TIRES

1 Introduction

Japan introduced a tire labeling system in January 2010. One of the trends seen in tire technologies since then has been an intensification of technological development to further enhance the environmental friendliness and economic efficiency of tires, as well as to improve fundamental safety aspects. Fuel-efficient tires have continued to grow in popularity.

In November 2012, Europe introduced new tire regulations covering the three areas of rolling resistance, external tire noise, and wet grip performance, along with a new tire labeling system displaying how the tire rates in each of those three areas, providing a good example of trends in tire regulations. Similar regulations have also been put into effect in South Korea, where tires for passenger vehicles must now be labeled with the grades the tires for rolling resistance and wet grip performance (as of December 2012) and the required minimum level of performance (as of December 2013).

In the U.S., preparations are underway to issue legislation that will require tires to be labeled with grades for rolling resistance, wet traction, and wear performance as part of a tire fuel efficiency program.

New laws and regulations concerning tires were issued in Brazil in October 2012. These include a tire labeling system that provides ratings for rolling resistance, external tire noise, and wet grip performance similar to the system in Europe, as well as stipulations on maximum values. These regulations will come into effect starting in April 2015 at the earliest.

In Saudi Arabia as well, regulations on rolling resistance and wet grip performance are scheduled to gradually come into effect starting in November 2015, reflecting the worldwide spread of environment-related laws and regulations.

2 Tire Production, Sales, and Results

As shown in Table 1, approximately 160 million vehicle tires were produced in 2014, a figure virtually unchanged from 2013 both in terms of number of tires and amount of rubber. Although this means the tire industry is recovering from the downturn due to the global financial crisis, it has yet to return to pre-crisis levels.

The tire sales results from Table 2 show that the number of tires sold in Japan for new vehicles remained about the same as in 2013, while the number sold for commercial use in Japan and sales of tires intended for export increased by 3% and 2%, respectively. The total demand for tires, including both sales in Japan and tires for export, increased by 2%.

3 Trends in the Consumption of Main Raw Materials and Production Energy for Tires

Table 3 shows the trends in the consumption of the main raw materials for tires. Raw material consumption for tire cord increased by 3% compared to 2013. Steel cord consumption rose by 4%, but rubber production levels remained flat and are still below pre-financial crisis levels.

4 Trends in Tire Technologies

4. 1. General trends

In light of environmental concerns prompted by global warming, tire manufacturers are developing tires that help the environment through higher fuel efficiency and lower noise and weight. These tires also emphasize economic efficiency and environmental friendliness while ensuring safety and reliability. The development of tire technologies has spurred the examination of ways to optimize the materials, structure, shape, and tread design, which has also led to the creation of new technologies to meet even more stringent requirements. Tires are expected to exhibit high performance in many areas, in-

Table 1 Vehicle tire production results

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

		2010	2011	2012	2013	2014
Amount of rubber	For passenger vehicles	599 075	583 792	535 354	523 064	526 341
	For small trucks	141 588	144 734	142 125	146 561	148 518
	For trucks and buses	281 604	282 053	263 370	259 638	263 082
	Other	173 444	201 384	206 056	198 687	183 121
	Total	1 195 711	1 211 963	1 146 905	1 127 950	1 121 062
Number of tires	For passenger vehicles	130 530	126 998	120 609	119 485	120 005
	For small trucks	22 176	22 604	23 194	24 682	24 649
	For trucks and buses	11 208	11 387	10 843	10 808	11 001
	Other	5 793	5 453	4 553	4 656	4 770
	Total	169 707	166 442	159 199	159 631	160 425

Source: JATMA

Table 2 Vehicle tire and tube sales results

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

		2010	2011	2012	2013	2014
Number of tires	For new vehicles	48 961	42 389	48 526	46 928	47 013
	Commercial	67 028	71 686	71 092	73 825	76 264
	(Japanese total)	115 989	114 075	119 618	120 753	123 277
	For export	70 716	67 874	54 157	51 819	53 100
	(Total demand)	186 705	181 949	173 775	172 572	176 377

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)

		2010	2011	2012	2013	2014
Tire cords	Nylon	20 385	22 447	21 722	18 013	17 940
	Steel cord	238 566	242 643	223 637	223 216	232 360
	Polyester	45 836	45 188	42 577	42 540	42 152
	High-tenacity rayon	3 603	3 998	3 281	3 174	3 610
	Other	958	1 041	794	717	734
	Total	309 348	315 317	292 011	287 660	296 796
Natural rubber		655 578	681 568	631 311	622 210	618 744
Synthetic rubber		507 153	512 333	479 669	478 045	480 042
Carbon black		594 058	602 077	551 701	540 334	538 526

Source: JATMA

Table 4 Energy conservation and power consumption in the vehicle tire industry.

