



Products



Value created

- ▶ Providing even greater safety and convenience by creating services for tires
- ▶ Stable driving on snowy and wet roads
- ▶ Reduced fuel consumption with ultra wide base tires
- ▶ Contributing to hydrogen vehicles

Product-related Initiatives

- Customer health and safety
- Marketing and labeling
- Customer privacy

More Comfortable Tires with Tire Sensor Technology Establishing the SensorTire Technology Vision

The DX^{*1} movement in the automotive industry is said to be a once-in-a-century period of transformation, and the so-called CASE^{*2} and MaaS^{*3} trends are expected to penetrate the market and significantly change consumer behavior.

The mobility-based society of the future aims to allow users to lead rich, sustainable lives while using mobility in a safe and secure manner. Advantages of such a society include eliminating traffic congestion in urban areas, reducing CO₂ emissions,

reducing air pollution, increasing green spaces by reducing the number of parking lots, and contributing to last mile mobility to help those with limited mobility and access to transportation.

*1 DX: Digital Transformation (penetration of advanced IT technologies)

*2 CASE: Acronym for Connected, Autonomous, Shared & Services, and Electric.

*3 MaaS: Abbreviation for Mobility as a Service. An abbreviation for Mobility as a Service, a new concept in which various types of transportation services are combined into a single service and provided to users.

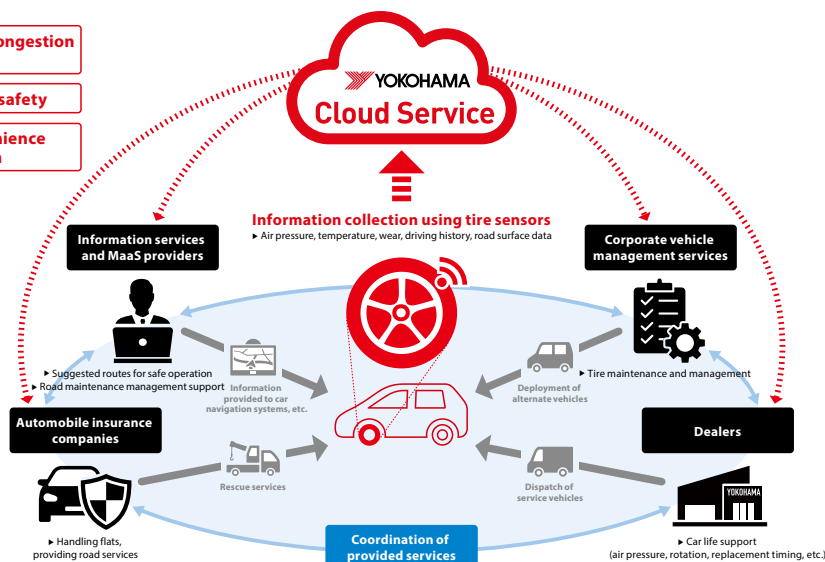
Services to be achieved through SensorTire Technology

Main Effects:

