TIRE TRADE-OFFS

A little help in selecting the right tires for you

by Sheldon Brown

What do you want from your bicycle tires? There is no such thing as the "perfect" tire. An educated tire choice requires balancing the trade-offs among different desirable qualities, some of which are mutually exclusive.

Rolling Resistance. Rolling resistance is the rolling friction of the tire against the road. After air resistance, rolling resistance is the main obstacle you work against to keep a bike moving on level ground. Rolling resistance results from the effort required to deform the bottom of the tire and tube where the rubber meets the road, from its normal round shape to a flat shape at the contact patch.

GREG SIPLE

The good, the bad, and the knobby.

Tread Thickness

Tires with thick rubber tread are more resistant to certain types of punctures, particularly small glass slivers and thorns, which may not be long enough to penetrate a thick tire through to the inner tube. However, there are tradeoffs involved with thick tires: The thicker the tire tread and fabric are, the stiffer the tire carcass will be. This amounts to increased rolling resistance. Thicker tires are also heavier, and this slows you down when going up hill.

Tire Pressure

Higher pressures result in a smaller contact patch and thus less tire deformation, so in general, higher pressure leads to lower rolling resistance. There is a "point of diminishing returns" for inflation pressure, however. Over-inflated tires give a harsh ride and also give poor cornering traction. Extreme over inflation leads to the tire actually bouncing on pavement irregularities, which increases rolling resistance and results in seriously reduced cornering ability.

Lower pressure provides a more comfortable ride, but the increased rolling resistance will slow you down a bit. If your pressure is too low, you'll be at risk for "snake bite" damage, where the inner tube gets pinched between the rim and a rock or other road hazard.

Most tires have a "maximum" pressure, or a recommended pressure range marked on the side of the tire. These pressure ratings are established by the tire manufacturers after consultation with the legal and marketing departments. The legal department wants the number kept conservatively low, in case the tire gets mounted on a defective or otherwise loose-fitting rim. They commonly shoot for half of the real blow-off pressure. The marketing department wants the number high because many tire purchasers make the (unreliable) assumption that the higher the pressure rating, the better the quality of the tire.

Newbies often take these arbitrary ratings as if they had some scientific basis. While you'll rarely get in trouble inflating your tire to this number, you typically will not get the best possible performance with this rote approach.

Savvy cyclists experiment with different pressures, and often even vary the pressure for different surface conditions. The best pressure for any given tire will depend on the load it's being asked to support. Thus, a heavier rider requires a higher pressure than a lighter rider for identical tires.

A tire is supposed to deflect a bit under load. This deflection is the purpose of pneumatic tires. When you sit on your bike, your tires should visibly bulge out at least a bit under your weight. If they don't, they're over inflated.

Tire Width

Generally speaking, wider tires will offer a more comfortable ride, give better traction, and be less easily damaged by road hazards. Narrow tires will usually be slightly faster, mainly because they're lighter and more aerodynamic. A common debate among cyclists centers on the issue of whether a wider tire has more or less rolling resistance at the same pressure. The constant pressure factor is proposed because it appears more scientific to eliminate it as a variable, but this is not realistic in practice. The short answer is that, yes, a wider tire of similar construction will have a lower rolling resistance than a narrower one at the same pressure. This fact, however, is of no practical value. If you are comparing two tires of similar construction, with the same load and the same pressure, either the wider tire is over inflated, or the narrower tire is under inflated.

Wide Tires or Narrow Rims?

Tire width is also somewhat related to the width of the rim it is mounted on. In particular, mounting an extremely wide tire on a very narrow rim may work but involves real risks.

The main reason for using wide tires is to take advantage of the lower pressures they make possible, but if a wide tire is used on a narrow rim, it may tend to flex or wallow from side to side during cornering, causing unpleasant and unpredictable handling.

If you increase the pressure to compensate for this, it creates serious stresses where the tire side walls bend over the edges of the rim. This frequently leads to chafing of the tire and eventual failure of the side wall. It can also lead to rim failure, as the rim edges are not designed to withstand such strong sideways stress.

Tread Patterns

Bicycle tires for on-road use do not need any sort of tread features, in fact, the best road tires are perfectly smooth, with no tread at all! Unfortunately, most people assume that a smooth tire will be slippery, so this type of tire is difficult to sell to unsophisticated cyclists. Most tire makers cater to this ignorance by putting a very fine pattern on their tires, mainly for cosmetic and marketing reasons. If you examine a section of asphalt or concrete, you'll see that the texture of the road itself is much "knobbier" than the tread features of a good quality road tire. Since the tire is flexible, even a slick tire deforms as it comes into contact with the pavement, acquiring the shape of the pavement texture while in contact with the road.

People ask, "But don't slick tires get slippery on wet roads, or worse yet, wet metal features such as expansion joints, paint stripes, or railroad tracks?" The answer is, yes, they do. So do tires with tread. All tires are slippery in these conditions. Tread features make no improvement in this regard.

Knobby treads actually give worse traction on hard surfaces. This is because the knobs can bend under side loads, while a smooth tread cannot. The bending of knobs can cause discontinuities in handling — the tire grips okay for mild cornering, but as cornering force exceeds some critical value, the knobs start to bend and the traction suddenly gets much worse, with little or no warning.

Finally, Weight

Weight tradeoff with tires is the same as with other bike parts: Generally lighter stuff is going to make the bike feel a bit quicker, and will make a small improvement in climbing ability, but generally this will come at a cost in durability and reliability.

Conclusion?

As you can see, there are many contradictory aspects to tire selection and use. Nobody can tell you what is the best tire or the best tire pressure for your specific conditions, only experimentation and consideration of your own priorities can determine where your best option is among these various tradeoffs. AC

Sheldon Brown offers more elucidation on cycling-related topics at www.sheldonbrown.com/harris.