(Units: Power = 1,000 kW/h, crude oil = kL, amount of rubber = tons)

		2010	2011	2012	2013	2014
Power	Consumption	2 093 737	2 084 669	1 989 006	—	—
	Unit consumption	1.751	1.720	1.734	—	—
Crude oil	Consumption	68 673	68 965	57 813	—	—
	Unit consumption	0.057	0.057	0.050	—	—
Vehicle tire and tube volume of production		1 195 711	1 211 963	1 146 905	—	—

Source: JATMA

Note: no longer calculated as of 2013

Table 5 Number of winter tires sold and comparisons to previous years.

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

	Number of tires sold				
	2010	2011	2012	2013	2014
Snow tires	18 410	22 093	23 043	24 958	25 958
Compared to previous year	111.9 %	120.0 %	104.3 %	108.3 %	104.0 %

Source: JATMA

cluding basic functions. Since reducing rolling resistance can have a negative impact on wet grip performance, tire technologies that ensure or improve wet grip performance while also reducing rolling resistance are being developed. Tire manufacturers are therefore giving careful consideration to the overall balance of tire performance when launching products with reduced rolling resistance.

In addition, efforts continue to be directed at the development of both studless winter tires, which enhance safety when driving on ice and snow, and run-flat tires, which feature superior durability in terms of safety and resource conservation.

4. 2. Weight reduction and fuel efficiency

With worldwide initiatives to address environmental concerns such as global warming leading to ever greater fuel efficiency in vehicles in the form of PHVs, EVs, and FCVs, the demand for lighter tires with lower rolling resistance is increasing. There is ongoing further development of technologies that balance those requirements with performance in areas such as wet grip and low noise.

4. 3. Studless tire technologies

Table 5 shows that the number of winter tires sold in Japan in 2014 increased by approximately 4% over the previous year. Sales of winter tires have now returned to pre-financial crisis levels.

Tire manufacturers continue to develop studless winter tire technologies in the fields of tread, structural, and material design. These efforts are aimed at improving the performance of studless winter tires on road surfaces covered with snow compacted by repeated stops and starts at intersections, as well as on mirror-smooth, slippery road surfaces (black ice). At the same time, the development of studless winter tires that also takes performance on dry and wet roads into consideration is being pursued.

4. 4. Vehicle exterior noise

The United Nations World Forum for Harmonization of Vehicle Regulations (UN/WP 29) in Europe put UN regulation R117-02 into effect in November 2012. Tire

rolling noise requirements were made significantly stricter by reducing the regulation values by an average of 4 dBs Consequently, tire manufacturers are working on developing technologies in fields such as tread, structural, and material design to further improve low-noise performance and meet the new regulation values. Furthermore, a revised ISO 10844 (Acoustics – Specifications of Test Tracks for Measuring Noise Emitted by Road Vehicles and Their Tires) was released in 2011 to minimize the variation in sound levels produced on the different test tracks where measurements were taken. Adopting the stipulations in this standard into UN R117-02 is under consideration.

In Japan, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and Ministry of the Environment (MOE) established a tire noise regulation investigative committee made up of experts from academia and other fields in February 2012. After examining the time frame for the introduction of the regulation and releasing its interim report on the MLIT and MOE websites on March 28, 2014, the committee is now finalizing work to enact the relevant legislation.

The committee has already decided to harmonize test methods and regulation values with UN R117-02.

4. 5. Run-flat tires

In recent years, the number of vehicles equipped with run-flat tires is increasing as automakers leave out spare tires to conserve resources and make more efficient use of space, as well the growing need to ensure safety in the event of a puncture on a highway or high-traffic road. Structurally, there are two broad categories of run-flat tires: self-supporting run-flat tires with reinforced sidewalls, and auxiliary-supported run-flat tire systems where an additional support ring attached to the wheel is inserted inside the tire. Self-supporting run-flat tires with reinforced sidewalls are currently the mainstream.