Reduced traffic congestion in urban areas

Improved traffic safety

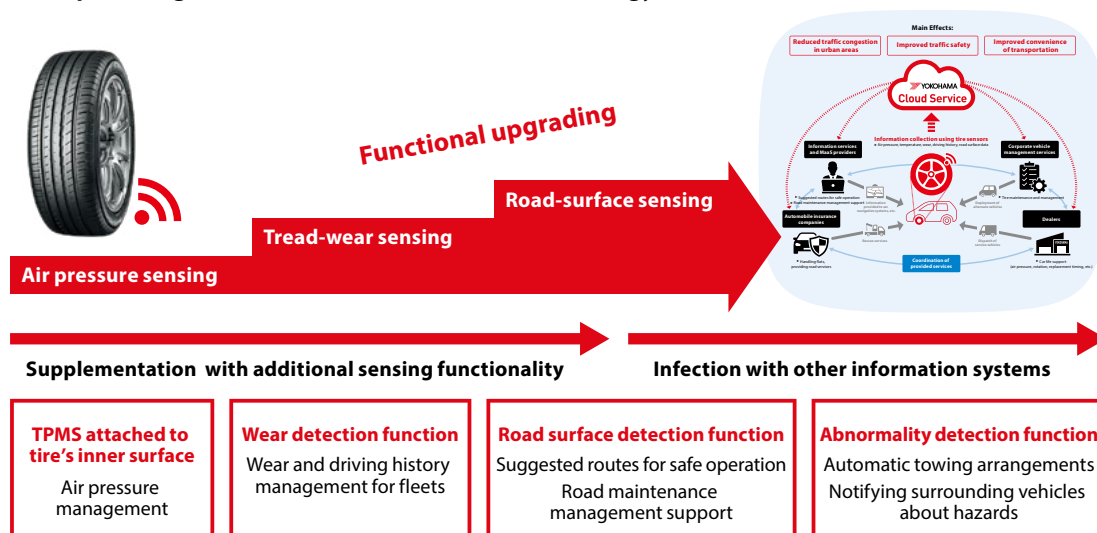
Improved convenience of transportation



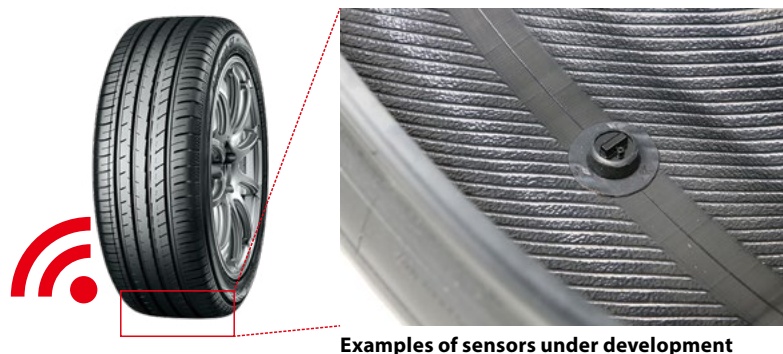
To support this mobility-based society, Yokohama Rubber will encourage the enhancement of information services through the digitization of tires in response to vehicles becoming increasingly electric and automated. We will develop IoT tires under our “SensorTire Technology Vision,” a medium- to long-term technology development vision for passenger car tires announced by Yokohama Rubber in February 2021. These are advanced sensor tires that can detect tire wear and road

surface conditions as well as air pressure. This information will be used to improve our mobility services. We will also expand the implementation of service vehicles that perform replacements, inspections, and tire management at corporate clients such as car dealers and car-sharing operators. As a tire manufacturer, we will strive to deliver safe and secure information services in addition to the comfort offered by conventional tires, such as low noise and riding comfort.

Conceptual diagram for YOKOHAMA SensorTire Technology Vision



Improved services provided by enhanced sensing functions and real-time capabilities



Examples of sensors under development

Looking Toward a New Mobility-based Society

Yokohama Rubber is conducting R&D with Alps Alpine Co., Ltd., a company skilled in sensor development, to process and manage the data acquired from tires and road surfaces using digital tools. Going forward, we will develop systems and applications that feed the data acquired from tires back to users or automated vehicles. Based on the concept of turning the real world into a library, we are looking into creating a new business by working with ZENRIN CO., LTD., which has a large supply of information on maps, road regulations, road slopes, and more, to link a wide variety of dynamic information.

Alps Alpine, ZENRIN, and our company will utilize

experimental vehicles equipped with IoT tires to acquire a variety of road surface information from public roads and link it with high-precision maps and road regulation information.

Our goal is to provide future solutions by analyzing the data from this demonstration experiment. For example, we will investigate and propose solutions that include navigation that avoids steep slopes and curves by detecting wear and lack of air pressure, safe driving support through the provision of information on frozen road surfaces and road cave-ins, and automatic vehicle control.



Ultra-wide Base Studless Tires for Trucks to Support Next-generation Transportation



Ultra-flat tires

Normally, the rear wheels of trucks are dual wheels due to the heavy loads they bear. Yokohama Rubber's 903W tire for trucks and buses is an ultra-flat tire that offers both excellent studless performance and long wear life. Combining dual tires into a single tire reduces the weight (by approximately 19-28%) and saves space. This makes it possible to increase the loading and unloading capacity of the cargo bed while simultaneously making maintenance work such as tire reassembly and daily inspections easier. This was made possible through the use of SpiraLoop®, a proprietary technology that utilizes seamless belts to reinforce the structure of wide tires and maintain their shape. The product was praised highly for its commercialization and received the "Good Design Best 100" award in 2020.

In terms of truck distribution, where demand is expected to increase in the future, we will lend our support by addressing the shortage of drivers and providing labor-saving maintenance.

Our strength lies in our ability to provide a one-stop shop for a wide variety of tires for long-distance truck transport, short-distance transport, and last mile delivery that puts cargo into people's hands.

We will continue to improve logistics efficiency with our ultra-flat tires using our proprietary SpiraLoop® technology, while also developing technologies and expanding our product lineup to meet the need for fully automated transportation. This will secure our place in the market in the face of future transformations in distribution.

