

TIRES

1 Introduction

Due to drop in demand caused by the COVID-19 pandemic, production automobile tires in 2020 was 121 million tires, a drop of roughly 19% in terms of rubber amount and 18% in the number of tires compared to 2019.

Focusing on protecting the environment, one trend in tire technology has been development aimed at further enhancing the environmental friendliness and economic efficiency of tires in addition to their basic safety performance. As various countries continue to tighten their regulations on automobile fuel efficiency and emissions and the transition toward electric vehicles intensifies, tire manufacturers are working to bring out a lineup of products with a low environmental impact centering on fuel-efficient tires.

The Japan Automobile Tyre Manufacturers Association (JATMA) was a forerunner in introducing voluntary industry standards enacted in January 2010 for a tire labeling system that rates rolling resistance and wet grip performance. It also provides consumers with information related to safety and the environment.

Regulations on tires cover both environmental and safety performance. In terms of safety performance, the UN regulations adopted in Europe, Japan, and other regions, along with the U.S. FMVSS, are the main regulations applied in many countries to ensure vehicle safety, and they are also spreading to other Asian countries and regions. Regulations on environmental performance can be divided into those that stipulate minimum performance requirements, and those of that set labels for grades that inform customers of the performance level of the tire. Following their introduction in Europe and Turkey, environmental performance regulations have been enacted in regions such as South Korea, Russia, Brazil, the Middle-East, Malaysia and Thailand, and are continuing to further spread throughout the world.

Since June 2016, the UAE has made it mandatory to affix tire identification labels with embedded radio frequency identification (RFID) tags on all tires sold or put on display. This endeavor is intended to provide traceability, offer users information about the tire, and allow authorities to verify certification. The recent trend of requiring two-dimensional codes or RFID in Russia, and QR codes in the EU and Thailand, is continuing.

2 Tire Production, Sales, and Results

Table 1 shows the vehicle tire production results up to 2020. The drop in demand caused from the COVID-19 pandemic led to an overall drop of about 19% in terms of rubber amount and about 18% in number of tires for 2020 as a whole compared to 2019. The sales results (Table 2) for 2019 show that compared to 2019, the number of tires sold in Japan dropped by 17% for new vehicles

Table 1 Vehicle Tire Production Results

(Units: Number of tires = 1,000 tires, amount of rubber = tons)

		2016	2017	2018	2019	2020
Amount of rubber	For passenger vehicles	486,732	471,774	477,617	475,369	384,946
	For light-duty trucks	130,183	127,179	129,239	132,489	113,080
	For trucks and buses	229,072	241,319	241,150	243,713	197,352
	Others	173,814	186,178	211,672	214,021	167,900
	Total	1,019,801	1,026,450	1,059,678	1,065,592	863,278
Number of tires	For passenger vehicles	110,002	108,258	109,816	109,327	89,014
	For light-duty trucks	21,783	21,527	21,921	22,081	19,167
	For trucks and buses	9,888	10,499	10,513	10,614	8,617
	Others	4,702	4,639	4,499	4,523	4,026
	Total	146,375	144,923	146,749	146,545	120,824

Source: JATMA

Table 2 Vehicle Tire and Tube Sales Results

(Units: Number of tires = 1,000 tires)

		2016	2017	2018	2019	2020
Number of tires	For new vehicles	44,434	46,377	46,103	45,523	37,781
	Commercial	72,175	73,979	73,725	72,573	64,866
	(Japanese total)	116,609	120,356	119,828	118,096	102,647
	For export	47,283	43,302	43,352	44,271	35,905
	(Total demand)	163,892	163,658	163,180	162,367	138,552

Source: JATMA

*1 As of 2007, imported tires are included in the figures for new vehicles.

Table 3 Trends for Consumption of Main Raw Materials for Vehicle Tires and Tubes
(Units: Amount of consumption = tons)

		2016	2017	2018	2019	2020
Tire cords	Nylon	17,495	15,541	15,460	15,713	12,366
	Steel cord	212,651	217,683	227,707	230,144	187,703
	Polyester	40,159	41,295	41,991	42,846	35,565
	Rayon	3,930	3,734	3,178	2,640	2,022
	Others	339	476	384	378	307
	Total	274,574	278,729	288,720	291,721	237,963
Natural rubber		598,093	595,027	621,200	632,616	511,499
Synthetic rubber		415,426	417,281	424,920	422,001	343,260
Carbon black		481,561	476,946	492,329	490,592	394,137

Source: JATMA

and 11% for commercial use, while exports fell by 19%, resulting in an overall combined domestic and export total demand decrease of 15%.

