

New School Geometry

Not all of us have the flexibility of a pro cyclist. If you fit into this category, don't worry, help is at hand. **Steve Hogg** explores the trend of high end, relaxed geometry bicycles.

ore Australians are participaling in cycling than ever before. There are more and larger training bunches out there than there were 10 years ago, but il seems to me that the average age of cyclists has crept up, with the increase in numbers mainly coming from riders between 35 and 50 years of age. While many riders aspire to the long, low upper body position on a bike that many continental pros display, for some this isn't possible comfortably. To meet an aesthetic ideal, one needs to be able to meet the functional ideal that allows it. And this is beyond the abilities of a significant number of cyclists. At speed and under pressure something over 90% of wind drag is caused by the rider, not their equipment. What I'm saying is that you can have the most aerodynamic frame and wheets avaitable, but there is still a huge advantage to be gained in minimising wind drag caused by the rider's body. The best way to do this is to use the drops and to extend the spine. Being able to extend (flatten) the spine comfortably means that effective tung capacity isn't compromised. Whereas flexing (arching) the spine wilt limit effective lung capacity because there will be tess room available for the lungs to expand into.

When we bend forward to reach down into the drop bars, two actions need to happen simultaneously. The top of the pelvis must rotate forward and the lumbar spine must flex forward. Considering the cycling population as a whole, an above average degree of Ilexibility is needed. Above average doesn't mean the flexibility of a gymnast or contortionist, merely a range of movement adequate for the task. This degree of function is only 'above average' because the average level of flexibility in the cycling population is poor.

The problem here is that many have limited ability to rotate the pelvis forward. Combine this with age related inter-vertebral disc changes and the accumulation of wear and tear and the result is that for many to use drop bars set at a tow height, the lumbar spine is lorced into early and excessive flexion. Doing so repeatedly will break down the discs and posterior ligaments of the lumbar spine which are its support structures. This is the reason that the advice I have sometimes heard offered to "just lower your bars gradually and you'll eventually get used to it" is exceedingly ill informed.

Warning Signs

Warning signs that riders may have a position forcing excessive lumbar flexion include low back or buttock pain in the first hour of a ride, excessive rounding of the spine, an inability to rotate the top of the pelvis forward on the saddle and the inability to use the drops comfortably.

A less than adequate range of movement in the pelvis and lumbar spine means that the rider has one of four choices –

The first is to never, or rarely, use the drops. In any bunch there are riders with bar tape that is well used in the upper portions of the handlebar but as new in the drop section. These are the people who when riding on the flat and under physical pressure; that is high heart rate and high toad; will still have their hands on the brake hoods, sitting up in the wind when others are using the drops:

The second is to excessively flex the spine to use the drops so that as viewed from the side, the rider's back looks like a variation of the Sydney Harbour Bridge. Doing this means



you have to accept the negative implications for spinal health and function oullined above. This isn't smart. As well as increasing long term damage to the spine, the room into which the lungs can expand is lessened and so effective lung capacity is diminished with obvious implications for performance.

The third and more of a medium to long term measure, is to work to improve flexibility. Improvements in flexibility can be gained at any age. All that is needed is the will and some direction. A couple of excellent sell help books for those interested are Stretching and Flexibility and Overcome Neck and Back Pain, both by Kit Laughlin.

The last is becoming increasingly popular and is the one that many bike manufacturers have taken over the last few years. This is to recognise that a long, low. Euro pro styfe upper body position cannot be applied to the cycling population as a whole and that there is a need for bike frames that allow higher handle bar placement. The way that this is done is to provide the option of frames with longer than 'standard' head tubes in each size. The Trek Madone 5.2, Cannondale Synapse, Specialized Roubaix, Giant Defy and Ceivelo RS are all examples of this type of thinking from larger manufacturers.

For the purposes of exptanation, I'll highlight

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the last three models and contrast them with the 'standard' offerings from the same manufacturers.

