

THE MICHELIN TECHNOLOGY CENTRE

CONSTANTLY INNOVATING...



PRESS KIT

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INNOVATIONS TO ENHANCE MOBILITY, MICHELIN'S DRIVING FORCE FOR 125 YEARS

Innovating to enhance its customers' lives has been Michelin's development credo ever since it was founded, as well as a powerful means of differentiation.

It has led to such important technological revolutions as radial and low energy consumption tyres and has laid the foundations for the Group's premium positioning, feeding its ability to meet the challenges related to ensuring safer, more effective, more environmentally respectful and more enjoyable mobility.

« Because we believe that mobility is a cornerstone of human development, we are passionate about innovation. Delivering uncompromising quality is a priority commitment to our customers and a constant driving force for Michelin for the past 125 years. »

Safety is the number one issue for Michelin. The number of vehicles on the road is expected to double by 2050. Expectations are therefore very high huge to ensure that mobility is increasingly safe. Tyres make a significant contribution to this objective and Michelin has a major role to play.

Another challenge that is just as important is respect for the environment which places the emphasis on the energy-efficiency and durability of our products.

Research and Development work obviously covers a very wide range of activities, since tyres will need to adapt to a world where the number of electric, hybrid

and connected vehicles on the road is increasing all the time.

To respond to this shift, Michelin is working hard on the materials it employs, as well as on the construction and weight of its tyres. This is where the full force and power of Michelin's innovation is being directed.

Currently, 70 percent of Michelin tyres on the roads of the planet are developed in the heart of France's Auvergne region at one of the largest centres for manufacturing research in the world. Located on the outskirts of Clermont-Ferrand, the Ladoux Technology Centre has been the hub of the Group's Research and 21 test and Development work for the past 50 years. The 450-hectare facility consists of 79 buildings tracks (totalling 43 kilometres in length) where 3,300 people work in 350 different professions.

Since its creation in 1965, the Michelin Technology Centre has evolved constantly to respond to the changing needs of a world in perpetual motion. Today, a new and important modernisation phase has begun.

The first phase of the ambitious URBALAD project, which will be fully operational at the beginning of 2018, is now a reality.

An important tool for the Michelin Group to serving its global Research, Development and Industrialisation needs is the RDI Campus which will house 1,600 work stations and an unprecedented pooling of skills in a single ultra-modern seven-hectare building.

A key feature of this new facility is that it will concentrate an exceptional innovative force which will enable Michelin to deliver solutions and services tailored closely to the needs of mobility-related issues and thereby strengthen its position as world leader.

(*) as of 2010.

THE LADOUX TECHNOLOGY CENTRE: THE HUB OF MICHELIN'S DEVELOPMENT DRIVE

Michelin was the first tyre manufacturer in the world to imagine test tracks for testing tyres in real-world conditions. The Ladoux Technology Centre was inaugurated in 1963. This visionary project allowed the company to stand out in the industry and provided it with powerful Research and Development tool.

The infrastructure of the facility has evolved constantly but the cutting-edge fundamental research laboratories, workshops and proving grounds continue to play the same vital part in the development of Michelin products. Half-a-century after the test tracks first came into use and the first wear tests were carried out in 1965, the Ladoux Technology Centre – which is home for half of the Group's Research & Development teams - has become a unique site that has its sights set firmly on innovation.

It has become a benchmark in the industry and one of the biggest tyre research and development centres in the world.

This concentration of expertise at a single site not only fosters an incomparable innovative-focused energy but it also ensures unrivalled speed of response. Nearly 70 percent of Michelin tyres in use around the world are developed at Ladoux. Every year, approximately 15,000 Michelin prototype tyres are produced and almost two billion kilometres are covered in testing. That's equivalent to a journey around the world every 12 minutes!

PRIMARY ACTIVITIES

Some 3,300 people exercise 350 professions in 31 different sectors at the site which focuses on vital Research and Development work, in issues ranging from the genome of the rubber tree to on-track testing:

- Design of materials used in tyres
- Tyre design
- Manufacture of prototype rubber compounds
- Design and manufacture of prototype moulds
- Manufacture of prototype tyres
- Tests and measures
- Track and bench testing
- Logistics and vehicle maintenance
- Simulation work, analysis and measures

Major Michelin inventions including the 'Green' tyre and the more recent Cross Climate, as well as the colossal earthmover tyre were all conceived at Ladoux.

Ladoux is also a place where a majority of the world's largest automobile constructors – including some of the most prestigious – come to test their prototypes. Their ranks include Porsche, Bugatti, Ferrari, Bentley, Tesla, as well as BMW, PSA, Renault, Hyundai and Kia.



DEVELOPMENT FACILITIES ON THREE CONTINENTS

The Michelin Technology Centre is a worldwide network that operates on three continents: North America, Asia and Europe. **The network employs 6,600 people in 350 fields of expertise** (researchers, engineers, developers, testers, etc.). It has already generated more than 10,000 active patents that protect Michelin's innovative muscle worldwide.

