Chapter 5

Tires

In This Chapter

- Finding your tire needs
- Picking a tire
- Maintaining your tires

Tires are the only contact point between your car and the road, so when you're tire shopping, think beyond the basic questions: Will they fit? How many miles will I get out of them? How much do they cost?

Tires, perhaps more than any other part of the car, help define how the car behaves and feels, how it takes corners, how quickly it can stop, how it transitions from one direction to another, how planted the car feels in different road and weather conditions, how much warning the driver has when approaching the car's limits of grip, and how hard the car launches under full acceleration. Without danger of overstatement, it is safe to say that tires are among the most critical items on your car.

Knowing When to Say When

According to the law in most U.S. states, tires must be replaced when they have reached a tread depth of 2/32 of an inch. While the "penny test" has been the tried and true way of measuring tread depth, tire manufacturers have made it even easier for consumers by including tread wear bars on tires to help show when they are due for replacement.

The wear bar test is simply a matter of looking for a narrow section of rubber (the tread bar) bridging the tread on your tire, going horizontally across the entire width of the tire. This bar was inserted at a depth of 2/32 of an inch when your tire was manufactured. If the wear indicator is at the same height as the tread it bridges, your tires are done and should be replaced. If you drive primarily in wet or snowy conditions, you would be well served by replacing your tires well before they wear down to 2/32 of an inch. Tire replacement at 4/32 of an inch, or even 3/32 of an inch, may be a good idea depending on seasonal road conditions.

The penny test involves placing a penny into the tread grooves on a tire, as illustrated in Figure 5-1. If part of Lincoln's head is not covered by tire tread, then there is less than 2/32 of an inch of tread remaining, and the tires are due for immediate replacement. You can measure for 1/32 of an inch similarly using a quarter and George Washington's head, and you can measure for 4/32 of an inch with a penny and the Lincoln Memorial monument on the back. For those of you outside the U.S. who don't have access to U.S. coinage, you will have to use a ruler with 32nd-inch demarcations.

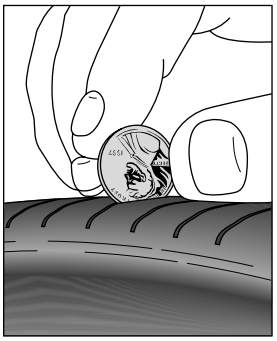

Figure 5-1: The penny test — this tire fails.

Reading a Tire Sidewall

When shopping for tires, you need to know what the numbers and letters on your sidewall mean in order to select the appropriate replacement tire.

Tires usually follow a pattern that I can illustrate by dissecting "Bridgestone Potenza RE040 205/50VR15 85V" like an earthworm in formaldehyde:

- **Brand:** Bridgestone

  This is the company that manufactured the tire.

- **Series:** Potenza

  Tire manufacturers often create a series of tires with somewhat similar handling and performance characteristics. For example, Bridgestone uses the *Potenza* name on many tires that may appeal to drivers who want a performance tire, and the *Turanza* name on many tires that are intended for less aggressive driving (or drivers with a less aggressive self-image).

- **Model:** RE040

  This is a pretty specific identification of the general performance characteristics of this tire, regardless of its size.

  Tires in the Potenza *series* vary greatly in performance, but tires of the RE040 *model* have virtually identical

- Construction
- Tread compound
- Design
- Ride

✓ **Width:** 205

This number is the width of the tire in millimeters. This is the most important number to describe a tire's *contact patch.*

For example, a 215-width, 17-inch tire may look great, but all things being equal, a 245-width, 15-inch tire will out-corner it every time, because the contact patch is wider.

✓ **Aspect ratio:** 50

This is the *height* of the sidewall from the rim to the tread, expressed as a *percentage* of the tread width.

For example, if the tire is 205 mm wide, and its aspect ratio is 50, then the sidewall is about 102.5 mm tall (50 percent of 205 mm).

Sidewall height is important for a number of reasons:

- As you move up to larger wheels, or down to smaller ones, a corresponding change needs to happen in the sidewall height of the tire in order for the rolling diameter of the wheel and tire combination to be as close to stock as possible. This will ensure the accuracy of your speedometer and prevent unwanted alignment changes.
- The sidewall height affects the turn-in feel (the responsiveness you feel at the steering wheel) and the ride quality.

