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COMPREHENSIVE CLASSIFICATION OF TIRE TYPES

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A tire is a ring-shaped covering that fits around a wheel to protect it and enable better vehicle performance by providing a flexible cushion that absorbs shock while keeping the wheel in close contact with the ground. The word itself is derived from the word "tie", referring to the outer steel ring part of a wooden cart wheel that ties the wood segments together. The earliest tires were bands of iron, placed on wooden wheels, used on carts and wagons. The tire would be heated in a forge fire, placed over the wheel and quenched, causing the metal to contract and fit tightly on the wheel. A skilled worker, known as a wheelwright, carried out this work. The outer ring served to "tie" the wheel segments together for use, providing also a wear-resistant surface to the perimeter of the wheel. The word "tire" thus emerged as a variant spelling to refer to the metal bands used to tie wheels. The first practical pneumatic tire was made by John Boyd Dunlop, a Scot, in 1887 for his son's bicycle, in an effort to prevent the headaches his son had while riding on rough roads Dunlop is credited with "realizing rubber could withstand the wear and tear of being a tire while retaining its resilience". Pneumatic tires are made of a flexible elastomer material, such as rubber, with reinforcing materials such as fabric and wire. Tire companies were first started in the early 20th century, and grew in tandem with the auto industry. Today, over 1 billion tires are produced annually, in over 400 tire factories, with the three top tire makers commanding a 60% global market share.

Tires are classified into several standard types, based on the type of vehicle they serve. Since the manufacturing process, raw materials, and equipment vary according to the tire type, it is common for tire factories to specialize in one or more tire types. In most markets, factories that manufacture passenger and light truck radial tires are separate and distinct from those that make aircraft or OTR tires. High performance tires are designed for use at higher speeds, and more often, a more "sporty" driving style. They feature a softer rubber compound for improved traction, especially on high speed cornering. The trade off of this softer rubber is shorter tread life. Mud and Snow is a classification for specific winter tires designed to provide improved performance under low temperature conditions, compared to all-season tires. The tread compound is usually softer than that used in tires for summer conditions, thus providing better grip on ice and snow, but wears more quickly at higher temperatures. Tires may have well above average numbers of sipes in the tread pattern to grip the ice. Dedicated winter tires will bear the "Mountain" if designated as a snow tire by the American Society for Testing & Materials. Winter tires will typically also carry the designation MS, M&S, or the words MUD AND SNOW. Some winter tires may be designed to accept the installation of metal studs for additional traction on icy roads. The studs also roughen the ice, thus providing better friction between the ice and the soft rubber in winter tires. Use of studs is regulated in most countries, and even prohibited in some locales due to the increased road wear caused by studs. Typically, studs are never used on heavier vehicles. Studded tires are used in the upper tier classes of ice racing and rallying. Other winter tires rely on factors other than studding for traction on ice, e.g. highly porous or hydrophilic rubber that adheres to the wet film on the ice surface. Some jurisdictions may from time to time require snow tires, or traction aids on vehicles driven in certain areas during extreme conditions.

Radial tire construction utilizes body ply cords extending from the beads and across the tread so that the cords are laid at approximately right angles to the centerline of the tread, and parallel to each other, as well as stiff stabilizer belts directly beneath the tread. The ad-

vantages of this construction include longer tread life, better steering control, and lower rolling resistance. Disadvantages of the radial tire include a harder ride at low speeds on rough roads and in the context of off-roading, decreased "self-cleaning" ability and lower grip ability at low speeds. Many tires used in industrial and commercial applications are non-pneumatic, and are manufactured from solid rubber and plastic compounds via molding operations. Solid tires include those used for lawn mowers, skateboards, golf carts, scooters, and many types of light industrial vehicles, carts, and trailers. One of the most common applications for solid tires is for material handling equipment. Such tires are installed by means of a hydraulic tire press. Semi-pneumatic tires have a hollow center, but they are not pressurized. They are light-weight, low-cost, puncture proof, and provide cushioning. These tires often come as a complete assembly with the wheel and even integral ball bearings. They are used on lawn mowers, wheelchairs, and wheelbarrows. They can also be rugged, typically used in industrial applications, and are designed to not pull off their rim under use.

All-terrain tires are typically used on SUVs and light trucks. These tires often have stiffer sidewalls for greater resistance against puncture when traveling off-road, the tread pattern offers wider spacing than all-season tires to remove mud from the tread. Many tires in the all-terrain category are designed primarily for on-road use, particularly all-terrain tires that are originally sold with the vehicle. The agricultural tire classification includes tires used on farm vehicles, typically tractors and specialty vehicles like harvesters. Driven wheels have very deep, widely spaced lugs to allow the tire to grip soil easily. High flotation tires are used in swampy environments and where soil compaction is a concern, featuring large footprints at low inflation pressures. The Industrial tire classification is a bit of a catch-all category and includes pneumatic and non-pneumatic tires for specialty industrial and construction equipment such as skid loaders and fork lift trucks.

The tread is the part of the tire which comes in contact with the road surface. The tread is a thick rubber, or rubber compound formulated to provide an appropriate level of traction that does not wear away too quickly. The tread pattern is characterized by the geometrical shape of the grooves, lugs, voids and sipes. Grooves run circumferentially around the tire, and are needed to channel away water. Lugs are that portion of the tread design that contacts the road surface. Voids are spaces between lugs that allow the lugs to flex. Tread patterns feature non-symmetrical lug sizes circumferentially in order to minimize noise levels at discrete frequencies. Sipes are valleys cut across the tire, usually perpendicular to the grooves, which allow the water from the grooves to escape to the sides in an effort to prevent hydroplaning. Tires that are fully worn can be re-manufactured to replace the worn tread. This is known as retreading or recapping, a process of buffing away the worn tread and applying a new tread. Retreading is economical for truck tires because the cost of replacing the tread is less than the price of a new tire. Retreading passenger tires is less economical because the cost of retreading is high compared to the price of a new cheap tires, but favorable compared to high-end brands. Worn tires can be retreaded by two methods, the mold or hot cure method and the precure or cold one.

Proper vehicle safety requires specific attention to inflation pressure, tread depth, and general condition of the tires. Tires should be repaired only at experienced tire repair shops, and in accordance with the manufacturer’s recommendations. A common test to check for excessive tire wear is to insert a US penny into the tread to see if it has been reduced to 1/16 or 2/32 of an inch. If part of Lincoln's head is covered by the tread, the tire has a legal amount of tread. If all of his head can be seen, however, it is time to replace the tire. It's important to note that a tire that just passes the "penny test" could be still be dangerous when driving in snow and could increase the risk of hydroplaning. Outside of the USA, the head of an unused match can be inserted into the tire's tread. If the tread is at any point below 3/4 of the head, the tire should be replaced. This test is most common in the EU, Australasia, and Asia.