
Tires

1 Introduction

Approximately 160 million vehicle tires were produced in 2013, approximately 2% less than the number produced in 2011. The amount of rubber that was used for tires also declined by approximately 2%. The tire industry has largely recovered from the downturn it suffered after the global financial crisis, but it still has not returned to pre-crisis levels.

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.

Europe has provided a good example of tire regulation trends. Regulations for a new tire labeling system were put into effect in November 2012, requiring all tires to display a special label with information about tire performance in three areas: tire rolling resistance, external tire noise, and wet braking performance. The tire labels display ratings and grades that indicate how well the tire performs in each of these areas. 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 braking 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 also require tires to be labeled with grades for rolling resistance, wet traction, and wear performance. This is being done as part of a tire fuel efficiency consumer information program.

New laws and regulations concerning tires were issued in Brazil in October 2012. These regulations also concern a tire labeling system that will display grades for rolling resistance, external tire noise, and wet brak-

ing performance, the same as in Europe. In addition, the maximum values are also regulated. These regulations will be applied starting in April 2015 at the earliest. A movement to create new laws and regulations for the environmental performance of tires is now spreading throughout the world.

2 Tire Production, Sales, and Results

Table 1 shows the vehicle tire production results for 2013. Overall, the results indicate a decline of approximately 2% from the number of tires produced in 2012 and a decline of the same amount in the amount of rubber used for tire production. This means that, while the tire industry has largely recovered from the downturn due to the global financial crisis, it has still not returned to pre-crisis levels.

Table 2 shows the tire sales results for 2013. These results indicate that the number of tires sold in Japan for new vehicles fell by approximately 3% compared to 2012, while the number sold for commercial use in Japan increased by 4% and sales of tires intended for export declined by 4%. The total number of tires that were sold (i.e., the total demand), which includes both tires for Japan and tires for export, decreased by 1%.

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 in 2013. In terms of tire cords, the amount of raw material consumption decreased by 1% compared to 2012. Nylon consumption fell heavily by 17%. Similar to the amount of rubber, these amounts declined in comparison to 2012 and have yet to return to pre-financial crisis levels.

4 Trends in Tire Technologies

4.1. General trends

Every tire manufacturer is promoting the development

Table 1 Vehicle tire production results.

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

		2009	2010	2011	2012	2013
Amount of rubber	For passenger vehicles	485 515	599 075	583 792	535 354	523 064
	For small trucks	122 208	141 588	144 734	142 125	146 561
	For trucks and buses	240 743	281 604	282 053	263 370	259 638
	Other	137 638	173 444	201 384	206 056	198 687
	Total	986 104	1 195 711	1 211 963	1 146 905	1 127 950
Number of tires	For passenger vehicles	107 409	130 530	126 998	120 609	119 485
	For small trucks	18 915	22 176	22 604	23 194	24 682
	For trucks and buses	9 450	11 208	11 387	10 843	10 808
	Other	5 364	5 793	5 453	4 553	4 656
	Total	141 138	169 707	166 442	159 199	159 631

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

Table 2 Vehicle tire and tube sales results.

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

		2009	2010	2011	2012	2013
Number of tires	For new vehicles	40 322	48 961	42 389	48 526	46 928
	Commercial	61 751	67 028	71 686	71 092	73 825
	(Japanese total)	102 073	115 989	114 075	119 618	120 753
	For export	59 476	70 716	67 874	54 157	51 819
	(Total demand)	161 549	186 705	181 949	173 775	172 572

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

*1 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)

		2009	2010	2011	2012	2013
Tire cords	Nylon	15 411	20 385	22 447	21 722	18 013
	Steel cord	199 649	238 566	242 643	223 637	223 216
	Polyester	37 204	45 836	45 188	42 577	42 540
	High-tenacity rayon	2 777	3 603	3 998	3 281	3 174
	Other	689	958	1 041	794	717
	Total	255 730	309 348	315 317	292 011	287 660
Natural rubber		549 596	655 578	681 568	631 311	622 210
Synthetic rubber		406 023	507 153	512 333	479 669	478 045
Carbon black		489 155	594 058	602 077	551 701	540 334