  Lower aspect ratio (shorter sidewall) provides better turn-in response than a higher aspect ratio, but at the expense of less break-away warning and a more jarring ride — in extreme cases, even exposing the wheels to potential bending and breaking damage from potholes and other surface irregularities.

✓ **Speed rating:** VR (V-rated radial)

In this case, V identifies a speed rating above 149 mph.

It's almost impossible to find a public road in the U.S. where you can legally drive faster than any tire's rated speed, but speed ratings are a very important safety consideration when shopping for tires for

- Motor sports
- Countries that allow high speeds on public roads

Table 5-1 lists speed ratings.

The *R* means the tire is a *radial.* Virtually every new tire is a radial, unless you have a special tire for a classic car or a racing car.

Table 5-1	Speed Rating Designations
Speed Designation	***Maximum Speed Rating***
N	87 mph
P	93 mph
Q	99 mph
R	106 mph
S	112 mph
T	118 mph
U	124 mph
H	130 mph
V	149 mph
W	168 mph
Y	186 mph
Z	149+ mph

Load rating: 85V

In this case, 85 means the tire is rated for 1,135 pounds (see Table 5-2). Multiply this by the number of tires on the car, and you get a maximum safe loaded vehicle weight of 4,540 pounds (including people, luggage, a full tank of gas, and all the loose change under the seats).

The last *V* repeats the V speed rating, listed in Table 5-1.

Table 5-2	Load Rating Designations		
Load Index	***Load Carrying Capacity (Per Tire)***	***Load Index***	***Load Carrying Capacity (Per Tire)***
71	761	77	908
72	783	78	937
73	805	79	963
74	827	80	992
75	853	81	1019
76	882	82	1047

Load Index	*Load Carrying Capacity (Per Tire)*	*Load Index*	*Load Carrying Capacity (Per Tire)*
83	1074	97	1609
84	1102	98	1653
85	1135	99	1709
86	1168	100	1764
87	1201	101	1819
88	1235	102	1874
89	1279	103	1929
90	1323	104	1984
91	1356	105	2039
92	1389	106	2094
93	1433	107	2149
94	1477	108	2205
95	1521	109	2271
96	1565	110	2337

If your tire isn't described by these two tables, then consult the tire manufacturer or a tire specialist, such as Tire Rack or Wheel Works, for further information.

Tire Shopping

Major tire retailers have tires for your car at almost any price and for almost any use. A smart buyer considers these factors when it's time to purchase:

- Weather extremes
- Driving style
- Ride and noise
- Tread life
- Styling
- Puncture resistance
- Price

Even if you aren't modifying your car, its current tires aren't always best for you:

- Car manufacturers want low costs and high profits. They may use an inexpensive tire or the brand that gives the biggest discount.
- Car manufacturers want cars to be easy to sell. They usually want tires that are smooth and quiet on a test drive, even if the tires don't grip so well.
- Car manufacturers don't want complaints. They want tires that last a long time, and do little to offend Joe or Jane Car-Buyer.

Some cars ship from the factory with tires that aren't intended for snow. If you have one of these cars, winter tires (preferably on a separate set of rims) might be a good idea. How good an idea depends mainly on such factors as

- How often you encounter snow
- How deep the snow is
- Whether you have another car to drive in snowy weather
- Whether you can just stay home when there's too much snow to drive on high-performance tires

Don't get sentimental toward tires — when it's time for them to go, let them go. They are not T-shirts, they are critical automotive components. It doesn't matter how expensive or cool they were when you bought them. Tires are expendable, and need to be treated as such. When they become sub par, replace them with the best new tires for your needs, even if your old tires still have legal tread.

Don't ignore the warning signs of a worn tire, or put off replacement to a more convenient time. This can't be stated strongly enough. The price you pay for saving money on a replacement set of tires may be your car or your well-being.

Tire Selection

Tire technology marches forward with time. The cutting-edge tire that shipped on a 1989 Corvette isn't cutting-edge by today's standards.

