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Wind Cheating Wheels Reviewed

BY AARON HERSH

Race wheels are not the most cost-efficient way to improve your bike split, but they may be the sexiest. However, those deep rims aren't just for looks: The rim is the most critical component of an aerodynamic wheel. Triathlon race wheels reduce wind drag by converting a standard tire and rim into an aerodynamically efficient shape. Designing race wheels with deep rims is the most common way manufacturers reduce drag, but the rim's shape is just as important as its depth. The first aero wheels utilized narrow V-shaped rims but aerodynamicists eventually figured out that certain wide and deep rims actually create less drag than narrower alternatives.

Zipp and Hed have dominated the race wheel market for many years because they shared a patent on the most aerodynamic rim shape—the toroidal rim. This bulged rim shape creates less drag than a deep-V rim even when the rider is in a gentle crosswind. The patent on this valuable rim shape just expired, leaving the race wheel market open to serious new competitors. No one has grabbed this opportunity yet, but Zipp has already designed and patented a new shape that it asserts is even more aerodynamic than a toroidal rim.



Photos by Nils Nilsen

THE ANONYMOUS AERODYNAMICIST ON THE TOPIC OF RIM DEPTH

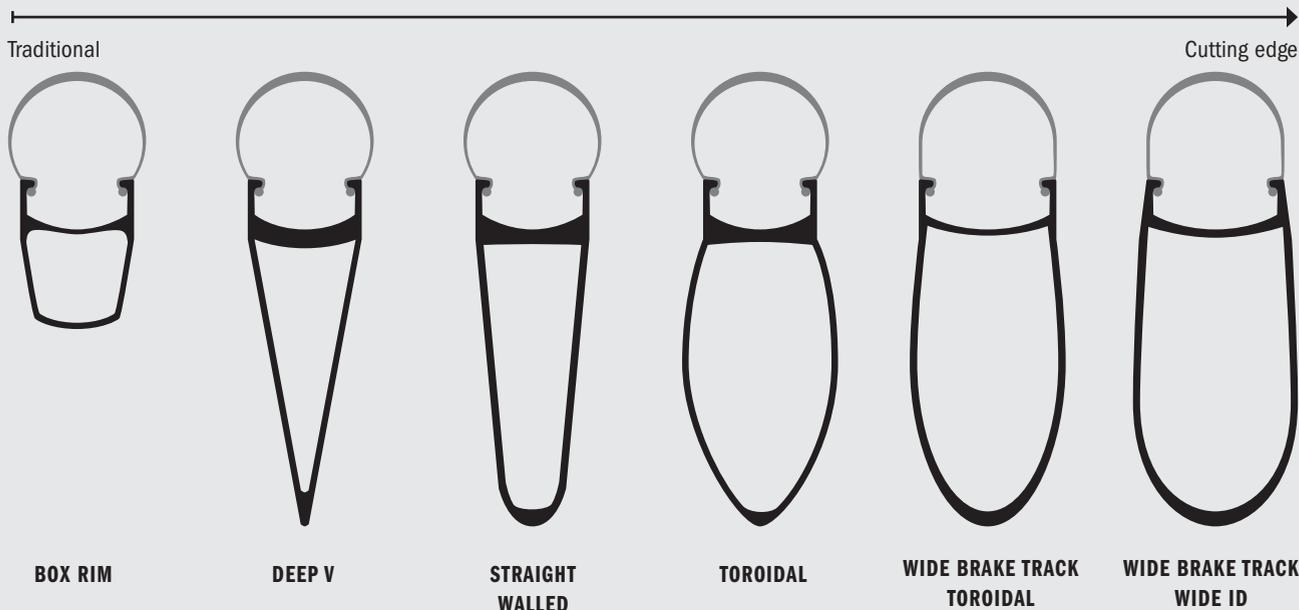
A wheel with a deep rim is not necessarily more aerodynamic than one with a shallower rim.

There are two types of aerodynamic drag: pressure drag and frictional drag. Frictional drag is the resistance created by air rubbing against an object as it passes over. Pressure drag occurs when air separates from an object as it passes over it, which creates a large air pressure difference in front of and behind the object. This difference creates a force on the object in the direction of the wind.

At the speeds bicycles travel, pressure drag is the predominant form of drag so aero

wheels are designed to keep the flow attached to the surface of the wheel to minimize pressure drag. The shape of the rim, not just the depth, determines if air will stick to the surface or flutter off to the sides. A deep rim that is the wrong shape will still see flow separation in even minimal crosswinds and, consequently, will create a lot of pressure drag. A rim that is shaped to allow air to gently transition from the tire to the brake track and onto the rim body reduces the wheel's aerodynamic drag more effectively than any other characteristic.

THE EVOLUTION OF RACE WHEELS



ZIPP 404 CARBON CLINCHER \$2700

RIDE QUALITY: 130/140.6 (Our product ratings are depicted as a fraction of 140.6, the number of miles in an Ironman.) It corners like a tubular but the carbon brake track isn't as grippy as an aluminum rim.

USABILITY: 125/140.6. The clincher tires make changing a flat simple, but the wide rim requires a brake adjustment when going from a standard training wheel to these.

VALUE: 128/140.6 Cutting edge aero profile and carbon clincher rims make it a phenomenal piece of wheel technology, but it is still really pricey.