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

of tires that help the environment through higher fuel efficiency and lower noise and weight. Manufacturers are emphasizing economic efficiency and environmental friendliness, while ensuring safety and reliability. These efforts are being undertaken from the standpoint of preserving the global environment in light of the challenges and dangers posed by global warming. 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. A high level of performance is being demanded of new tires in many different areas, including basic functions. Reducing the rolling resistance of the tire may also have a negative impact on the wet braking performance. Therefore, the development of tire technology that can improve and ensure wet braking performance while also reducing rolling resistance is being promoted. Consequently, every tire manufacturer has launched products with reduced rolling resistance by giving careful consideration to the overall balance of tire performance.

In addition, the development of studless winter tires,

which provide enhanced safety when driving on ice and snow, and run-flat tires, which have superior durability from the standpoints of safety and saving resources, is also continuing to make progress.

4. 2. Reducing weight and rolling resistance of tires

Increasing vehicle fuel efficiency is being promoted around the world as one initiative to help preserve the environment and address global warming. Consequently, there are increasing demands for tires that are lighter in weight and that have a lower rolling resistance. Further development of tire technologies is continuing to meet these demands while also ensuring other areas of tire performance, such as wet braking and low noise.

Starting in Europe and South Korea, regulations were put into effect in 2012 that require special tire labels that indicate grades for tire performance in three areas: tire rolling resistance, wet braking performance, and external tire noise, along with regulations for the required minimum levels of performance. Similar laws and regulations will be introduced in the U.S., Brazil, and other countries in the future, so the speed at which this regulatory trend is expanding is only accelerating. Consequently, since

Table 4 Number of winter tires sold and comparisons to previous years.

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

	Number of tires sold				
	2009	2010	2011	2012	2013
Snow tires	16 454	18 410	22 093	23 043	24 958
Compared to previous year	88.0 %	111.9 %	120.0 %	104.3 %	108.3 %

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

it is necessary to accurately quantify these areas of tire performance, the adoption of a unified tire testing method is being promoted, including in those countries that are introducing new laws and regulations.

4.3. Studless winter tires

Table 4 shows the number of winter tires that were sold in Japan. It indicates that the number sold in 2013 increased by approximately 8% compared to the previous year. Sales of winter tires have now returned to pre-financial crisis levels.

Each tire manufacturer is continuing to pursue the development of studless winter tire technologies in the fields of tread design, structural design, and material design. These efforts are aimed at improving the performance of studless winter tires on road surfaces covered with compacted snow, formed by repeated stopping and starting at intersections, and also the performance on mirror-smooth slippery ice-covered road surfaces (i.e., black ice). The development of studless winter tires that also takes into consideration performance on dry roads and environmental performance is being promoted and advanced as well.

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. This regulation strengthened the tire rolling noise requirements in conjunction with existing rules covering tire rolling resistance and wet braking performance. The regulation values for tire rolling noise were made significantly stricter by reducing the requirement by an average of 4 dB. Consequently, each tire manufacturer is performing additional development of tire technologies, such as tread, structural, and material design, to further improve low-noise performance and to achieve the required regulation values. 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 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 now being examined.

In addition, the Ministry of the Environment (MOE) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in Japan established a tire noise regulation investigative committee in February 2012 made up of experts from academia and other fields. This committee is examining specific dates for the introduction of the UN regulation and issued an interim report in March 2013. The committee has already decided to harmonize test methods and regulation values with UN R117-02.