The simple process for selecting a tire is

1. Consider each tire's unique characteristics carefully — and you can't do that without doing your homework.
2. Decide which characteristics that a tire might possess are most important to you.
3. Take into account factors such as speed ratings and tire sizing.

It can be that simple, or far more complex:

- A smart tire buyer will need to consider a slew of traits that each tire possesses, from cost to wear rating, what tire is available in what size, breakaway communication, and more. Talk to friends (and foes) and see what kind of tires they have, and how they like them. Maybe even ask for a test drive.

  Breakaway characteristics refers to a tire's ability to let you know when grip is turning to slip. This kind of information inspires confidence and allows the driver to always maintain complete control.
- Don't assume that because Tire Company X makes one brilliant tire, their entire line will be equally brilliant. No matter how similar the nomenclature, do not assume the Johnson Racing SuperSticky 5000 is "close enough" to the SuperSticky 6000.

How tires work

There are several variables that determine a tire's performance. Considering these variables may help you determine what you expect out of your tires, and thus help you pick the most appropriate tires for your application. You need to consider

- Forces on tires
- Compound
- Tread pattern
- Sidewall height and stiffness

Air pressure is part of the tire's strength. A tire without full air pressure is at risk of a big blowout, and will not feel or perform as it should. Check your tires' air pressure every other time you stop for gas for normal driving, and before *every* competition.

Forces on tires

Generally, a tire's grip must be shared three ways:

- Transferring power to the ground
- Providing grip against lateral forces when cornering
- Stopping grip, when braking

Because the car rides on four tires, the car always rides on what are referred to as four *contact patches.*

When the car is at rest, its entire weight is resting on these four points; a 4000-pound car with approximately 50/50 weight distribution is putting down 1000 pounds of static weight at each corner. When the car is under way at speed on a straight road, these numbers decrease as aerodynamics operate to lift the car from its tires. Depending on the design of the car's body, including spoilers, wings, diffusers, splitters, and air channels which are designed to either combat lift through vacuum or create down force through wind resistance, the car will put down varying amounts of pressure front to rear at speed, but will generally match the amount of pressure holding the car to the road from side to side.

- When accelerating, weight shifts rearward, reducing the weight on the front tires.

  This is why pure drag racing cars are built with rear-wheel drive — so that the massive amount of power doesn't lift the drive wheels right off the ground, effectively stopping the acceleration.
- When braking is applied, weight shifts *forward,* reducing the weight on the rear tires.

  This is why most street cars have more powerful brakes on the front wheels — they bear the brunt of the car's weight under heavy braking.
- When cornering, weight transfers to the tires on the *outside* of the turn.

  Things get more complicated as the car is, for example, both braking and turning at the same time, or accelerating and turning, in which case the car's weight will shift around as dynamic forces transfer the car's weight from tire to tire.

Compound

What the rubber in the tire is made of (the *tread compound*) determines how *grippy* the tire is. This grip depends on such conditions as

- Road surface
- Operating temperature range
- Tread depth

Street tires can be characterized by

- Working consistently across a wide range of temperatures
- Retaining their grip through month after month of *heat cycles* (rising to normal operating temperature while driving, then cooling back down while parked)

Generally, the grippier the tire, the faster it wears.

Tire manufacturers list tread wear ratings on the tire's sidewall. There isn't an industry standard for measuring tread wear, so these numbers are really only useful for comparing tires from the same manufacturer.

The Department of Transportation (DOT) requires tread wear ratings on all road-approved tires sold in the U.S., with the exception of winter and light truck tires. This tread wear rating, known as the Uniform Tire Quality Grade (UTQG) is expressed on the tire's sidewall as a number above or below 100. For tires of the same brand, a 125 tread-wear-rated tire should last 1.25 times as long as a tire with a 100 tread-wear rating.

Manufacturers do their *own* testing for UTQG numbers. There's no independent body checking in on the manufacturers at this time, so you should rely on a UTQG number strictly for the purposes of evaluating tires of the same brand:

- While a GripCzar tire rated at 300 should last about ten times as long as a 30-rated GripCzar tire, the difference between a GripCzar 30 and a NeverSlip 30 may be significant — and it's anyone's guess.
- Things get even murkier with house brand tires sold by large retail chains. Any tire can be sourced from any manufacturer, so the UTQG numbers can be even harder to decipher.
- If you aren't sure, look for independent third-party tests or consumer reviews like those found at `www.tirerack.com` or published by *Consumer Reports* magazine.