3 Trends in Consumption of Main Raw Materials for Tires

Table 3 shows the trends in the consumption of the main raw materials for tires up to 2020. The consumption of tire cord, synthetic rubber and carbon black dropped by 18 to 20% compared to 2019.

4 Trends in Tire Technologies

4.1. General Trends

In response to the introduction of environmental regulations around the world, tire manufacturers are developing low environmental impact tires offering improved fuel efficiency and reduced noise and weight without sacrificing safety or reliability. Research on developed materials, structure selection, new tire profiles, and tread design, as well as the optimal way to combine them, is being carried out and applied to the development of technologies for next-generation tires that meet even more stringent requirements. Notably, reducing rolling resistance tends to worsen wet grip performance, making it crucial to develop technologies that achieve high levels of performance for both of these characteristics. Manufacturers are therefore developing tires with reduced rolling resistance while giving careful consideration to the overall balance of performance, and are striving to spread the use of fuel-efficient tires.

In addition, studless winter tires offering enhanced safety when driving on ice and snow, as well as next-generation run-flat tires (enhanced mobility tires (EMT)) that address safety and resource conservation concerns

Table 4 Number of Winter Tires Sold and Comparisons to Previous Years
(Units: Number of tires sold = 1,000 tires)

	Number of tires sold				
	2016	2017	2018	2019	2020
Snow tires	22,600	24,303	25,787	23,769	20,202
Compared to previous year	97.1%	107.5%	106.1%	92.2%	85.0%

Source: JATMA

by emphasizing environmental performance and ride comfort more strongly than current run-flat tires. With the publication of an ISO standard on RFID covering tire traceability and the provision of tire information to users, technical studies across a broad range of fields have become necessary.

A new theme is the challenge presented by the development of next-generation tires, which include tires with a higher load than in the past for electric to reduce CO₂ emission, and tires adapted to passenger and commercial vehicles that capitalize on automated driving technology to offer a wide range of services such as mobility, distribution, and the sale of goods.

4.2. Reducing Weight and Rolling Resistance

Global concerns about environmental protection have led to even more fuel-efficient vehicles, and Japan has joined the U.S. (California), Canada, and China in the movement to eliminate gasoline vehicles initiated by the U.K. announcement that it would ban sales of new gasoline vehicles starting in 2030. This has created more stringent demand for reducing the weight and lowering the rolling resistance of both tires installed on new cars and tires distributed for sale. Research and development focused on the adoption of streamlined materials, as well as new materials and structures is leading to greater weight reduction. Moreover, since rolling resistance is mainly due to tire deformation caused by heat generation while driving, rubber heat generation is being reduced, and parameters such as tire profiles are being adjusted to control the deformation reduces rolling resistance. Technological development efforts are leveraging research and development on materials and optimization technologies to balance safety and other areas of performance.

4.3. Studless Winter Tires

The number of winter tires sold in 2020 decreased by 15% compared to 2019 (Table 4). On the technical front, the various tire manufacturers have accumulated their own unique technologies for special rubbers for studless

tires, such as the removal of the water film on iced surfaces to improve tire friction. In addition, they are working on technical development involving tread design as well as structural and material aspects. These efforts are aimed at improving performance on very slippery compacted snow surfaces (black ice). Products targeting even better environmental safety performance in areas such as dry and wet grip performance, lower rolling resistance, reduced weight, and longer wear life are also being developed.

4. 4. Vehicle Exterior Noise

The strengthening of regulations concerning vehicle and tire noise by the Working Party on Noise and Tyres (GRBP) of the World Forum for Harmonization of Vehicle Regulations (UN/ECE/WP.29) has made regulation values significantly stricter. Tire manufacturers are working on developing technologies in fields such as tread, structural, and material design to further lower noise levels. Furthermore, ISO 10844 (Acoustics – Specifications of Test Tracks for Measuring Noise Emitted by Road Vehicles and Their Tires) was revised with a new version in 2014 to minimize the variation in sound levels produced on the different test tracks where measurements were taken, and its stipulations have been incorporated into Regulation No. 117. In Japan, Regulation 117 annexed to the 1958 Agreement has been introduced for tires installed on new vehicles for passenger vehicles from 2018, and for tires installed on light-duty trucks starting in 2019. It has also been decided to apply them to medium- and heavy-duty trucks and buses from 2023.