4.5. Run-flat tires

The aim of run-flat tires is to enhance the safety of the vehicle in the event of a puncture on a highway or high-traffic road and to meet the growing needs of consumers who prefer to have a vehicle without a spare tire to improve the efficient use of vehicle space. The number of vehicles that are equipped with run-flat tires is increasing. Structurally, run-flat tires can be broadly divided into two different types: self-supporting run-flat tires with reinforced sidewalls and auxiliary-supported run-flat tire systems in which an additional support ring attached to the wheel is inserted inside the tire. Currently the self-supporting run-flat tires with reinforced sidewalls are the mainstream type of run-flat tire.

The structure of run-flat tires makes the tire itself heavier than a normal tire and these tires also tend to have a higher longitudinal spring constant. Although the use of run-flat tires increases the amount of CO₂ emissions, the reduction in overall vehicle weight due to the lack of a spare tire has the opposite effect. Therefore, reducing weight and rolling resistance is necessary to improve the overall effects of using run-flat tires. Other issues to be addressed include the long standing need to improve the ride comfort of run-flat tires, improving the durability of reinforced sidewalls, and developing run-flat tires in other sizes, such as tires with a high cross-

section height and tires for large-sized vehicles. Consequently, development is being promoted with a view to expanding the market for run-flat tires in the future.

The performance requirements and marking requirements for run-flat tires have been standardized by ISO and the tire technology standards of MLIT are being incorporated into UN R30.

4.6. Other

In recent years, the recycling of old tires has taken the form of burning as a source of heat in the paper, cement, and steel industries. The demand for such tires will continue to remain high in light of the rising prices for oil and coal. This is especially the case for paper manufacturing companies, where the use of old tires for fuel is becoming common, and high demand is expected to continue. Paper manufacturing companies account for approximately 60% (in 2011) of the tires that are burned for heat.

The demand for rebuilt tires is increasing and the reuse of scrap tires is being undertaken more actively as one part of activities to reinforce the reduce, reuse, and recycle (3R) approach.

5 Tire Standards

5.1. Main revisions in the 2014 JATMA Year Book

5.1.1. General

Efforts are being made to harmonize standards with the tire technology standards of MLIT and the ISO. The 2014 Year Book also revised the measurement temperature of new tire dimensions to room temperature.

5.1.2. Tires for passenger vehicles

The 2014 Year Book newly established 5 sizes of tires and 1 T-type spare tire size for passenger vehicles, centering on the aspect ratio. The 2014 Year Book also revised the new tire maximum overall width and maximum growth width for 22 sizes of 80-series tires, with the aim of harmonization with ISO values.

5.1.3. Tires for small trucks

Again, with the aim of harmonization with ISO values, the 2014 Year Book newly established 22 sizes for 14-inch and under N-range LT80-series tires.

5.1.4. Other tires

The 2014 Year Book newly established 7 sizes for motorcycle tires and 26 sizes of D-range tires for agricultural machinery.

5.2. ISO/TC 31 tire standards

In October 2013 meetings were held in Canada for

ISO/TC 31/SC 5 (Agricultural tires and rims), SC 6 (Off-the-road tires and rims), and SC 7 (Industrial tires and rims). Each of these meetings, including each WG, worked to standardize tire and rim standards. There were especially lively debates about how to best harmonize the different 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 5 shows the results of 39 on-road tire inspections conducted between January and December of 2013 by JATMA with the cooperation of prefectural police departments, the Transportation Bureau, each Nippon Expressway Company (formerly the Japan Highway Public Corporation, JH), the Japan Automobile Manufacturers Association, Inc. (JAMA), and other related groups. According to these results, 31.2% of all the vehicles that were inspected had poor tire maintenance, which was a 4.5% improvement from the results in 2012. According to the type of road on which the results were obtained, the rate of poor tire maintenance found on the national expressways was 30.9%, a 2.4% improvement from 2012. The rate of poor tire maintenance found on general roads was 31.4%, a 6.6% improvement from 2012.