AERO PROFILE: Truly the next generation.



Despite the name, the biggest difference between the Zipp 404 Carbon Clinchers and competitors' race wheels is not the fact that they are carbon clinchers. Other manufacturers have, in fact, been successfully producing carbon clinchers for a couple of years. The 404 CCs are a milestone in race wheel design because of their evolutionary rim shape and unmatched combination of speed, weight and usability. Like the Hed Jets, the 404 CCs have an ultra-wide brake track to improve wheel aerodynamics, but Zipp has taken the toroidal rim shape one step further with its new Firecrest rim profile.

The rim of the 404 CCs is not only incredibly aerodynamic, but the wide brake track also creates a silky ride experience that can only be matched by tubular tires and other wide clinchers. Widening the brake track increases the amount of air held in the tire and lets it absorb little bumps in the road that would normally skip the rider off the pavement. This buttery ride quality, combined with the incredibly light rims, make the 404 CCs a thrill on the road. Even with the carbon rim they are still heavier than comparable tubular wheels, but the 404 CCs are more nimble and eager to accelerate than any aero clincher wheel I've ever ridden.

HED JET 9 AND JET DISC CLINCHER JET 9 FRONT \$800, JET DISC \$1050

RIDE QUALITY: 120/140.6 Aluminum brake track grips perfectly, and the spoked disc corners better than any rival, but the deep front rim can feel twitchy in the wind and the Jet wheels' relatively stout weight makes them slow to accelerate.

USABILITY: 130/140.6 Clincher tires. Aluminum brake track. Solid cornering characteristics. The only issue is spreading the brake calipers to accommodate the wide rim and handling the front wheel in a crosswind.

VALUE: 133/140.6 Best aero profile for the price in the industry, but the flexible fairings give the wheels a cheap feel.

AERO PROFILE: Hed Jet wheels are simply standard aluminum rim wheels covered with carbon fairings. The fairing is flexible and feels a bit chintzy. Despite their low production value, the Jet 9 and Jet disc are near the pinnacle of wheel aerodynamics. The key to their aerodynamic efficiency is the smooth integration between the rim and the tire. Its 23mm wide brake track, as opposed to a conventional 19mm wide track, turns the wheel and tire combination into one smooth toroidal unit.

Until just three years ago, even the most aerodynamic wheels in the world had an obvious design flaw. The rims themselves had an efficient toroidal profile but, with a tire on, the wheels became a figure eight because they had a narrow brake track that formed a waist between the wide tire and wide rim. Mad scientist Steve Hed was the first to solve this problem by building an aero wheel with a wide brake track that smoothly transitions from rim to tire and makes the entire system, rather than just the rim, fully toroidal.

Not only is the Jet disc aerodynamic, but it rides better than any other disc because of its construction. It has sheets of carbon covering a conventional spoked wheel to give it the aerodynamic properties of a disc. Foam core discs transmit more road vibration than spoked wheels and this makes the ride feel harsh and compromises cornering because the wheel bounces off the pebbles in an asphalt road. The Jet disc rides like a spoked wheel because it is a spoked wheel.





EASTON EC90 TT \$1699

RIDE QUALITY: 135/140.6 Wide rim clinchers are great, but nothing rides as well as a tubular tire. Easton's mastery of carbon construction is evident when jamming these wheels into a high speed corner or accelerating away from T1. The light yet stiff rims accelerate and corner like a motorcycle. The rim sidewalls are paper thin but the wheels are still stiffer than many of the bulkier race wheels on the market. The snappy and responsive ride distinguishes the EC90 TTs from many other tri race wheels.

USABILITY: 100/140.6 Tubulars are a pain to install and expensive to replace.

VALUE: 118/140.6 They are light and fun to ride but lack the formerly patented aerodynamic toroidal rim that separates Zipp and Hed wheels from the rest.

AERO PROFILE: The EC90 TTs have a hurdle to overcome to compete against the incumbent industry-leading race wheels. Although the EC90s have a deep rim, the straight-walled shape has been shown to be slightly less aerodynamic than the toroidal shape (see *VeloNews*, Sept. 2010, "Knife the Wind"), but that doesn't mean that the EC90 TTs aren't great wheels.

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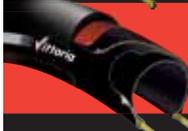
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SRAM S80 WHEELSET \$1190

RIDE QUALITY: 90/140.6 The S80s weigh more than some training wheels and have a standard, narrow clincher rim so they aren't a blast to ride.

USABILITY: 130/140.6 The narrow clincher rim makes swapping wheels and changing a flat easy. The deep front wheel catches air like any other 82mm deep rim.

VALUE: 128/140.6 Moderately priced with the rim shape that made the Zipp 808 an aerodynamic marvel.

AERO PROFILE: These SRAM wheels are built on Zipp-designed rims. They have the same shape as the previous generation Zipp 808 clinchers that sold for more than \$2,300. Lower grade hubs, cheaper spokes and no dimples are the differences between the 808s and the S80s, but they still have the all-important toroidal rim shape. The S80s are not light but once they are up to speed, they keep rolling because of the aero rim. They do not, however, have a wide brake track to take full advantage of the toroidal shape like the pricier wheels from Zipp and Hed. They provide most of the performance of the most expensive race wheels at a sensible, although certainly not cheap, price.



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