The non-stop modernisation of this huge platform results in dramatic advances in a constantly changing context.

For Michelin, which in 2014 invested €650 million in Research & Development, it is an imperative necessity. **The revolutionary MICHELIN Cross Climate tyre** – which was developed in a period of just 36 months, compared with the 56 months initially planned – **is one of its most recent successes.**



THE NEW RDI CAMPUS

In taking steps to strengthen its innovation muscle and consolidate its position as world leader, Michelin has begun a major phase of its modernisation plan with the URBALAD project at Ladoux.

Aimed at facilitating interaction between staff and their ideas, this project necessitated an investment of €270 million. It will be fully operational at the beginning of 2018 when it will play an active part in Michelin's global Research & Development strategy.

A key part of this project is the RDI Campus (for Research, Development, Industrialization) which sits on a seven-hectare site. Delivered in two phases, the first being in the autumn of 2015, it is the largest building to be found in France's Auvergne region (67,000 square metres). When completed, this fully-integrated, **low energy consumption building will accommodate 1,600 work stations.**

The architecture of the new campus has been designed to promote speed and flexibility in the way the teams work. **Eighty 300 sq. metre platforms that can be modulated** as a function of the needs of the moment will each feature a staff of 20 people who can work in a cross-functional and multi-disciplinary manner. This new design mode will enhance Michelin's innovative power and reduce the time products require to reach the market.

This bold use of the available space will put tyre performance at its heart, with direct links to the materials and tyre expertise centres that span the test track. The concept will also foster interaction between the different skill pools, as well as the quality of life in the workplace, with services better adapted to the needs of the staff.

The Group will consequently have a new tool that is suited to the functional requirements of the company today. It will promote co-design approaches and the implementation of cross-function projects while supporting exchanges and the transfer of skills within the global RDI network.



LANDMARK DATES

1959 **Purchase** of agricultural land.

1960 **Test track and building** construction begins.

1965 **Wear, durability and handling tests begin.**
A total staff of 150 people.
Test track '3bis' (known as the 'duck') **is built.**

1971 **The transfer** of tyre and machines research from Carmes to Ladoux begins.

1973 **The transfer of material research activities begins.**
Staff levels reach more than 1,800.

1974 - 1997 **Another 25 buildings are built,** including the mould and prototype tyre workshops, as well as the tyre and vehicle analysis laboratories.

2006 **The URBALAD (URBA**nisation of **LAD**oux) **begins.**

2007 The cross-company day **nursery opens.**

2, 3 et 4 octobre
2015 **Ladoux enters a new era** with the implementation of Phase 1 of the RDI Campus.

LADOUX IN NUMBERS

450 **hectares of fenced** and secure land including 380 hectares of test tracks and access zones and ISO 14001-certified environmentally-friendly cultivated land.

1 **protected natural area** (presence of a salt marsh in the middle of the test site).

21 **test tracks** totalling 43km in length.

79 **buildings** with a total surface area of 169,400 sq. metres.

38 **activities** involving between 10 and 500 people, including 20 essentially tertiary activities.

3,300 **total staff**

2 cross-company **restaurants.**

70 % **of Michelin tyres** are developed at Ladoux.

3.

FOCUS ON RESEARCH AND DEVELOPMENT

1.5

million: The number of measures taken every year in the Michelin materials and semi-finished laboratories.

12

minutes: The time required to complete the equivalent of a journey around the world thanks to the endurance and longevity tests done on rigs or on a Michelin vehicle (1.8 billion kilometres per year).

400

The number of simulation tools used to reproduce the performance characteristics expected by customers.

700

The number of measuring methods and qualified tests. Michelin performs both analysis at the nanoscale level and also tests on four meter-high tyres weighing more than five tonnes.

75,000

The number of customer tests conducted each year (96 million kilometres in passenger vehicles, 18 million in vans, and 360 million in trucks).

40,000

The number of tests conducted with vehicles every year.

80

The amplitude, in Celsius, of the test conditions conducted by Michelin's rigs. They can conduct their analysis at ambient temperatures ranging from minus 30°C to +50°C up to speeds of 450kph.

200

The number of different ingredients that go into the production of a tyre.

4

The number of different tyre test types – laboratory tests, tyre tests on rigs (static and dynamic), tests on vehicles (objective and subjective) and customer tests.

1/2

Development times have been halved. The development times of Michelin's entire 'sport radial' motorcycle tyre range has been halved and the range was renewed in the space of two years.

4.

50 YEARS OF MICHELIN INNOVATION

Since its creation in 1965, the Ladoux Technology Centre has been perfected considerably. In the space of half-a-century, and thanks to Ladoux, Michelin, which profoundly changed the industry with the development of the radial tyre in 1946, has remained at the forefront of progress.