Recognized as a winner of the Good Design Best 100 Award in fiscal 2020



GOOD DESIGN AWARD 2020

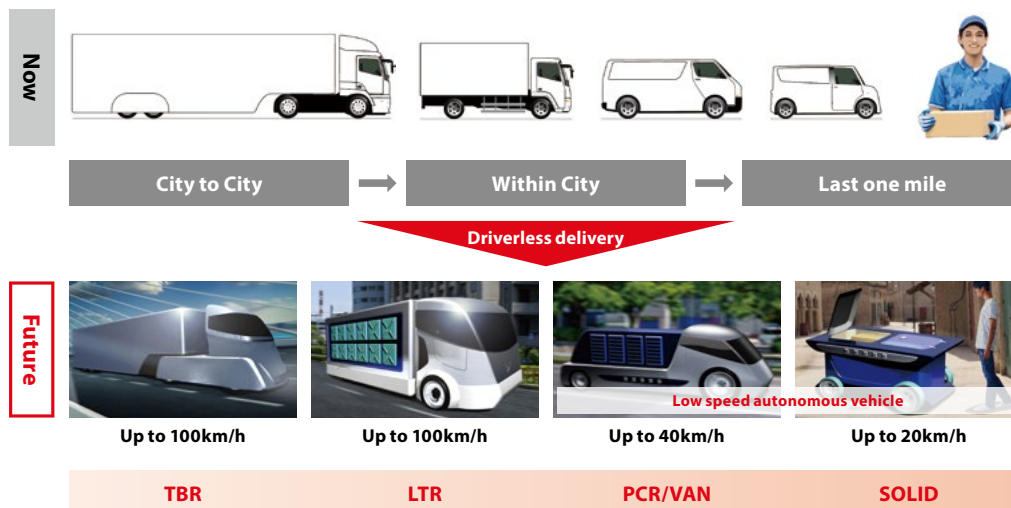
BEST 100



Effects

- Weight reduction of approx. 100 kg per axle (for a set of tires and wheels)
- Improved flexibility in vehicle design due to space saved in the tire unit
- Environmental impact reductions due to waste tires
- Environmental impact reductions due to fewer discarded tires

Predicting current and future vehicle changes according to the stage of distribution



Strengthening the R&D System (Improving Winter Tire Performance on Ice and Snow)

We are constantly engaged in research and development to ensure that our customers can enjoy safe and secure driving in various weather conditions and on rough roads.

We are also actively working to improve the ice and snow performance of winter tires, including studless tires, and have winter tire test centers in Hokkaido and Sweden. The Hokkaido Tire Test Center features one of the largest indoor ice testing facilities in Japan at approximately 100 meters long, and we are enhancing its system of development by installing new refrigerant equipment that enables development in various temperature ranges*.

* At a reference room temperature of 5 degrees Celsius, it has the ability to adjust the ice surface temperature between -10 and 0 degrees Celsius.



Tire Test Center of Hokkaido (TTCH)



Massive New Cooling Unit at the indoor ice testing facility

Hydrogen Refueling Hose

Hoses for hydrogen refueling that support a decarbonized society

Currently, a number of efforts to reduce CO₂ emissions are actively underway. That being said, Japan is highly dependent on fossil fuels as part of its power supply mix, and it largely relies on overseas sources for its energy needs. There are also concerns about price instability due to the growing demand for energy from emerging countries.

In the Basic Energy Plan, there is an accelerating movement toward achieving a society based on hydrogen energy, which can be produced from a variety of primary energy sources, can be stored and transported in solid, liquid, and gaseous forms, and is expected to have high energy efficiency and a low environmental impact.

In this context, promoting the use of fuel cell vehicles (FCV) necessitates a hydrogen gas filling hose that can be used safely at hydrogen stations. Yokohama Rubber was commissioned by the New Energy and Industrial Technology Development Organization (NEDO) to pursue joint development and commercialization of this technology with Iwatani Industrial Gases Corp.

In our “ibar” series of hoses for high-pressure hydrogen gas, we sell ibar HG35 for hydrogen filling pressures of 35 Mpa. Compared to metal hoses, this hose is lighter and more flexible, making it easier to transport and fill, and it also provides a high degree of safety and durability.

In the future, as the cruising range of FCVs increases (assumed to be 700km), we plan to commercialize high pressure hydrogen hoses that match the international standards for the hydrogen stations in Japan and the other

countries, and we are currently actively developing hoses that can handle 87.5MPa.

The hydrogen hose we are developing is intended to be lightweight, flexible, and durable, and we are evaluating it through domestic and international testing organizations. For example, we are investigating and evaluating a variety of durability tests and hydrogen gas filling cycle tests that simulate actual conditions.

Japan's strategic roadmap for hydrogen and fuel cells aims to promote and expand the use of next-generation vehicles. This includes household fuel cells and FCVs and calls for the widespread use of 5.3 million household fuel cells and about 800,000 FCVs by 2030. The target for number of hydrogen stations installed is about 320 stations by 2025. We will continue to contribute to the development of the infrastructure necessary for a hydrogen-based society.



Hydrogen station