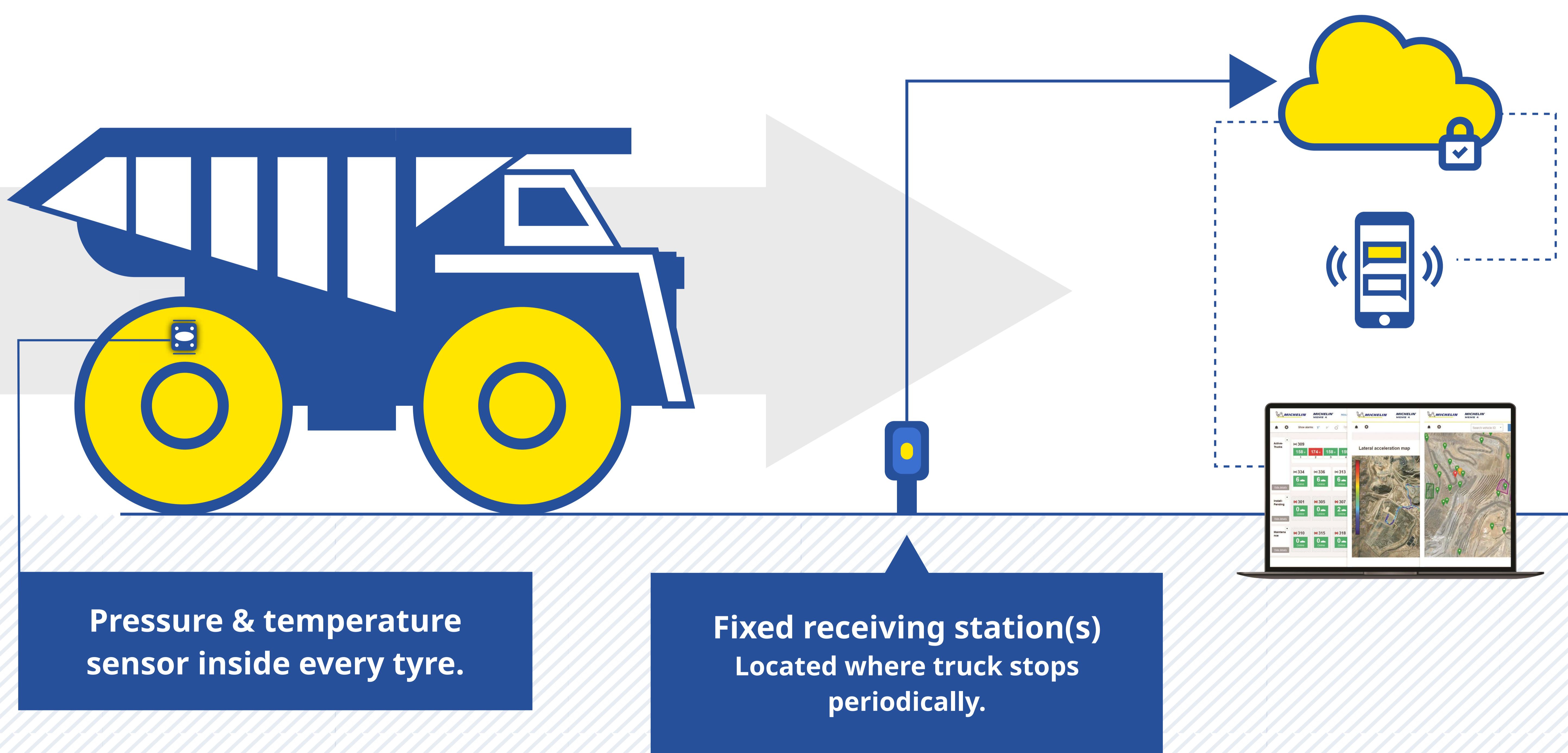
## **MICHELIN® MEMS® LITE**

Michelin recently launched an entry-level TPMS designed for operationally minded mines with smaller trucks and tyres (typically mine operating trucks below 150 tonnes). MICHELIN MEMS LITE combines Michelin's proven MEMS pressure and temperature sensors with fixed reading stations strategically installed at a mine site to periodically transmit tyre pressure and temperature data. Where MEMS4 offers real-time, continuous data readings – typically every minute – MEMS LITE features periodic tyre pressure and temperature readings when vehicles drive by fixed reading stations. Further, MEMS LITE gives smaller mines peace of mind and greater control of their mine and equipment with SMS and email alerts when a timely response is needed and in-depth analysis and reporting to help prevent unscheduled downtime.

MEMS LITE is designed for small-to-medium surface mining operations and contractors who move from one mine to the next, with a receiving station that can be easily relocated.

### **The benefits of MEMS LITE include:**

- **Improved safety by measuring tyre pressure and temperature remotely to help prevent premature tyre failure.**
- **Increased savings with more tyre lifespan and a budget-friendly, entry-level TPMS that requires no hardware installation on trucks.**
- **Reduced labour and maintenance costs.**



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## **PART 3**

### **GOING BEYOND TYRES**



Michelin services are designed to enhance the value of our products and help mines operate safer, smarter and more sustainably. We call this Michelin Better Mining. Our in-field tyre experts and consultants are well-respected in the industry, and we go the extra mile to help our customers maximise the benefits of our innovations as efficiently as possible.

