

## **The invisible danger of aging tires: the U.S. tire industry is aware of the dangers posed by age degradation but has failed to alert consumers.**

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Tire manufacturers have long known that tires more than six years old regardless of tread depth, pose a substantial safety hazard to consumers. Tire age degradation has been an "open secret" within the industry, but the public has only recently started to take notice as the number of crashes caused by "aged" tires has grown. Prompted by consumer advocates and a growing body of research on the effects of tire aging, the government and manufacturers are beginning to address the issue.

Tires, like other rubber products, have a limited service life. Over time, a tire's internal structure degrades, reducing adhesion between the belts, which in turn facilitates tread separation. This internal degradation occurs regardless of tread use and wear. It is invisible and cannot be discerned, even by tire experts, without destructive testing.

Car crashes related to tread separation caused Ford to recall millions of Firestone tires in 2000. (1) After investigating the accidents, the National Highway Traffic Safety Administration (NHTSA) began examining tire aging as a factor in tread separations. In 2002, it proposed a tire-aging test that tire manufacturers would be required to perform on their products. (2)

The proposal recognized auto-safety advocates' long-held concern that government test requirements ensured only short-term durability and did not protect against catastrophic tire failures from long-term chemical degradation. Unfortunately, overwhelming industry opposition and the industry's lack of consensus on an aging standard led NHTSA to shelve the proposed rule-making until it completed research on potential test protocols. (3) The agency is expected to reexamine tire-age test requirements and publish the results of its ongoing research in June 2005.

Ford Motor Co. also began sponsoring studies on tire aging after the 2000 recall of Firestone tires on Ford Explorers. Their findings, which are being released publicly and presented at tire industry technical conferences, lay an important foundation documenting the mechanisms of tire age degradation. (4)

### Tire construction

To understand tire aging and what tread separation is, you need to know how a tire is made. A steel-belted radial tire has several components, including an inner liner, two polyester body plies, two steel belts, two bead reinforcing strips, the sidewall rubber, and a tread.

After these components are assembled in their "green" (uncured) state, the tire is loaded into a tire press for vulcanization. In this process, the tire is subjected to extreme heat and pressure, which cause the components to fuse into a single structure--a completed tire. (5) In a typical tread separation, the top steel belt and tread become detached from the rest of the tire.

With age, tire components dry out, causing the adhesion between them to break down. The process of oxidation hastens the deterioration: It occurs as air permeates the inner liner, a thin rubber lining that coats the inside of the tire and acts as a robe. The internal oxidative degradation caused by air permeation occurs over time, regardless of whether the tire is used. Current studies suggest that in-use tires age no more than those stored as spares on the same vehicle. In other words, age degradation occurs regardless of the mechanical fatigue that a tire undergoes. (6)

That rubber deteriorates with age has been recognized since the production of synthetic rubber began in the 1930s. More recent scientific publications have noted that natural rubber is particularly susceptible to oxidative degradation. (7) The tire industry is acutely aware of the problem and has routinely performed lab tests under various conditions, usually using elevated temperatures and oxygen inflation. (8)

To slow the oxidative aging process, manufacturers use combinations of antidegradant chemicals and other construction methods. (9) Inherent in the consumer's expectation when purchasing a tire is that its "fatigue life"--the period in which its components will hold together--should always exceed the tread life by some safety margin for all reasonably foreseeable service conditions. (10)

## Research and regulation

Older tires often are put into use after having served as a spare. Others may have been stored in a garage or warehouse, or simply used on a vehicle that was infrequently driven. Unfortunately, the owner of the tire may not know this history. Used-tire sales make up a huge market in the United States; an estimated 30 million tires are resold each year. (11) Many consumers buy used tires through tire dealers, swap meets, flea markets, and online forums. Tires with adequate tread and without any visible defect are likely to find their way onto a vehicle regardless of their age, which consumers can determine only by decoding a 10- or 11-digit U.S. Department of Transportation (DOT) number molded on one side of the tire. (12)

Although tire and vehicle manufacturers have been aware of the age degradation problem for years, they continue to keep warnings hidden, leaving service shops, dealers, and consumers dangerously uninformed.