4. 5. Run-Flat Tires, EMT

European vehicles have led the way in increasing instances of installing run-flat tires and leaving out spare tires to make more efficient use of resources and spaces, as well as to offer greater safety in the event of a puncture on an expressway or high-traffic road. The self-supporting reinforced side structure of mainstream run-flat tires makes them heavier than normal tires and gives them a higher longitudinal spring constant. This makes it necessary to keep weight and rolling resistance down sufficiently for the decrease in CO₂ emissions resulting from leaving out the spare tire to exceed the increase in those emissions from the use of run-flat tires.

In light of such issues and the needs of the market (environmental regulations, user preferences), there is demand, particularly in Europe, for next-generation run-flat tires that place more emphasis on ride comfort, weight

reduction and lower rolling resistance than current run-flat tires. Many European vehicles feature these next-generation tires. Tires with that next-generation run-flat tire are defined as extended mobility tires (EMTs) technology, and ISO 16992, which standardizes their performance and labeling requirements, was revised and published in August 2018. The introduction of EMT legislation also led to additional revisions to Regulation Nos. 30 and 64, in January 2020, with EMTs treated as a type of radial tire.

As a side note, ISO 19940, which standardizes tire rigidity measurement methods for run-flat tires and EMTs, had already been issued in 2017.

4. 6. Radio Frequency Identification (RFID) Tyre Tag

The use of RFID to ensure tire traceability (tire manufacturing information, management of sales, users, vehicles, and repair history), provide tire information matched to user attributes, and allowing customs to check for certification with government authorities, has been spreading. The UAE has mandated the affixing of labels with embedded RFID tags since June 2016 to eliminate poor quality products by relying on the difficulty of copying or reusing such tags. Russia has followed suit since November 2020 with the introduction of RFID based on its own rules.

The ISO standards for RFID tags attached to tires were discussed in ISO/TC 31 (Tyres, rims and valves), and all four standards concerning matters such as RFID specifications and test methods were issued in April 2020.

4. 7. Other

(1) Recycling of Waste (Used) Tires in Japan:

Recycling use in 2019 fell by 31,000 tons over the previous year, totaling 966,000 tons, a 3% decrease that brings the recycling rate to 94%. Use in paper factories notably dropped by 44,000 tons compared to the previous year. The recycling situation above only takes statistics on waste (used) tires produced in Japan into account, and does not include imported products.

5 Tire Standards

5. 1. Main Revisions in the 2021 JATMA Year Book

(1) **General Trends:** In Japan, the direct quoting of UN Regulations Nos. 30, 54, 75, and 117 in the amendments to the *Safety Regulations for Road Vehicles*, led

Table 5 Results of On-Road Tire Inspections in 2020 (January to December)

Source: The Japan Automobile Tyre Manufacturer's Association, Inc. (JATMA)

Inspection items		2019						2020								
		Expressway			General road			Total			Expressway		General road		Total	
		Change from previous year		Number of problems	Change from previous year		Number of problems	Change from previous year		Number of problems	Percentage of problems	Number of problems	Percentage of problems	Number of problems	Percentage of problems	
Number of inspections (times)		18	5		19	-3		37	2							2
Number of vehicles inspected (A)		604	113	1,409	47	2,013	160	26	180	206						
Number of vehicles with poor tire maintenance (B)		172	37	256	-42	428	-5	11	59	70						
Percentage of problems (B/A) (%)		28.5	1.0	18.2	-3.7	21.3	-2.1	42.3	32.8	34.0						
Number of problems found and percentage of problems		Number of problems		Percentage of problems		Number of problems		Percentage of problems		Number of problems		Percentage of problems				
			%	Change	%	Change	%	Change	%	Change	%	Change	%	Change		
Breakdown of poor tire maintenance items	Insufficient tire tread	19	3.1	-0.6	15	11.1	-0.2	34	1.7	-0.2	2	7.7	1	0.6	3	1.5
	Uneven wear	15	2.5	-2.2	22	1.6	-1.2	37	1.8	-1.5	2	7.7	8	4.4	10	4.9
	External damage (reaching the cords)	0	0.0	-0.2	1	0.1	0.0	1	0.0	-0.2	0	0.0	0	0.0	0	0.0
	Imbedded nail or other foreign object	2	0.3	-0.1	2	0.1	0.0	4	0.2	0.0	0	0.0	2	1.1	2	1.0
	Insufficient tire pressure	141	23.3	4.0	214	15.2	-3.1	355	17.6	-1.0	6	23.1	52	28.9	58	28.2
	Others	7	1.2	-0.6	45	3.2	-1.6	52	2.6	-1.4	4	15.4	5	2.8	9	4.4
	Total	184	—	—	299	—	—	483	—	—	14	—	68	—	82	—