Frame designs and top lube stopes vary widely. This means that sizing bikes by seat tube length can be an impractical means of comparison. When comparing frames and trying to understand the differences in weight balance between wheels and altered steering characteristics that occur when the bars are raised, the five key parameters are:

• Head tube length, as this will targely dictate bar height.

• Seat tube angle, which more or less determines the lore and alt position of the seat.

• Top tube length, when combined with seat lube angle and stem length will dictate the

reach to the bars.

Steering trail, This is literally how far the contact patch of the front tyre 'trails' behind the steering axis. Think of it as the tendency for the

steering axis. Think of it as the tendency for the steering to self centre. A higher number equals greater steering stability and a lesser number means lesser steering stability

• Chain stay length, which is measured from the certifie of the bottom bracket to the centre of the rear axle.

 The frames compared are 56cm in the Specialized and Cervelo ranges and Medium – Large in the Giant range, *denotes conventional head lube length model

Specialized Tarmac* versus Specialized Roubaix

	Tamac	Roubaix
Head tube length	1 70 m m	190 mm
Seat tube angle	73.25 degrees	73.25 degrees
Top tube length	565mm	565 mm
Trail	55mm	55 mm
Chain stay length	405 mm	415 mm

Giant TCR Advanced SL* versus Giant Defy Advanced

	TCR	Defy
Head tube length	170mm	185 mm
Seat tube angle	72 degrees	73 degrees
Top tube length	570 mm	560 mm
Trail	not known	not known
Chain slay length	405 mm	420 mm

Cervelo R3* versus Cervelo RS

Head tube ierigth 160 mm 180 mm Seat tube angle 73 degrees 73 degrees Fop tube length 565 mm 565 mm Frail 58 mm 58 mm Chain stay length 399 mm 410 mm	1000	R3	RS
Seat tube angle 73 degrees 73 degrees Fop tube length 565 mm 565 mm Frail 58 mm 58 mm Chain stay length 399 mm 410 mm	Head tube iength	160 mm	180 mm
Top tube length 565 mm 565 mm Frail 58 mm 58 mm Chain stay length 399 mm 410 มาก	Seat tube angle	73 degrees	73 degrees
rail 58 mm 58 mm Chain stay length 399 mm 410 את 410	Soptube length	565 mm	565 mm
Chain stay length 399 mm 410 mm	Frail	58 mm	58 mm
	Chain stay length	399 mm	410 mm

So What are the Implications of These Differences?

Head Tube Length

All three manufacturers have longer head tubes than on their out and out performance models. Specialized and Cervelo have added 20mm and Giant 15mm. As well as allowing a higher bar height and less spinal flexion, this extra front end height reduces the reach to the bars by seven millimetres for Specialized and Cervelo, and five millimetres for Giant. This is a good result when you are designing a frame for a group of riders who are less flexible than the group that your 'pro' model is designed for.

Seat Tube Angle

Specialized and Cervelo have left the seat tube angle unchanged whereas Giant have a one degree difference in seat tube angle between their two models. A single degree doesn't sound like a lot but at a typical seat height for these size frames it means that the Defy will have its seat 12 -14 mm further forward than the TCR Advanced SL.

I have some sympathy for the Giant

approach. For me, what determines ideal seat tube angle is not how long your femur is or other isolated proportional relationships but how functional you are. The more functional Ihe rider, the greater their ability to rotate the top of their pelvis forward and extend their lorso out from the seat. By doing so, more weight will be cantilevering forward from their pelvis on the seat. This in turn will mean more weight borne on the hands and supported by the shoulder complex. Too much weight forward not only does nothing for comfort, but indirectly restricts the ability to breathe fully because the upper body musculature that needs to relax to allow deep breathing is engaged in supporting weight.

To my mind, that means the more functional rider will need to counterbalance that by having their seat further back to star: with and Giant have adopted an approach that allows that. There is nothing to stop the Cervelo R3 or Specialized Tarmac owner from moving their seat further back but they will not have as much latitude for adjustment as the Giant TCR

Advanced SL owner will.