German vehicle manufacturers (including Audi, Volkswagen, BMW, and Mercedes) and Toyota began adding warnings about tire age in their owner's manuals beginning in the early 1990s. They differed a bit, but the messages were consistent: Tires more than six years old present an increased risk.

For instance, a Volkswagen manual says: "WARNING--Old tires can fail in use, causing loss of vehicle control and personal injury. Replace tires after six years regardless of tread wear. Always reduce speed and drive cautiously if you must use an old tire in an emergency. Replace the tire as soon as possible." (13) A Toyota warning reads: "Any tires which are over six years old must be checked by a qualified technician even if damage is not obvious. Tires deteriorate with age even if they have never or seldom been used. This also applies to the spare tire and tires stored for future use." (14)

European manufacturers developed these warnings based on research results. For example, the German testing and scientific research firm DEKRA issued a "special topic" report in 1986 examining tire defects that resulted in crashes. (15) The study found an increase in tread separations after two

years and a continuous increase from the fifth through the eighth years, with a dramatic increase in tires more than six years old.

These researchers concluded that "consumers should not drive on tires that are six or more years old, regardless of tread depth particularly tires stored for an extended period of time.

The results of another German study concluded that failure frequency rose disproportionately with increasing tire age. It estimated that a breakdown of a nine-year-old tire was eight times as likely as a breakdown of a two-year-old tire. (16) The author noted that one reason "over aged" tires were being sold was the "consumer unfriendly" way the date of manufacture was coded in the DOT number. The author shared the results with vehicle and tire manufacturers.

These reports are only two examples of the type of research that has been undertaken. Other more comprehensive and detailed findings exist. (17) One of the most important disclosures about the tire-age hazard came from the United Kingdom-based Tyre Industry Council (TIC), which issued an unprecedented warning to consumers about the dangers of old tires in September 2003. (18)

The TIC is a nonprofit organization funded by U.K. tire manufacturers and retailers whose principal objective is to improve public awareness of tire safety. While conducting roadside inspections in conjunction with the police, the TIC observed that numerous vehicles were fitted with tires that were 10 to 15 years old. In response, the TIC recommended that motorists check the date codes on their tires and replace any that were 10 years old or older--and that tires 6 years old or older that have not been used should not be placed into service. (19)

The TIC pointed out that tire components dry with age and can separate, and that anti-aging chemicals added to tires are "only active when the tyre is in use; therefore tyres fitted to spare wheels, caravans, and trailers are particularly at risk of premature aging brought on by ozone degradation and static 'sitting' for lengthy periods."

According to a TIC spokesperson, the organization based its warning on a practice recommended in 2001 by the British Rubber Manufacturers Association (BRMA) that was previously unknown outside that organization. (20) BRMA members include manufacturers of tires, tire-related products, and other rubber and polymer-based products in the United Kingdom. The BRMA "strongly recommends" that previously unused tires not be used if they are more than 6 years old and that all tires be replaced 10 years from the date of their manufacture. (21)

The BRMA also noted that environmental conditions such as exposure to sunlight and coastal climates, as well as poor storage and infrequent use, accelerate the tire aging process. A tire may have a life expectancy of more than 10 years in ideal conditions, but such conditions are rarely met, according to the recommendation.

The BRMA noted that aging may be identified by small cracks in the tire sidewall, but that aging "may not exhibit any external indications and, since there is no nondestructive test to assess the serviceability of a tyre, even an inspection carried out by a tyre expert may not reveal the extent of any deterioration." (22) The BRMA also noted that spare tires and tires that are not frequently used are particularly vulnerable to aging.