The structure of run-flat tires makes the tire itself heavier than a normal tire, and they also tend to have a higher longitudinal spring constant. Weight reduction and lower rolling resistance are crucial to counterbalancing the increase in CO_2 emissions due to the use of run-flat tires with the decrease in CO_2 emissions resulting from the lack of a spare tire. Other issues include the long standing need for enhancing ride comfort, improving durability when the tire punctures while driving, as well as making run-flat tires with a high cross-section height and producing tires for heavy-duty vehicles. Development targeting the future expansion of the run-flat tire market is underway.

Performance and marking requirements for run-flat tires have been standardized by the ISO and incorporated into UN R30, as well as in the MLIT tire technology standards in Japan.

4. 6. Other

In recent years, the rising prices for oil and coal is creating a high demand for old tires that can be recycled as a source of heat in the paper, cement, and steel industries.

Activities to reinforce the reduce, reuse, and recycle (3R) approach is also stimulating demand for retreaded tires and leading to more active reuse of scrap tires.

Current tires are produced from materials such as organic fiber and natural or synthetic rubbers, but tires made from sustainable raw materials are also being developed, and manufacturers are undertaking initiatives to shift from exhaustible to renewable resources.

5 Tire Standards

5. 1. Main revisions in the 2015 JATMA Year Book

5. 1. 1. General

Efforts are being made to harmonize standards with the MLIT tire technology standards and the ISO. The 2015 edition also clarified the phrasing of dynamic load radius measurement conditions for passenger vehicles tires.

5. 1. 2. Tires for passenger vehicles

The winter tire outside diameter for passenger vehicle tires increase was revised to 1% to harmonize it with the ISO. The dimensions for new T-type spare tires and the static load radius tolerances for 37 tire sizes were modified. Focusing on aspect ratio, 6 new sizes and 1 new T-type spare tire size were established.

5. 1. 3. Other tires

Two new sizes were established for motorcycle tires. In the section on agricultural tires, notes on the indicated PR and LI/SS sizes of bias tires for tractor driving wheels were added. The tire air pressure – load capacity correspondence chart was amended to achieve harmonization with the ISO standard. Also, 9 new radial tire sizes were established.

5. 2. ISO/TC 31 tire standards

The main ISO meetings were postponed in 2014. The ISO/TC 31/SC 3 (Passenger car tyres and rims) is scheduled to take place in Luxembourg in April 2015, while

Table 6 Results of on-road tire inspections in 2014 (January to December).

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

Inspection items \ By year / By road type		2013						2014								
		National expressways		General roads		Total		National expressways			一般道路			Total		
									Change from previous year			Change from previous year			Change from previous year	
Number of inspections (times)		18		21		39		12	−6		32	11		44	5	
Number of vehicles inspected (A)		657		874		1 531		463	−194		1 599	725		2 062	531	
Number of vehicles with poor tire maintenance (B)		203		274		477		136	−67		269	−5		405	−72	
Percentage of problems (B/A) (%)		30.9		31.4		31.2		29.4	−1.5		16.8	−14.6		19.6	−11.6	
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	Number of problems	Percentage of problems		Number of problems	Percentage of problems		Number of problems	Percentage of problems	
									%	Change		%	Change		%	Change
Breakdown of poor tire maintenance items	Insufficient tire tread	27	4.1	23	2.6	50	3.3	10	2.2	−1.9	17	1.1	−1.5	27	1.3	−2.0
	Uneven wear	37	5.6	49	5.6	86	5.6	13	2.8	−2.8	49	3.1	−2.5	62	3.0	−2.6
	External damage (reaching the cords)	3	0.5	5	0.6	8	0.5	3	0.6	0.1	2	0.1	−0.5	5	0.2	−0.3
	Imbedded nail or other foreign object	4	0.6	3	0.3	7	0.5	1	0.2	−0.4	1	0.1	−0.2	2	0.1	−0.4
	Improper tire pressure	117	17.8	200	22.9	317	20.7	103	22.2	4.4	182	11.4	−11.5	285	13.8	−6.9
	Other	32	4.9	72	8.2	104	6.8	15	3.2	−1.7	73	4.6	−3.6	88	4.3	−2.5
	Total	220	—	352	—	572	—	145	—	—	324	—	—	469	—	—

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

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.

the ISO/TC 31/SC 5 (Agricultural tyres and rims) SC 6 (Off-the-road tyres and rims), and SC 7 (Industrial tyres and rims) meetings will be held in Sapporo.

At these meetings and WGs, lively debates are held about standardizing tire and rim standards, particularly in terms of harmonizing the standards used by JATMA, the European Tyre and Rim Technical Organisation (ETRTO), and the U.S. Tire and Rim Association, Inc. (TRA).