Tread pattern

The tire tread pattern is the series of grooves, rain channels, and tread blocks that allow the tire to grip the road surface and channel water or snow to prevent hydroplaning. (Hydroplaning occurs when the tire is unable to channel enough water from under the contact patch, forcing the car to lift up and skim across the water and so lose traction with the road.)

A tread design that is more like a treadless racing slick resists

- *Chunking* (literally ripping off tread blocks)
- *Squirming* (tread blocks twisting under load)

Of course, if everyone drove around on slicks all the time, the roadways would turn into giant pinball machines during the first rain or snowfall. But you can check these aspects of a tread design:

- Deeper water channels and smaller tread blocks can move more water from under the contact patch. But these helpful smaller tread blocks with deeper channels also squirm a lot under aggressive maneuvering, so keep the universal idea of *compromise* in mind here.
- Shallow water channels and larger tread blocks provide
  - More direct cornering response
  - More grip
  - Less chunking

  High-performance street tires often have a center water channel, with smaller channels whisking water away from the center.
- Deeper water channels and a more complex tread pattern provide
  - More squirminess when cornering
  - Less grip and a louder ride on dry roads
  - Superior grip and more confidence on a wet road

Sidewall height and stiffness

Sidewall *height* and *stiffness* affect responsiveness and ride.

A tire with a lower, stiffer sidewall usually responds to your steering inputs faster than a tire with a taller or less rigid sidewall. The downsides to a tire with a lower or stiffer sidewall are

- More ride harshness
- More vulnerability to rim damage
- Less warning of breakaway

A tire with a stiffer *carcass* (a tire's internal structure and reinforcements) usually weighs more than a tire with less internal reinforcement belting. A heavier tire has slightly slower suspension and acceleration response than a lighter tire of the same size.

The difference between sidewalls may depend on how you use your tires:

- A stiffer sidewall helps in cornering.
- A softer sidewall is preferred for speed.

Street tires

A street tire is a compromise of handling characteristics against wear, noise, weather conditions, temperature variations, and puncture resistance.

Off-road truck and SUV tires aside, street tires for passenger cars can further be broken down into several different types. Please refer to Table 5-3 for a quick comparison.

Table 5-3 Comparing Different Kinds of Tires

Type of Tire	*Designed For*
Winter/Snow	Street driving in wet, snowy, or icy conditions
Touring	Minimum noise, a cushy ride, and long wear, but no performance
All Season Performance	Spirited driving all year round
Summer High Performance	Optimized for performance on dry roads
Ultra-High Performance	Similar to Summer Performance with more grip and lower tread wear
Dual Purpose	A track or auto-cross tire that can be driven to and from the event

Summer performance tires and *ultra-high performance* tires are essentially the same, but they are offered in different sizes. Ultra-high performance tires are generally offered in larger sizes.

Disregarding the collision between the permanence of book publishing, and the fast-moving evolution of the performance tire, as of the press date, the following summer performance tires offer good value for their performance level:

- Toyo T1-S (see Figure 5-2)
- Falken Azenis (see Figure 5-3)
- Yokohama Advan A048 (see Figure 5-4)

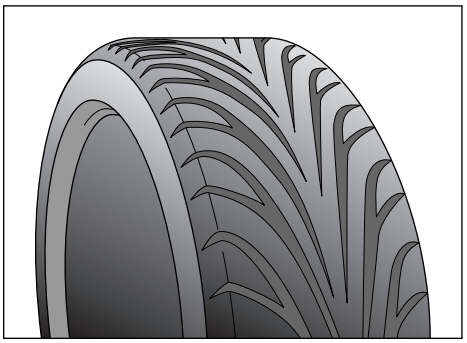

Figure 5-2: The Toyo T1-S tire.

Figure 5-3: The Falken Azenis.

Figure 5-4: The Yokahama Advan A048.

Maybe you shouldn't spend the big bucks on an ultra-high performance tire:

- A dual-purpose or competition tire outperforms an ultra-high performance tire on the track.