Sean Kane, president of Safety Research and Strategies, obtained the BRMA recommendation--which was never published--and submitted it to NHTSA in September 2003, along with a list of aged-tire cases in the United States and a request to consider requiring expiration dates on tires. (23)

In late 2003, the U.S. Rubber Manufacturers Association (RMA) Tire Engineering Policy Committee held meetings chaired by a Bridgestone representative and attended by representatives of

Continental, Cooper, Goodyear, Michelin, and Pirelli. The committee drafted this recommendation for maximum service life for light-truck and passenger car tires:

While most tires will need replacement before 10 years, it is recommended that any tires in service older than 10 years from the date of manufacture be replaced with new tires as a simple precaution (including spare tires), even if such tires appear serviceable (or even if such tires have not reached the legal wear limit). (24)

The RMA never disclosed this draft recommendation to the public.

## Liability theories

In almost all aging-tire cases, the lives of unsuspecting consumers have been put at risk unnecessarily because tire manufacturers chose not to provide critically important safety information about the age of their tires and the dangers of age-induced tire failure. The evidence may support several liability theories.

**Failure to warn.** The tire manufacturer's failure to adequately warn consumers of the dangers associated with the use of an aged tire is a clear violation of [section]402A of the Restatement (Second) of Torts: Product Liability, (1998):

[A product] is defective because of inadequate instructions or warnings when the foreseeable risks of harm posed by the product could have been reduced or avoided by the provision of reasonable instructions or warnings by the seller or other distributor, or a predecessor in the commercial chain of distribution, and the omission of the instruction or warnings renders the product not reasonably safe.

For a warning to comply with [section]402A, it must be given in a form that can reasonably be expected to catch the attention of the person using the product. A marketing defect, therefore, can be either an ineffective warning or no warning at all.

No U.S. tire manufacturer currently provides a written warning about age-induced tire failure, so cases involving failures of aged tires will be "no warning" marketing-defect cases. In certain jurisdictions, the absence of a warning can give rise to a rebuttable presumption that an adequate warning would have been read and followed. (25)

**Defective design.** Manufacturers can reduce the oxidation degradation problem by either elevating the tire's antidegradant chemical content or designing a better, thicker inner liner. Antidegradants are costly, and tire manufacturers use as little as possible. At the same time, inner liners are often designed to be as thin as 0.005 inch, which is much too thin when antidegradant levels are low. (26)

As the adhesion between a tire's components begins to break down, constant centrifugal forces work to render the tire more and more susceptible to tread separation. Alternative designs that allow tires to better tolerate these forces reduce the risk of age-related failure.

For example, the use of a cap ply (nylon overlay) boosts a tire's ability to withstand long-term adhesion fatigue. (27) Advanced by Pirelli in the early 1970s, this technique takes advantage of

nylon's shrinking when exposed to heat. When an additional nylon belt is wound over the steel belt and extended over its edges, the nylon contracts during vulcanization and acts as a tourniquet. By holding down the belt edges, the nylon largely prevents separation. Although a cap ply will not completely eradicate age-induced failure, this technique will significantly reduce its likelihood.

Dealer liability. Tire dealers and repair shops often have internal policies requiring that the tires be inspected before a vehicle is returned to its owner. Advertised as a free additional service, these inspections are nothing more than a self-serving marketing ploy. Depending on the policy and respective state law, the inspector may have a legal duty to use reasonable care in performing an inspection. (28) A tire store that allows an aged tire to remain on a vehicle or that places an aged spare into use has potential liability.

### Common defenses

Tire manufacturers defend their cases by blaming the consumer or the environment in which the tire was used. Invariably, the manufacturer will claim that improper maintenance, a bad repair, underinflation, or exposure to a road hazard caused the tread separation. Also, the manufacturer will probably claim that the driver failed to properly control the vehicle after the tread separation occurred.

Manufacturers bolster their "blame the consumer" defense by asserting that people should know better than to drive on old tires. Defendants claim that the DOT code serves as an adequate age warning and that common sense should caution consumers about the dangers of driving on old tires.

In fact, the overwhelming majority of tire consumers are unaware that a DOT code even exists, let alone where to find it or how to decipher it. Tire manufacturers clearly never intended the DOT code to serve as a consumer warning.