This ongoing evolution of its infrastructure and the progress achieved by its Research and Development Centre, has led to some major breakthroughs:

1965: the **Michelin XAS.**

The first tyre with an asymmetrical tread pattern to provide enhanced safety and greater driving pleasure.

1978: the **Michelin Bib X.**

The first radial tyre for agricultural vehicles.

1981: the **Michelin Air X.**

The first radial aircraft tyre.

1983: the **Michelin XM+S100.**

The first winter tyre to feature a heavily siped pattern rather than solid tread blocks, leading to a huge improvement in performance on snowy roads.

1987: the **first radial motorcycle tyre.**

1992: the **Michelin MXN.**

The first 'green' tyre achieved by adding silica to the rubber compound. This technology improves energy efficiency while also increasing safety and longevity.

1994: the **Michelin Alpin with Y-shaped sipes.**

This technology doubled the density of siping to deliver outstanding traction on snow throughout the tyre's lifespan.

2000: **Michelin X-One.**

A truck tyre with a zero-degree steel belt to replace twin tyres and increase load capacity and volume while at the same time reducing fuel consumption.

2001: the **NZG.**

Intended for aircraft tyres, Near Zero Growth radial technology significantly increases tyre life by allowing a greater number of landings thanks to the use of ultra-resistant nylon and aramid.



2003: Michelin Ultraflex.

A technology intended for agriculture tyres allowing for a significant deflection of the sidewalls with reduced air pressure. The longer footprint allows for better load distribution while reducing soil compaction.

2005: Michelin Power Race.

The first dual-compound racing tyre homologated for road use.

2006: Michelin Durable Technologies.

Technologies for truck tyres: Infinicoil (continuous steel cord creates a more rigid crown and improves casing endurance). Double-wave sipes (three-dimensional sipes that make the tread blocks more rigid for increased mileage, while maintaining the flexibility necessary for good grip). Raindrop sipes (three-dimensional sipes that become more open when the tyre is two-thirds worn, creating a new groove at the centre of the tread block).

2007: MEMS.

Michelin Earthmover Management System is the first electronic tyre surveillance system to be commercialized world-wide.

2010: Michelin Protek Max.

An inner tube capable of cancelling out the effects of a puncture by substantially reducing the loss of pressure between two usages and enabling unprecedented ease of assembly.

2011: Michelin Tall&narrow.

A tyre with a tall, narrow architecture that simultaneously improves energy-efficiency and pushes back the aquaplaning threshold, along with enhanced comfort and less noise.

2012: Technologie B².

For earthmoving tyres. An innovative, unprecedented bead and wheel rim design.

Michelin Energy™ E-V.

This tyre specially designed for electric vehicles obtained an A-rating for both wet braking performance and energy efficiency under the European labelling system.

2013: Michelin AxioBib IF900/65R46.

Presentation of the world's biggest tractor tyre.

2014: Michelin Premier A/S.

With a self-regenerating pattern and using a mix of innovative compounds, this tyre uses Ever Grip technology to deliver outstanding grip on wet roads, even when part worn.

Michelin Pilot Road 4.

A motorcycle tyre combining a new revolutionary architecture that also benefits from Michelin 2AT technology (Dual Angle Technology).

2015: the Michelin CrossClimate.

The first tyre approved for winter use to be capable of running safely in all weather conditions. It obtained Europe's top 'A' rating for braking performance in the wet despite being approved for winter use.



5.

THE MICHELIN GROUP IN NUMBERS

Founded

1889

Factories

68 production plants in **17 countries**.

Staff

112,300 employees worldwide.

Research and development

More than **6,600** R&D staff working out of 25 facilities on three continents (North America, Europe and Asia).

R&D budget (2014)

€656 million.

Annual production

178 million tyres, plus more than **13 million** maps and guides sold in **170 countries** and **970 million itineraries** computed by ViaMichelin.

Total revenue (2014)

€19.55 billion.

A broad portfolio of brands covering every sector of the market:

MICHELIN, BFGOODRICH, KLEBER, UNIROYAL¹, WARRIOR, KORMORAN, RIKEN, TAURUS, TIGAR, PNEU LAURENT, RECAMIC, MICHELIN REMIX.

MORE THAN 3,500 POINTS OF SALE (GROUP-OWNED AND FRANCHISES) IN 29 COUNTRIES

The mission of tyre industry leader **Michelin** is to play an active part in the sustainable transport of people and goods. To achieve this goal, the Group manufactures, distributes and markets tyres for all types of vehicle. Michelin also proposes innovative digital services, including vehicle fleet management and mobility aids. It publishes travel, restaurant and hotel guides, as well as maps and road atlases. Its headquarters are in Clermont-Ferrand, France, and the group is active in 170 countries with a total staff of 112,300 worldwide. It has 68 manufacturing facilities in 17 countries, as well as research and development technology centres in Europe, North America and Asia. (www.michelin.com)