  At a track or an autocross, it *hurts* to demolish a $1,000 set of prestige street tires in a few hours trying to keep up with someone on a better track tire.

- A summer performance tire nearly matches an ultra-high performance tire on the street for less money.

On the street, you're a menace to yourself and others if you drive hard enough to justify upgrading from a well-engineered summer performance tire to an ultra-high performance tire. If you care whether you can drive 83 mph or 89 mph through a highway curve posted at 35 mph, something is very wrong with your street driving habits. And a dual-purpose DOT (Department of Transportation) legal race/street tire probably can make it at 95 mph!

Other types of tires are available, and may fit your needs better than summer performance tires:

- **Winter snow/ice tires:** A deep, open tread pattern resists snow clogging. A soft tread compound provides more grip on icy surfaces.

  If you drive your performance car in snowy months, mount snow tires on the stock wheels for winter and use upgraded aftermarket wheels for performance tires in other months. Winter tires are available in most original-equipment sizes.

- **All-season tires:** These aren't for performance driving. They're compromised for very long tread life and all extremes of weather.

  Manufacturers offer mud and snow rated all-season "performance" tires. These outperform the average Touring tire, but are by no means comparable to summer performance or ultra-high performance tires.

- **Touring tires:** These aren't for performance driving. They're compromised for a very quiet and gentle ride.

There are a couple of reasons to consider ultra-high performance tires:

- They may be the only tires with the larger diameter and low aspect ratio you want for your car.
- They deliver the most grip and best handling response of any street tire.

Your best tire and wheel decisions may depend on your wallet and your storage space:

- The ideal solution is *two* sets of wheels and tires you can swap at a moment's notice:
  - On the street, your everyday wear can be whatever tickles your fancy, whether you want stock wheels with reasonably priced performance rubber or oversized bling-bling spinner rims with wide whitewall tires.
  - For the track or autocross, you want a dedicated competition performance tire on lightweight wheels.
- If you're limited to one set of wheels and tires, and you want a performance feel for street driving, track days, or autocrosses, your best bet is almost always a *dual purpose tire,* not a high-dollar prestige street tire.

When you attend your first performance driving school, stick with street tires for the first few track visits. Street tires tend to be more gradual and forgiving at the limit, which makes learning your car's limits easier (while putting less stress on your suspension components and chassis). Begin the switch to race tires when

- You're comfortable driving your car at 80 percent or 90 percent of its potential.
- You're turning consistent lap times at the track on your street tires.
- You have adjusted your car's suspension to suit your driving style.

  After switching to competition tires, you may need to readjust your suspension if your car's behavior changes.

Race tires

Unlike on the street, race tires are less about brand appeal and more about finding something that you are comfortable driving consistently at the limit.

Race tires have some quirks:

- A race tire becomes hard and unpredictable after a number of *heat cycles* (heating up through use, then cooling down again). This number of cycles varies from tire to tire.
- Race tires need to be slowly brought up to an optimal temperature before they perform their best. This can take a few turns or an entire lap, depending on the length of the circuit, the weather, and other factors.

  Autocross and gymkhana drivers have even less opportunity to bring the tires up to temperature because their runs are shorter than track drivers.

- A race tire has a very narrow warning envelope at its limits. It demands a more skilled driver to feel out where those limits are.
- Race tires are needed in both grooved and slick or shaved versions, depending on whether there is moisture on the track.

  Race tires can flat-spot (get shaved flat in one spot, from skidding) when the brakes lock up or when the car spins/slides. A flat-spotted tire is like a square wheel, which is both an oxymoron and the end of your day (unless you have a replacement).

  This isn't same kind of flat-spotting that appears when a car is parked for an extended period and the tires become out of round. A parking flat spot, unlike one caused by friction, is generally temporary and disappears after the car has been driven a few miles.

Using racing tires meant for the track on public roads might be tempting, but don't do it. Why?

- Non-DOT racing tires are illegal on public roads in the U.S.
- Racing tires puncture easily.
- Racing slicks are hazardous to your health in a sudden rain.
- Racing tires will blast your paint job with gravel and other debris.