The term "common sense" implies an underlying knowledge, but no such consumer knowledge about aging tires exists. The industry itself is unclear about when a tire should be removed from service. U.S. manufacturers have never issued any recommendation about when tires become dangerous because of their age. Some warranties last five years, others six: Does an expired warranty indicate the tire should be removed from service? Consumers would never throw away a television, microwave, or automobile when the warranty expires. Contrary to what the tire industry would have a jury believe, most consumers are clueless as to when a tire is too old to use safely.

### Investigating the case

At the outset of your investigation, retain a well-qualified accident reconstructionist with experience in tread-separation cases and immediately begin to collect evidence. Often, the client does not have the tread that separated from the tire. A wrecker driver or law enforcement officer may have put the tread in the vehicle or stored it elsewhere; more often, the tread and other accident debris have been swept onto the median or shoulder to clear the road for traffic. If the client does not have the tread, undertake an exhaustive search as soon as possible.

Recovering the separated tread piece can be important in countering the manufacturer's defenses. The tread's depth can show that the tire had not exceeded its service life, and uniform tread wear is a good indication that the tire had not been consistently used while over- or underinflated. Forensic examination of the tire and tread can rule out damage, underinflation, neglect, and a bad repair as the cause of a tread separation.

Also, retain the vehicle involved in the accident. Your expert will use his or her findings from an examination of the vehicle as a basis for the accident reconstruction. For example, analysis of the wheel well and surrounding components often reveals black transfer marks, indicating the extent to

which the tire's separating tread struck the vehicle's undercarriage. This creates a drag that pulls the vehicle to the side of the failing tire. The greater the interaction between the separating tread and the vehicle, the more difficult it is for the driver to maintain control. Also, after a tread separation, a vehicle responds to the driver's steering in a way dramatically different from normal. (29) Analysis of the physical evidence on the vehicle can be important in understanding what occurred while the tread was separating and after the tire failed.

Also consider retaining a vehicle dynamics expert who can conduct handling tests in which tread separations are induced and their effects on vehicle control scientifically studied. This type of testing and expert testimony can be used to effectively rebut the manufacturer's efforts to blame the driver for losing control after the tread separation occurred.

The tire industry has recognized the safety hazard of age-induced tire failure, yet no U.S. manufacturer has provided clear warnings to consumers. Litigation can obtain justice for the injured and motivate tire manufacturers to disseminate critically important safety information.

## Notes

- (1.) Bridgestone/Firestone Announces Voluntary Recall of 3.85 Million Radial ATX and Radial ATX II Tires, and 2.7 Million Wilderness AT Tires. PR NEWSWIRE (Aug. 9, 2000). available at [www.prnewswire.com/cgi-bin/stories.pl?ACCT=105 &STORY=/www/story/09-14-2000/0001313321](http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=105 &STORY=/www/story/09-14-2000/0001313321) (last visited Feb. 22, 2005); see also Robert E. Ammons & Vuk Stevan Vujasinovic, Tires That Kill, TRIAL, Nov. 2000, at 52.
- (2.) Federal Motor Vehicle Safety Standards; Tires, 67 Fed. Reg. 10,050 (Mar. 5, 2002) (to be codified at 49 C.F.R. pt. 571); Final Rule, Federal Motor Vehicle Safety Standards: New Pneumatic Tires for Light Vehicles. 68 Fed. Reg. 38,116 (June 5, 2003) (to be codified at 49 C.F.R. pt. 71).
- (3.) Federal Motor Vehicle Safety Standards; Tires, 68 Fed. Reg. 38,116 (June 26, 2003) (to be codified at 49 C.F.R. pt. 571).
- (4.) John M. Baldwin et al., Ford Motor Co., Field Aging of Tires, Part I, AM. CHEMICAL SOC'Y RUBBER DIV. MEETING (Oct. 2003); John M. Baldwin et al., Ford Motor Co., Accelerated Aging of Tires, Part II, AM. CHEMICAL SOC'Y RUBBER DIV. MEETING (Oct. 2003).
- (5.) See REX J. GROGAN, THE INVESTIGATORS GUIDE TO TIRE FAILURES 8-9 (2d ed. 1999) ("Properly made, the separate components will never separate again. If they do, then it is an indication that the tire was made incorrectly ...").
- (6.) John M. Baldwin et al., Field Aging of Tires, Part II, PROC, RUBBER DIV., AM. CHEMICAL SOC'Y (Fall 2004).
- (7.) See, e.g., ANTHONY A. DAVIS & DAVID SIMS. WEATHERING OF POLYMERS 238-65 (1983).
- (8.) MECHANICS OF PNEUMATIC TIRES (Samuel K. Clark ed., rev. ed. 1981); Marion G. Pottinger & Kenneth D. Marshall, The Effect of Tire Aging on Force and Moment Properties of Radial Tires. SAE Tech. Paper No. 810066 (1981).
- (9.) See R.C. Ayerst & E.R. Rodger, Steel Cord Skim Compounds: The Achievement and Maintenance of Maximum Adhesion, 45 RUBBER & CHEMISTRY TECH. 1497 (1972).
- (10.) Giovanni Rimondi, Basic Car Tyre Development Principles, SAE Tech, Paper No. 890103 (1989).