Poor tire maintenance was also examined according to the different inspection items or types of poor maintenance problems. It was found that the most common problem was improper tire pressure, which is the same as in previous years. This accounted for 20.7% of all the problems that were found.

There are two main initiatives related to tires that 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. The relevant industries are deploying various activities to educate drivers about the importance of maintaining the proper tire air pressure since this affects the environment, vehicle fuel efficiency, and safety. However, the results of the on-road inspections found that the number of vehicles with improper tire pressure in 2013 remained high.

A more proactive awareness campaign to educate drivers about managing tire air pressures in the same vein as recent campaigns to promote less electric power

Table 5 Results of on-road tire inspections in 2013 (January to December).

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

Inspection items		By year		2012						2013											
		By road type		National expressways		General roads		Total		National expressways		General roads		Total							
										Change from previous year		Change from previous year		Change from previous year							
Number of inspections (times)				19		22		41		18		-1		21		-1		39		-2	
Number of vehicles inspected (A)				882		865		1 747		657		-225		874		9		1 531		-216	
Number of vehicles with poor tire maintenance (B)				294		329		623		203		-91		274		-55		477		-146	
Percentage of problems (B/A) (%)				33.3		38.0		35.7		30.9		-2.4		31.4		-6.6		31.2		-4.5	
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	13	1.5	18	2.1	31	1.8	27	4.1	2.6	23	2.6	0.5	50	3.3	1.5					
	Uneven wear	52	5.9	51	5.9	103	5.9	37	5.6	-0.3	49	5.6	-0.3	86	5.6	-0.3					
	External damage (reaching the cords)	4	0.5	4	0.5	8	0.5	3	0.5	0.0	5	0.6	0.1	8	0.5	0.0					
	Imbedded nail or other foreign object	4	0.5	3	0.3	7	0.4	4	0.6	0.1	3	0.3	0.0	7	0.5	0.1					
	Improper tire pressure	190	21.5	268	31.0	458	26.2	117	17.8	-3.7	200	22.9	-8.1	317	20.7	-5.5					
	Other	53	6.0	86	9.9	139	8.0	32	4.9	-1.1	72	8.2	-1.7	104	6.8	-1.2					
Total		316	—	430	—	746	—	220	—	—	352	—	—	572	—	—					

- Notes: 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) The method of measuring the tire air pressures included both visual inspections and actual measurement with an air gauge. Hot air was included as a tire state.

consumption and energy conservation in the home are greatly desirable.

6. 2. Laws and regulations

6. 2. 1. Japan

The Fuel-Efficient Tire Promotion Council was established in Japan based on the recommendations of the International Energy Agency (IEA) and global environmental protection movements. In January 2010, a tire labeling system was introduced that requires the indication of grades for rolling resistance and wet braking performance according to voluntary industry standards. The second report of the Central Environment Council also announced that that tire noise regulations would be introduced in Japan. Working toward the introduction of these regulations, MLIT and MOE established a tire noise regulation investigative committee in February 2012 made up of experts from academia and other fields. This committee is examining specific dates for the introduction of the UN regulation and issued an interim report in March 2013.

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. By September 2007 it was 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. After being signed into law by the President, this law created a consumer tire information program. In December of 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 details of this rule's content 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. Furthermore, these tire noise regulations would become significantly stricter in November 2012 and UN R117-02, which mandates a tire labeling system indicating grades and ratings for tire rolling resistance, external tire noise, and wet braking performance, would also start to be applied. 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 these three areas of tire performance was introduced in November 2012. Customers are now provided with information about the performance grades and ratings 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 braking performance. A recent example is the INMETRO Regulation No. 544/2012 that was issued in Brazil. This regulation requires both grading and the meeting of minimum required performance regulations for tire noise, rolling resistance, and wet braking performance. The Middle-East also plans to require minimum performance guarantees for rolling resistance and wet braking performance, dem-

onstrating the growing emphasis 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 tire certification systems that are continuing to appear in an increasing number of 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. It 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.