6 Tire Safety Issues

6. 1. On-road tire inspections

Table 6 shows the results of 44 on-road tire inspections conducted between January and December of 2014 by JATMA with the cooperation of prefectural police departments, the Transportation Bureau, the Nippon Expressway Companies (formerly the Japan Highway Public Corporation, JH), the Japan Automobile Manufacturers Association, Inc. (JAMA), and other related groups. According to these results, 19.6% of all the vehicles that were inspected had poor tire maintenance, an 11.6% improvement over the 2013 figures. Broken down by road type, the rate of poor tire maintenance found on the national expressways was 29.4%, a 1.5% improvement from 2013. On general roads, the rate was 16.8%, a 14.6% improvement from 2013.

As in previous years, the most common poor tire maintenance problem on a per item basis was improper tire air pressure, which accounted for 13.8% of all problems found.

Two main tire-related initiatives are being undertaken to make vehicles more fuel efficient. One is to improve the performance of the tire itself by reducing rolling resistance. The other is to make sure that all tires are inflated to the proper air pressure. Activities by the relevant industries to educate drivers about proper tire air pressure, particularly in terms of its environmental, economic, and safety aspects are bearing fruit as 2014 results indicate that the number of vehicles with improper tire pressure is starting to drop. Even more proactive awareness campaigns about managing tire air pressure, in the same vein as those to promote energy conservation and less power consumption in households, are desirable.

6. 2. Laws and regulations

6. 2. 1. Japan

The Fuel-Efficient Tire Promotion Council was established based on the recommendations of the International Energy Agency (IEA) and global environmental protection movements. A tire labeling system requiring the indication of grades for rolling resistance and wet grip performance according to voluntary industry standards was introduced in January 2010. The second report of the Central Environment Council announced that tire noise

regulations would be introduced in Japan, and MLIT and MOE established a tire noise regulation investigative committee made up of experts from academia and other fields for that purpose in February 2012. After examining the time frame for the introduction of the regulation and releasing its interim report on the MLIT and MOE websites on March 28, 2014, the committee is now finalizing work to enact the relevant legislation.

6. 2. 2. U.S.

A large tire recall triggered the enactment of the Transportation Recall Enhancement Accountability and Document (TREAD) Act in 2000. This act mandated the phasing in of tire pressure monitoring systems (TPMS) starting in October 2005. Since September 2007 it has been mandatory for all vehicles sold in the U.S. to be equipped with TPMS.

The U.S. Congress also enacted the Energy Independence and Security Act of 2007 in December 2007, which led to the creation of a consumer tire information program after the President signed it into law. In December 2011 the Final Rule regarding the tire labeling system 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, and the specifics of this rule are now being examined.

6. 2. 3. Europe

EC 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, and these tire noise regulations became significantly stricter in November 2012. At the same time, UN R117-02, which mandates a tire labeling system indicating grades and ratings for tire rolling resistance, external tire noise, and wet grip performance, also came into effect. A further strengthening of the tire rolling resistance regulations (Stage 2) will begin in November 2016. A tire labeling system that requires the display of grades for the above three areas of tire performance was introduced in November 2012, providing customers with information about the performance grades of tires.

6. 2. 4. Asia, Middle East, Africa, and South America

Countries in these regions have also begun putting tire certification systems into effect in recent years. There have also been moves to introduce minimum performance guarantees and rating systems (labeling systems) for tire rolling resistance and wet grip performance. A recent example is the INMETRO Regulation No. 544/2012 issued in Brazil. This regulation requires both grading and the meeting of minimum required performance regulations for tire noise, rolling resistance, and wet grip performance. The Middle-East also plans to require minimum performance guarantees for rolling resistance and wet grip performance, demonstrating the growing focus on both environmental and safety regulations around the world. Under the umbrella of the United Nations Economic Commission for Europe (UNECE), the Working Party on Brakes and Running Gear (WP 29/GRRF) is promoting the examination and formation of a Global Technical Regulation (GTR) for tires to develop worldwide unified safety standards for the ever-growing number of tire certification systems being established in various countries. This tire GTR passed through the deliberations of GRRF in September 2012 and February 2013 as a GTR for passenger vehicles. Although it was presented to WP 29 in June 2013, it was decided that further discussions were required for some of the test methods and was due to be presented to WP 29 again in June 2014. Currently, work is proceeding with the aim of receiving final approval from WP 29 in November 2014.