(11.) RUBBER MFRS. ASS'N, U.S. SCRAP TIRE MARKETS, 2003 EDITION (July 2004).

(12.) The first two characters after "DOT" indicate the manufacturer; the second two characters indicate the plant where the tire was manufactured. The following three to four characters are optional. Most manufacturers use these to record company-specific information about the tire and, if necessary, use them as a guide when issuing product recalls. Because they are company-specific, these codes are not standardized and are meaningful only to the manufacturer. The last three or four digits indicate the date the tire was manufactured.

(13.) VOLKSWAGEN CORP., 1998 VOLKSWAGEN PASSAT OWNER'S MANUAL.

(14.) TOYOTA MOTOR CO., 1990 TOYOTA LAND CRUISER OWNER'S MANUAL.

(15.) HELMUT ZEISBERGER, DEKRA, TECHNICAL DEFECTS ON MOTOR VEHICLES 1986 (1987).

(16.) E. Pflaum, Observations in the Field: Knowledge Is Lying on the Pavement. 40 NATURAL RUBBER & RUBBER PLASTICS, No. 8/87 (Alexandria Translations for Strategic Safety trans., 2003).

(17.) Lawrence R. Sperberg, Tire Life and Failure Analysis, 2 AUTOMOTIVE ENGINEERING & LITIG. (1990); SHMUEL L. WEISSMAN ET AL., SYMPLECTIC ENGINEERING CORP., EXTENDING THE LIFESPAN OF TIRES: FINAL REPORT (2003).

(18.) Tyre Indus. Council. Press Release, TIC Warn on Dangers of Old Tyres (Sept. 4, 2003), available at [www.tyresafety.co.uk](http://www.tyresafety.co.uk) (last visited Feb. 22, 2005).

(19.) Id.

(20.) BRIT. RUBBER MFRS. ASS'N, TYRE--AGEING, PASSENGER CARS, LIGHT VANS AND TRAILERS UP TO 3.5 TONNE GVW (2001).

(21.) Id.

(22.) Id.

(23.) Strategic Safety, submission to NHTSA Docket 15400 (15400-12 Sept. 17, 2003).

(24.) Meeting Minutes, Rubber Manufacturers Association Tire Engineering Policy Committee (Dec. 10, 2003).

(25.) Magro v. Ragsdale Bros., Inc., 721 S.W.2d 832, 834 (Tex. 1986).

(26.) D.A. Peterson & K.M. Wolniak, Miles, Inc., Tire Innerliner Technology: Unseen Advances, INT'L TIRE EXPOSITION & CONFERENCE (Sept. 1994).

(27.) U.S. Patent No. 4,284,117 (1988); U.S. Patent No. 3,850,219 (1987).

(28.) RESTATEMENT (SECOND) OF TORTS [section]324A (1977); see also Colonial Sav. Ass'n v. Taylor, 544 S.W.2d 116, 119-20 (Tex. 1976).

(29.) Federal Motor Vehicle Safety Standards; Tires, 67 Fed. Reg. 10,050 (Mar. 5, 2002) (to be codified at 49 C.F.R. pt. 571).

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