Tires

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1 Introduction

Approximately 160 million vehicle tires were produced in 2012, approximately 4% less than the number produced in 2011. The amount of rubber that was used for tires also declined by approximately 5%. The tire industry has largely recovered from the downturn it suffered after the global financial crisis in the autumn of 2008, but it still has not returned to the levels of 2008.

Japan introduced a tire labeling system in January 2010. One of the trends seen in tire technologies in 2012 was an intensification of technological development to further enhance the environmental friendliness and economic efficiency of tires, as well as to improve the fundamental safety aspect of tires. Fuel-efficient tires continued to grow in popularity.

The trends in tire regulations were seen clearly in Europe, where regulations for a new tire labeling system were put into effect in November 2012. This requires 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 will 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 braking 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. The move 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 2012. Overall, the results indicate a decline of approximately 4% from the number produced in 2011 and also a decline of approximately 5% in the amount of rubber that was used for tire production. This means that, while the tire industry has largely recovered from the downturn due to the global financial crisis in the autumn of 2008, it has still not returned to the levels prior to that date.

Table 2 shows the tire sales results for 2012. These results indicate that the number of tires sold in Japan for new vehicles increased by approximately 14% compared to 2011, while the number sold for commercial use in Japan decreased by 1% and sales of tires intended for export also declined by 20%. 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 4%.

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

Table 3 shows the trends in the consumption of the main raw materials for tires in 2012. Similar to the amount of rubber, these amounts declined in comparison to 2011 and have not returned to the levels of 2008.

Table 4 shows the amount of energy that was consumed for tire production in 2012. The table indicates that the amount of heavy fuel oil that was consumed in 2012 decreased in comparison to the amount consumed in 2011.

Table 1 Vehicle tire production results.

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

		2008	2009	2010	2011	2012
Amount of rubber	For passenger vehicles	633 863	485 515	599 075	583 792	535 354
	For small trucks	159 078	122 208	141 588	144 734	142 125
	For trucks and buses	363 618	240 743	281 604	282 053	263 370
	Other	191 823	137 638	173 444	201 384	206 056
	Total	1 348 382	986 104	1 195 711	1 211 963	1 146 905
Number of tires	For passenger vehicles	134 787	104 885	125 457	120 871	120 609
	For small trucks	23 986	18 915	22 176	22 604	23 294
	For trucks and buses	14 140	9 450	11 208	11 387	10 843
	Other	9 750	7 888	10 866	11 580	4 453
	Total	182 663	141 138	169 707	166 442	159 199

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)

		2008	2009	2010	2011	2012
Number of tires	For new vehicles	58 862	40 322	48 961	42 389	48 526
	Commercial	68 221	61 751	67 028	71 686	71 092
	(Japanese total)	127 083	102 073	115 989	114 075	119 618
	For export	74 049	58 446	68 468	63 424	54 157
	(Total demand)	201 132	160 519	184 457	177 499	173 775

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

*1 From 2007, the number of tires for new vehicles includes imported tires

Table 3 Trends for consumption of main raw materials for vehicle tires and tubes.

(Units: Amount of consumption = tons)

		2008	2009	2010	2011	2012
Tire cords	Nylon	23 411	15 411	20 385	22 447	21 722
	Steel cord	264 157	199 649	238 566	242 643	223 637
	Polyester	48 433	37 204	45 836	45 188	42 577
	High-tenacity rayon	4 042	2 777	3 603	3 998	3 281
	Other	836	689	958	1 041	794
	Total	340 879	255 730	309 348	315 317	292 011
Natural rubber		757 918	549 596	655 578	681 568	631 311
Synthetic rubber		550 442	406 023	507 153	512 333	479 669
Carbon black		664 711	489 155	594 058	602 077	551 701

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

4 Trends in Tire Technologies

4. 1. General trends

Every tire manufacturer is promoting the development 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,

Table 4 Amount of energy consumption by vehicle tire industry.

(Units: Electric power = 1,000 kW/h, heavy fuel oil = kL, amount of rubber = tons)

		2008	2009	2010	2011	2012
Electric power	Consumption	2 225 624	1 819 644	2 093 737	2 084 669	1 989 006
	Basic unit	1.651	1.845	1.751	1.720	1.734
Heavy fuel oil	Consumption	94 962	62 267	68 673	68 965	57 813
	Basic unit	0.070	0.063	0.057	0.057	0.050
Number of vehicle tires and tubes produced		1 348 382	986 104	1 195 711	1 211 963	1 146 905

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

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

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

	Number of tires sold				
	2008	2009	2010	2011	2012
Snow tires	18 689	16 454	18 410	22 093	23 043
Compared to previous year	89.6 %	88.0 %	111.9 %	120.0 %	104.3 %

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

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 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 5 shows the number of winter tires that were sold in Japan. It indicates that the number sold in 2012 increased by approximately 4% compared to the previous year. This is almost the same number of winter tires that were sold prior to the global financial crisis.