- Note: 1) In some cases, a single vehicle had multiple items of poor tire maintenance, so the number of vehicles with poor tire maintenance and the number of poor tire maintenance problems found do not always match up.
 2) Percentage of problems: Number of vehicles with poor tire maintenance or number of poor tire maintenance problems / Number of vehicles inspected × 100 (rounded to two decimal places)
 3) National expressways include those exclusively for four-wheeled vehicles.
 4) Tire air pressures were measured through both visual inspections and actual measurement with an air gauge. Hot air was included as a tire state.

JATMA to revise its standards to harmonize them with the UN regulations and ISO standards.

(2) Tires for Passenger Vehicles: Descriptions of the codes for extended mobility tires were added. A total of five new sizes for the standard load 45, 50, and 60 series, and of nine new sizes for the extra load 30, 40, 45, 50 55 and 60 series have been added.

(3) Tires for trucks and buses: A load capacity coefficient for speeds exceeding 100 km/h to the table showing the relationship between speed and load capacity to reflect international harmonization and actual market conditions.

(4) Other tires: Stipulations on the increase or decrease in the load capacity ratio of due to changes in speed regarding tires for rice transplanters and tillers were added to the chapter on agricultural tires, and a new size was established for motorcycle tires.

6 Tire Safety Issues

6.1. On-Road Tire Inspections

Table 5 shows the results of five on-road tire inspections conducted in 2020 in Japan by JATMA with the cooperation of prefectural police departments, transportation bureau branch offices, the three Nippon Expressway Companies, and other automotive- or tire-related organizations. Tire problems were found in 34.0% of vehicles. The most prevalent problem was deficient air pressure

at 28.2%, which is overwhelmingly higher than the second most common, uneven wear, at 4.9%. Activities to educate the public about maintaining proper air pressure are being pursued not only because proper tire pressure is crucial for fuel efficiency on the environmental level, but also for safety purposes since insufficient pressure presents the risk of a tire puncturing while driving.

6.2. Laws and Regulations

(1) Trends Concerning Environmental Performance Regulations: The Fuel-Efficient Tire Promotion Council was established based on the recommendations of the International Energy Agency (IEA) and global environmental protection movements. In January 2010, JATMA led the way in introducing a tire labeling system requiring the indication of grades for rolling resistance and wet grip performance according to voluntary industry standards.

In preparation for the introduction of a regulation on the tires themselves, the partial amendment of the Safety Regulations for Road Vehicles, which was issued and came into effect on October 8, 2015, ultimately made compliance with the technical requirements for tire exterior noise, rolling resistance, and wet grip performance in UN Regulation No. R117 gradually mandatory starting in April 2018.

In Europe, EEC Directive 92/23/EEC (later amended by EC directive 2001/43/EC) stipulated that tire noise

regulations would be gradually applied in EU member nations starting in February 2003. At the same time, UN Regulation No. R117, which significantly strengthens vehicle exterior noise and also includes stipulations on rolling resistance and wet grip performance, came into effect in November 2012. A further strengthening of the tire rolling resistance regulations (Stage 2) began in November 2016. A tire labeling system (Regulation (EC) 1222/2009) that requires the display of grades for these three areas of tire performance was introduced in November 2012, and a new labeling system (Regulation (EU) 2020/740) was introduced in May 2021. The new system partially modifies the performance grades, and uses QR codes to provide information to consumers.