Michelin's structured approach ensures a results-oriented focus.

**The services we offer to further enhance productivity and reduce total cost of ownership include:**

- **Commercial and day-to-day activity.**
- **Technical expertise focused on tyre performance and tyre-related improvements, from testing new technologies and compounds to reporting on performance KPIs.**
- **Consultations and mining solutions, working with customers to devise and implement the means to safely enhance overall productivity.**
- **MEMS performance support and reporting on status and any areas of concern, as well as providing on-site training on the system's use and its capabilities.**



## **COMPONENTS OF A COMPLETE MINING SOLUTION**

Site conditions play a big part in tyre longevity and overall mine productivity. The presence of ruts and stones or areas with inefficient water drainage can slow down vehicles and accelerate tyre wear. We can advise on everything from road design to tyre loading and rotation best practices and provide a site audit assessing haul roads and loading/unloading areas, outlining recommended vehicle operating parameters and measures for improvements.

**The services and solutions we offer to further enhance productivity and reduce total cost of ownership include:**

### **- Video Site Severity and D-Box Study**

Utilising the GPS capabilities of MEMS4, Video Site Severity & Michelin D-Box Studies create a route profile that factors slopes, curves, cambers and other impediments to mobility. Analysis can then be applied to optimise routes and determine ideal speeds at specific sections and corners, as well as recommended braking and acceleration frequency and duration.

This modular measurement system allows for the measurement of various parameters of a vehicle in the field, including static and dynamic pressures, speed, 3D accelerations and global positioning. A set of analysis tools (Michelin proprietary software) allows for computation based on the sensor inputs and measurements made in the field. This system has been developed by Michelin, and there is no comparable tool available on the market.

### **- Truck Load Optimisation**

The weighing and centring of loads is crucial since overloading on one side of a vehicle will cause accelerated and uneven tyre wear and compromise safety. We can determine optimal load size based on the density of the materials and improve load centring using 3D modelling. In addition, we analyse the variation between onboard scales and the actual figure to provide customers with a margin of error for calibration and compliance purposes.

### **- Adapted Tyre Rotation Policy**

A mine operation's discarded tyres can reveal a great deal about their usage conditions. Michelin technicians and analysts can assess your scrapped tyres to identify issues like premature or uneven wear reducing longevity or damage from improper or overly aggressive use. **Then take a step further with a rotation policy study to find the optimised rotation point that will suit your operations.**

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## - Consulting and Productivity Studies

Michelin can assist customers with customised studies to enhance a mine's overall productivity, safety and cost efficiency and develop future productivity simulations. A study will analyse data from the previous two years, covering tyre performances, truck speed, loads, cycle distances, tyre productivity KPI, TKPH, distance/hour and tyre rotation. Then, based on the historical data analysis, in addition to the mine plan evolution and a customer's operational levers strategy (new cycles, speed, load, fleet evolution), the study will offer operational guidelines and tyre recommendations, enabling mines to achieve their targets.

## - Training and Tyre Management

Michelin facilitates on-site training on the safe use, management and handling of OTR tyres and implements a tyre management solution. Experienced OTR trainers can help to improve efficiency and safety with training based on recognised standards approved by the Tire Industry Association (TIA).

### ***MICHELIN'S MINING SOLUTIONS IN ACTION: AN AFRICAN GOLD MINE EXAMPLE***

Michelin helps customers realise significant gains in productivity, and one such example is a gold mine in Northeast Africa. This particular case illustrates how tracking tyres can reveal insights into operational efficiency and how productivity can be boosted without increasing tyre or even fuel expenditure.

The African gold mine had seen its tyre budget increase over the previous two years and decided to call Michelin for help. Our data analysis showed changes in operations over time in terms of speed and payload that were aimed to increase productivity. These changes had a direct impact on the mine's tyres. Michelin's consultants were able to devise a pragmatic solution that not only extended tyre life and brought the tyre budget back under control, it also boosted productivity.

By working on productivity levers such as maximum load to carry, tyre rotation policy and tyre specification, the mine was able to implement actions that resulted in a 10% increase in tyre life and a 7% increase in truck productivity.

[Read more of the African Gold Mine case study here.](#)

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## **CONCLUSION**

Mobility is at the heart of a mine's operations, and data collection is key to future success in the industry. But this can only be achieved if it is analysed and interrogated thoroughly to extract actionable insights.

If trucks can accelerate cycle times and carry more load while becoming more efficient and easier to manage through data-driven insights, operations can be optimised while simultaneously minimising the risks involved.

Furthermore, data-driven efficiency means operational expenses, including fuel and tyres, can be kept in check rather than undermining any productivity gains. This is what Michelin's mining consulting and services are all about. They complement our industry-leading earthmover products with value-enhancing benefits, tools and guidance to lower total cost of ownership, boost productivity, improve safety and minimise a mine's environmental impact.

We've applied up-to-the-minute technologies in innovative ways to make this possible, harnessing the capabilities of a digitally transforming industry and putting them to work through complete, smart mobility solutions.

To have your questions answered or begin the conversation about modernising your mine with Michelin, get in touch with one of our mining experts [here](#).

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