The Tire Pressure Revolution

BY **JAN HEINE**

Skinny doesn't mean fast, fat doesn't mean slow, and some wider rubber might change your life

IF you've tuned in to blogs about racing and bicycle technology recently, you've read about wider tires and lower pressures. Professional racers now run 25mm tires on the super-smooth roads of the Tour de France and 30mm-wide tires on the cobblestones of the Spring Classics. And they run them at pressures of 80 PSI and lower, yet they aren't going any slower — often faster — than they did when they ran narrower tires at ultra-high pressures. Not long ago, it was generally accepted that to roll fast tires had to be inflated to high pressures. What has changed?

Tire Pressure ≠ Tire Performance

The most revolutionary finding of recent research about tire performance is this: Tire pressure has almost no effect on a tire's speed.

Tire resistance consists of two types of energy losses. One is from deformation of the tire when it touches the ground as it rotates (hysteretic loss). To reduce your tire's hysteretic losses, you inflate them harder so they deform less. That part has been known for many decades.

The second loss often has been overlooked. As the bicycle vibrates, energy is lost (suspension loss). What the rider experiences as discomfort is actually friction between body tissues as energy is converted to heat. That energy is taken from the forward movement of the bike so it slows you down. With higher tire pressures, vibrations increase; thus, the suspension losses go up.

The two effects roughly cancel each other out. At higher pressures, you have smaller hysteretic losses from casing deformation but greater suspension losses from vibrations. At lower pressures, your hysteretic losses go up a bit, but you also reduce the suspension losses. The sum of the two resistances remains almost the same as long as your tires are inflated enough to prevent the sidewalls from collapsing during cornering.

There are small differences in performance at different pressures, but they are non-linear and depend on the road surface, tire construction, and rider weight. On many roads, moderately high pressures (say 100 PSI for 25mm tires) actually are slower than either lower or higher pressures. The effects are small and difficult to predict so as a rider you shouldn't worry about them. (If you were a racer who is doing a short time trial over a road with a uniform surface, you could test various tire pressures on that road surface to gain a little extra speed.)

GREG SIPLE

Narrow tires inflated to high pressure might seem faster, but science says otherwise.

Placebo effect

"Wait a minute!" I hear you say, "When my tires are inflated rock-hard, I can feel that my bike is much faster." Indeed, the higher you run your tire pressures, the faster your bike often feels. The emphasis is on "feels" because this is a placebo effect. The faster you ride, the faster the bike hits the minor irregularities of the road surface. The frequency

at which the bike vibrates goes up with speed so our bodies are used to interpreting high vibration frequencies as high speeds. However, if you increase the tire pressure, you also increase the frequency of the vibrations. This feels the same as the bike going faster so it tricks you into believing that higher pressures make the tires roll faster. Careful testing has shown that this is just an illusion.

Tire Performance

Even though tire pressure makes little difference in a bike's performance, the construction of the tire itself determines the speed and feel of your bike more than anything else — especially at touring speeds. The speed difference between a slow and a fast tire can easily be 15 percent. That is huge — about 10 times as much as the performance advantage of aero wheels (1 to 2 percent).

To make a tire fast, you need to reduce both types of losses: the hysteretic losses from the deflection of the tire and the suspension losses from the vibrations of rider and bike. The key to this is a supple casing. The supple casing flexes more easily, which reduces the energy it absorbs as the tire rotates (hysteretic losses). By flexing easily, the tire also transmits fewer vibrations, which reduces the suspension losses. Thus, a supple tire reduces both types of losses, making this adjustment an extremely effective way to improve your bike's performance and comfort at the same time.

What makes a casing supple? The threads need to be very thin, not woven too densely, and coated with only a minimum of rubber. You can feel the suppleness when you flex the tire — it's thin and easy to flex with almost no "springiness" to it.

Tread thickness also plays a role in tire performance. Obviously, thicker rubber is harder to flex, which increases both types of losses. The ideal tread is thick enough in the middle to ensure a reasonably long life for the tire, but it gets thinner on the shoulders where the tire only touches the road during hard cornering.

Puncture-proof belts and foam layers make the tire stiffer. Reinforced sidewalls also stiffen the tire. Stiffer tires are not only slower, they are also less comfortable.

The Wide Tire Revolution

In the past, it seemed impossible to make wide high-performance tires. If you made the casing supple, your tire would not support high pressures, and we all thought that high pressures were key to high performance. If you beefed up the casings, the tire might be able to run at high pressures, but the sturdy casing would limit the tire's performance. It seemed like a Catch-22 with no good way out. The solution was to stick to narrow tires where you could combine supple casings and high-pressure ratings.

Now that we know that tire pressure has little effect on performance, the equation has changed. You can use supple casings, run them at low pressures, and still enjoy great performance. Several makers now offer wide tires with supple casings, so riders can enjoy the feel and performance of a supple casing *and* the comfort and safety of wide tires. It's a win-win situation.

Touring Bikes

What does all this mean for touring bikes? It's really good news because it means that you can run wider, more supple tires at lower pressures without giving up any speed or the lively feel of your bike. Wider tires and lower pressures can make a huge difference in the enjoyment of your ride, and even in how and where you tour. Obviously, wider tires and lower pressures are more comfortable. Scenic backroads often have poorly maintained pavement — or none at all in the case of gravel roads. With narrow, harsh-riding tires, these roads are enticing, but not much fun. Wide, supple tires change all that — when your bike floats over the roughest chipseal, there is little temptation to return to a noisy, busy highway.

The downside of the supple casing and thin tread of a high-performance tire is reduced puncture resistance. Supple casings are easier to cut, and thin treads are easier to penetrate. There is a simple solution to this problem: Run wider tires! Wider tires get fewer flats because they roll over debris that would get hammered into narrower tires. Imagine somebody stepping on your toe with a running shoe versus a stiletto heel.

Even if you don't change your routes, wider tires are better able to handle heavier loads. They also greatly reduce the stress on your wheels because the added suspension reduces the battering that the rim receives from narrower tires. Since I switched to 42mm-wide tires, I have not needed to true my wheels in more than 25,000 miles.

Conclusion

If you want to increase the speed and enjoyment of your rides, try a set of wide, supple, high-performance tires. Get the widest ones you can fit on your bike with adequate clearances, both to enjoy the maximum benefit of the added comfort and safety, but also to reduce the risk of flats. And, if you get a new bike, make sure it can accommodate wide tires! Wider tires roll no slower than narrow ones so there isn't a good reason to ride on narrow rubber any longer. AC

Jan Heine is the editor of Bicycle Quarterly, *a magazine about the technology, history, and culture of cycling. For full disclosure, his company Compass Bicycles offers wide and supple tires in a variety of sizes.*