In the Middle East, Israel has been following in the footsteps of Europe, applying grade labeling since June 2013 and Regulation No. 117 since January 2015. That country switched to the same new labeling system as Europe in May 2021. In addition, a tire labeling system with grades for rolling resistance and wet grip performance, as well as minimum performance requirements, have been applied since November 2015 in Saudi Arabia and since January 2016 in other Persian Gulf countries. Iran started applying UN Regulation No. 117 and the European grade labeling system to imported tires in August 2016 and March 2017, respectively.

In Asia, legislation on grade labeling for tire rolling resistance and wet grip performance, as well as on minimum performance requirements, has been gradually applied in South Korea since December 2012. Furthermore, control methods for noise and vibration (tire noise regulations and the application of noise labels) are also gradually being introduced since 2020. In Malaysia, noise regulations (UN Regulation No. 117 Stage 1) have been applied since July 2015. The rolling resistance (Stage 2), vehicle exterior noise (Stage 2), and wet grip performance stipulations from UN Regulation No. 117 have been gradually applied since November 2017. Since September 2019, Thailand has also introduced performance requirements equivalent to the European UN Regulation No. 117, as well as grade labeling for rolling resistance, vehicle exterior noise, and wet grip performance. The Thai labels are notable for indicating both the performance value and the grade, and using QR codes to provide information to consumers has been mandatory since 2021.

In Brazil, the INMETRO Regulation No. 544/2012 was

issued, and came into effect in April 2015, imposing minimum performance requirements and a grading systems for tire vehicle exterior noise, rolling resistance, and wet grip performance.

The minimum performance requirements for rolling resistance, vehicle exterior noise, and wet grip performance from Regulation No. 117 are also in effect in Turkey, Russia, Iran, and the U.K.

In the U.S., the Final Rule regarding the grading systems for tire rolling resistance, wet traction, and wear performance was published in the Federal Register as the U.S. Tire Fuel Efficiency Consumer Information Program Part 575.106 in December 2011. The enactment process stalled under the Trump information, and whether the Biden administration restarts the process will have to be monitored closely.

Other countries that plan on introducing a minimum requirement performance system similar to the above include China and India. Both of those countries are also considering introducing grade labeling systems using their own labels.

(2) Trends Concerning Safety Performance Regulations: Safety performance regulations are gradually being introduced in Asia. Vietnam has established new certification rules for new tires that have the same technical criteria as Regulation Nos. 30, 54 and 75. Similarly, Thailand has also established new Thai standards (TIS) that have the same technical criteria as Regulation Nos. 30, 54 and 75, and they have been applied since January 2019. More recently, Cambodia started applying UN Regulation Nos. 30, 54 and 75 in January 2020. Similar legislation is also under consideration in Laos and Myanmar.

The ASEAN nations concluded a Mutual Recognition Arrangement in January 2021, and further expansion is anticipated in light of moves to adopt Regulation Nos. 30, 54 and 75 as tire safety regulations.

(3) Other: The Working Party on Brakes and Running Gear (GRRF) of the World Forum for Harmonization of Vehicle Regulations (UN/ECE/WP29) examined and formulated a Global Technical Regulation (GTR) for tires to develop globally unified safety standards for the tire certification systems appearing in a growing number of countries, and GTR No. 16 was officially issued on January 16, 2015. Revision 1, which harmonizes with the latest related UN regulations, was subsequently issued in March 2017. In addition, discussions to harmonize the

standards for light-duty truck tires initiated in January 2017 led to issuing Revision 2 in October 2020.

At the World Forum for Harmonization of Vehicle Regulations (UN/ECE/WP.29), Japan submitted the International Whole Vehicle Type Approval (IWVTA) proposal to build a new international mutual recognition framework for vehicle approval. The proposal was established as Regulation No. 0 in August 2018. The tire-related requirements in that proposal consist of the UN regulations (Nos. 30, 54, and 117).

Other upcoming tire-related regulations include regulations on RFIDs, on the aging of tires in the context of

factors such as further discussions about evaluating abraded tire wet grip performance as part of environmental performance, and on limits on tire purchases or use, as well as regulations regarding the performance of winter tires. The Working Party on Noise and Tyres (GRBP) of the World Forum for Harmonization of Vehicle Regulations (UN/ECE/WP.29) continues to discuss new regulations and revisions to existing ones, and it will be necessary to continue monitoring global trends closely to address increasingly diverse and complex certification systems and regulations.