A car on slicks accelerates and corners on a dry race track in ways that street tires can't approach. Even a dual-purpose DOT-legal street/race tire pales in comparison to a true race slick.

To get the most out of race slicks, your car needs to undergo some preparation in order to handle all that extra grip. Race slicks (see Figure 5-5 for an example) will work your suspension to its limits. The car leans, the chassis twists, and the body groans under the strain. The sway bar end link mounting tabs, if not reinforced, may bend or break. Without mudguards (or careful application of masking tape) slicks will kick up enough gravel to sandblast the rocker panels under cornering. Perhaps most disastrous, cars can suffer engine oil starvation under the extreme cornering.

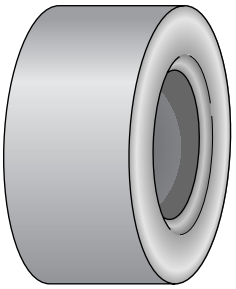

Figure 5-5: A racing slick.

A well-baffled oil pan and oil pressure gauge, with a warning light, are essential if you're running on racing slicks. Increased cornering forces can starve an engine with an oil pan not designed with these forces in mind. The baffles in the pan help keep the oil from sloshing around from side to side, and possibly away from the pump pickup point.

If you're just getting started looking for race tires, check with race teams and on race-oriented automotive message boards for a set of used tires with a few days of use left in them. Tires that have hardened by time or heat cycles can be rejuvenated with chemicals available from race shops. Visually inspect the tires before mounting them to ensure that they haven't sustained punctures or flat-spotting.

Dual-purpose tires

DOT-legal race compound tires are dual-purpose street-legal tires that are specially designed for competition. They are the only true race tire in the U.S. that can legally (or reasonably) be driven to and from the track.

Dual-purpose street/track tires embarrass even ultra-high performance street tires at a fraction of the price (especially in smaller sizes).

Race compound tires often carry the *R* designation in the name of the tire (such as A032R, 555R, R3SO3, or RA1) or may simply be so designated by the manufacturer without any *R* used in the name (V700). Unfortunately, there is no clear way of knowing if the *R* on the sidewall refers to the compound or the radial carcass, since almost all radial tires also have an *R* on the sidewall. If in doubt, you just have to do a little extra research on the tire, or consult with your tire retailer.

Dual-purpose tires are available with either

- Full tread for street driving and wet racetracks
- Shaved tread for dry racetracks

Shaved tires aren't welcome everywhere:

- Shaved tires may be illegal and unsafe for street driving.
- If you have shaved tires for racing, make sure they are legal for your class.

Dual-purpose tires, like the Yokohama A032R (see Figure 5-6), are often designed as wet-weather race tires. Dual-purpose tires use racing tire rubber compounds on a reinforced street-legal carcass. Sturdy, heavy sidewalls can easily offset any weight saved from ultra light alloy wheels, so consider the big picture before settling on a setup.

Figure 5-6: The Yokohama A032R.

I've run Yokohama A032R dual-purpose tires on my MR2 for three years, and they've served me well as a compromise tire for driving to a weekend track day, coping well with the rigors of track use, and still allowing me to drive my car home after the event without changing wheels. A set lasts me about 5,000 miles before they become either too worn and/or heat cycled. Companies like Toyo, Bridgestone, and Kumho offer similar tires. For the drag race fans, Nitto's 555R can be dropped in pressure so it reacts much like a "wrinkle wall" drag tire on launch; at normal inflation, it corners with the best.

Although I personally run my daily driver on dual-purpose street tires, there are a couple of significant considerations to keep in mind before running out and buying a set:

- These tires usually last less than 7,500 miles on the street before the tread wears below legal and safe depth, or they become hardened from multiple heat cycles.
- They can be much noisier than normal street tires, much like I imagine monster truck tires would sound at freeway speeds.

Most dual-purpose tires are designed for racing and autocross classes that require street-legal tires. They're also great for track days.

Top competitors in street tire classes treat their tires like racing tires. If they drive the car on the street, they don't use their competition tires. If you have dual-purpose tires for competition or track days, I recommend that you

- Minimize the street miles on the tires.
- Complete at least one full heat cycle before driving hard on the track.
- Use shaved tread if the tires are to be driven only on dry racetracks. (Make sure the shaved tread is legal for your class.)