Top Tube Length

Again, Giant stands out from the other Iwo. Specialized and Cervelo have the same lop tube lengths in each model whereas Giant have shortened the top tube of the Defy by 10mm compared to the TCR Advanced. Relying on the rider's llexibility, Cervelo and Specialized have used the same seal position as a starting point (same seat tube angle), for both of their models. This means that any decrease in reach comes only from the higher head tube and as mentioned above, that amounts to a seven millimetre shorter reach to the bars from the extra head tube length alone. Giant have moved the rider of the Defy forward compared to the TCR Advanced and increased head tube length by 15 mm. This in turn shortens the reach to the bars by five millimetres and in addition, lessens the distance to the bars by another 10mm by having a shorter top tube on the Defy.

There is no right or wrong with the decisions made by these manufacturers. It is



more a difference in emphasis. Specialized with the Roubaix and Cerveto with the RS are offering frames that provide a mild comfort 'dividend' for those who aren't quite up to their pro models. Giant are offering a large difference between their models in an attempt to capture a wider market perhaps. So even quite a sliff person coming into cycling for the first time or perhaps re-entering the sport after a lay off of many years will not have to make too many compromises to ride the Dely.

Trail

There is a difference in philosophy here between manufacturers, Both Specialized models have a trail ligure of 55 millimetres, which means quick, or if you prefer, agile steering. But it has been achieved in two different ways. Trail is a product of head tube angle and lork offset. All other things being equal, a steeper head tube angle (higher number) decreases stability. And a shallower head tube angle (lower number), increases stability. With the same caveat, a greater fork olfset (higher number), decreases stability and a lesser lork olfset increases stability. The Tarmac uses a combination of 73.5 degrees / 43mm and lhe Roubaix 72.5 degrees / 49mm both of which yield 55mm of trail. The implication here is

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Cerveio RS

Giant Defy Advanced Zero

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that the slacker head tube angle and greater fork offset of the Roubaix will give it more compliance over bumps than would the Tarmac.

Giant also have a stacker head tube angle in the Defy than they do In the TCR Advanced SL but they do not tist their fork offsets meaning that any comparisons I would make would only be speculative.

Cervelo have both their models with the same steering geometry of 73 degrees / 43 mm producing 58mm of trait. This will make them slightly more stable or slightly stower steering than the Specialized models but with no difference in compliance between the two Cervelos.

Chain Stay Length

Here it would seem that the three manufacturers have all adopted simitar philosophies and lengthened the chain stays of their tess extreme models, though there is a difference in degree. The reason that the higher head lube models have longer chain stays is as follows. When the bars are raised, a portion of the rider's weight is transferred from front wheel to rear wheel. If too pronounced this can lessen steering stability and cause the front end to feel imprecise when cornering at speed. So the frame designer needs to keep some weight on the front wheel but doesn't want the rider to have to bend further down to achieve this. The simplest option is to move the rear wheel further back. Doing his leaves the rider's centre of gravity inherently closer to the front wheel than would be the case with shorter chain stays. Specialized have added an extra 10mm, Giant 15mm and Cervelo 11mm in an effort to achieve this. One by product is that longer chain slavs cause less bend in the chain when using the innermost and outermost rear cogs and so is a positive in terms of having a smoother and quieter gear train.

Conclusion

All of these 'alternative' models fill a perceived need, but there are slight differences in emphasis as you would expect from different frame designers and all promote an optical illusion of sorts. With compact frames, as all of these are, when a viewer glances at the bike, what they lend to note is how much seat post is exposed. Also whether the stem is in the lower minus 6 - 8 degree position or Ilip flopped to the higher plus 6 -8 degree position and how many millimetres of head set spacers are used, These higher head tube frames allow a more appealing, racy look than would otherwise be possible with a shorter head tube. Equally, and I hope I have been successful in explaining, all have been designed as a package to allow those tess flexible to have bikes that steer and perform as well as each manufacturers 'pro' offering. Choice is good and all the manufacturers mentioned at the beginning are to be applauded for making these frames available.