WHERE TO CARRY A LOAD

The best option for you depends on your bicycle

by Jan Heine

If you want to start a lively discussion, ask a group of bicycle tourists how best to carry a load. Front rack versus rear? Wheel-top racks versus low-riders? What about trailers? Are backpaks okay? Every solution has fervent adherents, each has its detractors, and all can be made to work — if you’re willing to put in some time. In this column, we’ll look at the underlying physics to help you determine the best way to carry your load.

Let the bike carry the weight

Backcountry bikers have no alternative but to carry backpaks. On a bike, there is no need to burden your body. Let your bike carry your luggage. One possible exception is technical off-road terrain where a light bike can be easier to maneuver and carrying a backpack may make sense.

How a bicycle stays upright

Where should you put the weight on the bike? Let’s look at how a bicycle is balanced by constantly moving the ground contact patch from side to side, so it stays underneath the center of gravity. If the bike starts leaning to the left and the center of gravity no longer is over the wheels (Figure 1), you move the wheels to the left until they are back under the center of gravity of the bike. A front loading bike will handle poorly with a heavy front load. The optimal solution has a lower center of gravity makes the bike easier to balance. The reason is simple geometry. For a lean of one degree, a lower load moves not as far sideways as a front load on a front-loading bike will handle poorly with a heavy front load. Similarly, a heavy rear load on a front-loading bicycle also will impair the handling.

Real-world bicycles

Does that mean every bike should carry its load on the front wheel? Not quite: a front load does introduce a new set of variables, because it directly affects the steering of the bicycle.

There is no space in this column to get into the details of trail, wheel flop, inertia of the load, the influence of tires, and more. (We treated these subjects at length in Bicycle Quarterly Volume 5, Number 1.) Suffice it to say that the effect of the front load on the steering can be harnessed to make a bicycle handle better with a front load than without, but only if the bike’s geometry is suitable for a front load. Such a touring bike, fully loaded, handles as well as a good racing bike, whether cornering hard, riding no-hands (not recommended, of course), or climbing out of the saddle.

Most touring-bike manufacturers appear to have only a limited understanding of bicycle geometry. The geometries of most production touring bikes copy the “relaxed angles” of old British touring machines, which were designed for a rear load. Such a “rear-loading” bike will handle poorly with a heavy front load. Similarly, a heavy rear load on a front-loading bicycle also will impair the handling.

Figure 1: A bicycle is balanced by constantly moving the wheels to keep them under the center of gravity.

Figure 2: In 1946, Daniel Rebour drew the different load placements on a touring bike. Nothing has changed since then.

Figure 2a: Rack-top bags (Fig. 2a) sit much higher than necessary. In addition, most are supported only at the bottom, which means that much of the weight is free to wiggle from side to side. (A handlebar bag at least has a top support.) If you use a rack-top bag, put as little weight as possible inside, and place heavy items at the bottom.

Figure 2b: Panniers (Fig. 2b) lower the center of gravity significantly. For many years, panniers were the standard solution for carrying touring loads. Starting in the 1930s, some French builders experimented with low-rider racks that place the bags even lower (Fig. 2c). On the front, low-rider racks not only lower the load further, but they also place it further back and thus closer to the steerer axis of the bicycle. This reduces the inertia of the load, making the handlebars easier to turn with than a wheel-top rack.

On the rear, it is difficult to lower the load, because it interferes with your heels as you pedal. You can shift the load backwards, but this exacerbates problems associated with rear loads. I have used bikes with front and rear low-riders, but this set-up worked well only if most of the load was in the front panniers, and only light items were carried on the rear. With such a setup, cornering is improved due to the very low center of gravity and evenly distributed weight, but the panniers must be packed carefully to avoid putting too much weight behind the rear axle. For most riders, rear low-rider racks are not worth the trouble.

Conclusion

A front load is inherently easier to balance than a rear load, but few of today’s touring bikes are designed for a heavy front load. The optimal solution for most bikes on paved roads is a combination of front low-riders with rear panniers on a wheel-top rack (Fig. 2d).

Experiment and determine which weight distribution works best for your bicycle.

Jan Heine is editor of Bicycle Quarterly, a magazine about the culture, technology, and history of cycling. More information and back issues can be found at www.bikequarterly.com.