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 and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in Japan also held joint meetings of an investigative commission to consider the introduction of similar tire regulations. These examinations are proceeding toward the release of a final report and eventual legislation. The commission decided to harmonize test methods and regulation values with international regulations (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 CO_2 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.

The majority of tires are currently made from natural rubber, synthetic rubber, and organic fibers, but tires composed of sustainable raw materials are also being developed. Efforts are now being made at each tire manufacturer to make the switch from exhaustible resources to these renewable resources for tires.

5 Tire Standards

5. 1. Main revisions in the 2013 JATMA Year Book

5. 1. 1. General

Efforts are being made to harmonize standards with the tire technology standards of MLIT and the ISO. A review of JATMA's own standards is also being examined in conjunction with these efforts.

5. 1. 2. Tires for passenger vehicles

Four sizes of tires for passenger vehicles were newly established, centering on the aspect ratio.

5. 1. 3. Tires for small trucks

The upper limit value for the additional external diameter of deep-groove tires and winter tires was changed from 1.5% to 1.0% for the purpose of harmonization with international standards.

5. 1. 4. Other tires

The dynamic external diameter maximum growth dimensions of P-range size 6 tires for motorcycles were reviewed for consistency with the ISO.

5. 2. ISO/TC 31 tire standards

In November 2012 meetings were held in Milan, Italy for ISO/TC 31/SC 5 (Agricultural tires and rims), SC 6 (Off-the-road tires and rims), and SC 7 (Industrial tires

Table 6 Results of on-road tire inspections in 2012 (January to December).

JATMA

By year / By road type / Inspection items		2011			2012					
		National expressways	General roads	Total	National expressways	Change from previous year	General roads	Change from previous year	Total	Change from previous year
Number of inspections (times)		17	17	34	19	2	22	5	41	7
Number of vehicles inspected (*A*)		796	958	1 754	882	86	865	−93	1 747	−7
Number of vehicles with poor tire maintenance (*B*)		198	288	486	294	96	329	41	623	137
Percentage of problems (*B*/*A*) (%)		24.9	30.1	27.7	33.3	8.4	38.0	7.9	35.7	8.0
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	Number of problems	Percentage of problems: % / Change	Number of problems	Percentage of problems: % / Change	Number of problems	Percentage of problems: % / Change
Breakdown of poor tire maintenance items	Insufficient tire tread	30 / 3.8	23 / 2.4	53 / 3.0	13	1.5 / −2.3	18	2.1 / −0.3	31	1.8 / −1.2
	Uneven wear	41 / 5.2	27 / 2.8	68 / 3.9	52	5.9 / 0.7	51	2.9 / 3.1	103	5.9 / 2.0
	External damage (reaching the cords)	3 / 0.4	1 / 0.1	4 / 0.2	4	0.5 / 0.1	4	0.5 / 0.4	8	0.5 / 0.3
	Imbedded nails or other foreign object	2 / 0.3	4 / 0.4	6 / 0.3	4	0.5 / 0.2	3	0.3 / −0.1	7	0.4 / 0.1
	Improper tire pressure	99 / 12.4	247 / 25.8	346 / 19.7	190	21.5 / 9.1	268	31.0 / 5.2	458	26.2 / 6.5
	Other	44 / 5.5	37 / 3.9	81 / 4.6	53	6.0 / 0.5	86	9.9 / 6.0	139	8.0 / 3.4
	Total	219 / —	339 / —	558 / —	316	— / —	430	— / —	746	— / —

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 number of incidents of improper tire pressure equals the total of both insufficient air pressure and excessive air pressure (breakdown: insufficient air pressure = 303 cases, excessive air pressure = 43 cases).

5) 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.

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 6 shows the results of 41 on-road tire inspections conducted between January and December of 2012 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, 35.7% of all the vehicles that were inspected had poor tire maintenance, which was 8% worse than the results from 2011. When the results were examined according to the type of road on which the results were obtained, the rate of poor tire maintenance found on the national expressways was 33.3%, which was 8.4% worse than the results from 2011. The rate of poor tire maintenance found on general roads was 38%, which was 7.9% worse than the results from 2011.

Next, poor tire maintenance was 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 26.2% 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 2012 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 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. Currently, the Ministry of the Environment, MLIT, and other industry groups are holding meetings of a tire noise regulations investigative committee to discuss concrete regulatory measures and the date on which these regulations would go into effect.

6. 2. 2. The 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 performance rating systems (labeling systems) for tire rolling resistance, wet braking performance, and the like. 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. Under the umbrella of the United Nations Economic Commission for Europe (UNECE), the Working Party on Brakes and Running Gear (WP29/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. It is scheduled to be presented to WP29 in June 2013.