When There Isn't Any Air There

Modern tires are strong and puncture-resistant. Flats and blowouts are less common than in the bad old days. Still, you're bound to run over a nail (or a hammer) now and then, almost always at an inconvenient time and place. There's never a good time for a flat.

For safe everyday driving, you need either

- A spare tire and all the equipment to change it

  Pop quiz! Is your spare tire inflated to the recommended pressure? Do you have all the wrenches and jack parts to change it? If you don't know, go out and check right now. I'll wait here until you get back.

- Run-flat tires with a pressure-monitoring system

  Run-flat tires (see Figure 5-7 for an example) are one of the biggest advances in everyday tire technology since the invention of the steel-belted radial.

Figure 5-7: The Kumho ECSTA MX XRP, a run-flat tire.

The dinky spare tire in most cars lets you drive a few miles to get where you can repair or replace your flat tire. Don't go *anywhere else* on that spare tire! (The speed rating restriction on those space-saving spare tires is designed not so much to prevent a tire blowout as it is designed to minimize wear on your differential from having a tire size that is dramatically different from the one on the other end of the axle.)

Pressure monitoring

Tire pressure monitoring can keep you from driving on under-inflated tires if you have a puncture or neglect your tire pressure.

Tire pressure monitoring systems are available for most cars, either as factory equipment or as an add-on. Most pressure monitoring systems are light and simple, weighing mere ounces, and transmit wirelessly to a monitor mounted in the passenger compartment. You are alerted instantly when a tire loses pressure. Figure 5-8 illustrates a pressure sensor mounted on a rim.

A budget-minded solution that will visually alert a driver to low pressure is a simple mechanical device that screws on to the valve stem of each wheel. This

solution has several limitations, however: It can't tell you the exact pressure (the colors change to indicate the approximate tire pressure), and it can't alert you to a drop in pressure from within the passenger compartment.

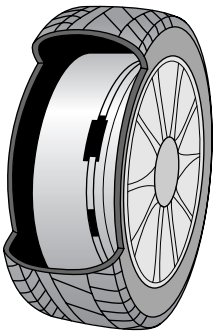

Figure 5-8: A tire pressure sensor mounted on a rim.

It is generally a good idea to carry a portable air compressor that can be run off your car's cigarette lighter or similar power source, along with a tire plug kit. While this will not ensure that you will never be stranded on the side of the road, it may be useful for minor punctures or if idiots let the air out of your tires.

A can of *tire repair* (such as Fix-a-Flat) may be substituted for an air compressor, but it has a couple of significant drawbacks:

- The stuff is flammable, which makes fixing the tire later a hazard.

  Always warn the technician if you've used anything but compressed air in a tire. *Never* just hand the car over and ask for a new tire if you've used a tire-sealing product.

- Hardened sealant foam must be removed from the inside of your wheel when the tire is repaired. It's a nasty job.

Removing your spare tire, and carrying a plug kit or can of foam and a roadside service card may be a great way to save unwanted pounds from your car, but being stuck at the side of the road — usually at the worst time possible — is a big trade-off for the added weight of the spare tire and tools.

Run-flat tires

Run-flat tires (also known as *extended mobility tires* or *EMT*) can be driven a short distance at reduced speeds without any air pressure. If you have a puncture, you can drive to a safe place for help. They're standard on street cars when designers eliminate the space and weight of a spare tire and its tools.

A run-flat tire needs air pressure for *normal* driving, like any other tire:

- You can drive only a few miles for a repair if you don't have full pressure in a run-flat tire. If you continue driving without full air pressure, you will damage or shred the tire (just like a standard tire).
- Pressure monitoring is essential on a street car with run-flat tires. Otherwise, you might not realize you've sustained a puncture until the tire is completely shredded.

One of the latest industry developments in run-flat technology focuses on new polyurethane tire compounds. Beyond being more environmentally friendly than conventional rubber compounds, and eventually allowing for more consistent manufacturing quality control compared to rubber, the handling and load carrying abilities of future polyurethane tires, when run with low to no pressure, promise to greatly surpass those of rubber compounds when used as a run-flat tire.