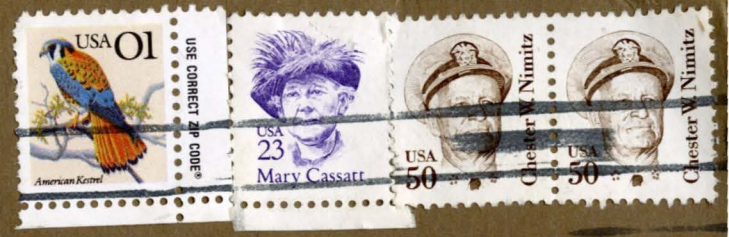




BRIDGESTONE

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RIVENDELL BICYCLE WORKS
EVER SINCE 1994

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Dear Drew (I think I already sent you this)

Thanks for your interest in a Rivendell frame. I don't have a brochure yet, or even any pictures, but here's some background and detailed information. You are not seeing it in final form, but the information is accurate.

I plan to have road frames by the end of February, and the others by late March. But few things you really care about ever work according to plan, and this is especially true in a start-up. I'm mentally preparing for delays.

The issues are the tubing and lug delivery. I'd be up and running now if I'd chosen stock lugs and tubes, but I didn't want to start off with that compromise. My very first customers should get my best efforts—I'd be embarrassed to sell you a Rivendell frame now, and later send out a flyer saying "New! Improved! Way better!" As it is, every detail on these frames is just the way I want it. Maybe my delivery concerns are unfounded, but if Reynolds needs more time to get the butting right, I want to give them that time, rather than substituting a second choice tube. And, since the tubes are custom, I have to guess how many of each model and size I'll be selling in any given month, and order tubes 60 days in advance, and the only thing I know for sure is that my guesses will be off.

Yet another potential snag is that both Waterford's frames and Rivendell's are made with Reynolds 753 tubing, and you can't just pluck an experienced frame brazer off of the unemployment line and have them light the torch—they have to become certified to build with 753, and they have to learn the Waterford way. As you know, Waterford builds its own frames, too, and the increasing demand, combined with whatever demand there is for Rivendell frames, may tax the capacity. Richard Schwinn at Waterford is a wonderful guy, and has assured me that Rivendell frames will be given a high priority.

If you want a frame, let me know as soon as possible. If you bail out, you get a refund, so you're risking nothing. The earlier you get your name on the list, the better the chances of delivery. Your patience and tolerance will be rewarded with a beautiful frame that will last you a long, long time.

I can design for you a custom frame, but with the few exceptions noted in the enclosed propaganda, expect an upcharge of about $100, and another month or so to deliver. Custom sizes are the easiest. Geometry changes are possible to an extent, but "the sky's the limit" doesn't apply here (No tri-bikes or recumbents, for instance). Although I haven't listed small sizes, I am especially sympathetic to riders who need small frames, and I know how to design a good one without cheating.

I expect to be able to offer single-color powder-coated frames for between $850 and $875, and fancier, paneled, painted frames for $950 to $1,000. And you'll be able to buy them bare, or with the hs, bb, and seat post of my choosing. I'll choose good ones. There will be one or two standard Rivendell colors, and custom colors cost extra.

Thanks again for your interest, and contact me any time for more information.

Grant Petersen

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## Rivendell Frame Geometry • January 7, 1995

| | seat tube | head tube | fork rake | top tube | chain-stay | bb drop | over-lock | TT/ST Ø | DT Ø |
|---|---|---|---|---|---|---|---|---|---|
| ROAD | | | | | | | | | |
| 52 | 73.5 | 73 | 45 | 53.5 | 42 | 75 | 128 | 28.6 | 28.6 |
| 54 | 73 | 73 | 45 | 55 | 42.5 | 75 | 128 | 28.6 | 28.6 |
| 56 | 72.5 | 73.5 | 42.5 | 57 | 42.5 | 75 | 128 | 28.6 | 28.6 |
| 57.5 | 72.5 | 73.5 | 42.5 | 58 | 42.5 | 75 | 128 | 28.6 | 28.6 |
| 59.5 | 72.5 | 74 | 40 | 59 | 43 | 75 | 128 | 28.6 | 28.6 |
| ALL-ROUNDER | | | | | | | | | |
| 42 | 74 | 72 | 42.5 | 495 | 42.5 | 45 | 128 | 28.6 | 31.8 |
| 48 | 73.5 | 72 | 42.5 | 525 | 42.5 | 45 | 128 | 28.6 | 31.8 |
| 52.5 | 72.5 | 73 | 38 | 555 | 42.5 | 45 | 128 | 28.6 | 31.8 |
| 54 | 72.5 | 73 | 38 | 565 | 42.5 | 45 | 128 | 28.6 | 31.8 |
| 55.5 | 72.5 | 73 | 38 | 575 | 42.5 | 45 | 128 | 28.6 | 31.8 |
| 58 | 72 | 73 | 38 | 585 | 42.5 | 45 | 128 | 28.6 | 31.8 |
| MOUNTAIN | | | | | | | | | |
| 14 | 73 | 71.5 | 40 | 535 | 42.5 | 40 | 132.5 | 28.6 | 31.8 |
| 16 | 73 | 72 | 40 | 555 | 42.5 | 40 | 132.5 | 28.6 | 31.8 |
| 17.5 | 73 | 72 | 40 | 570 | 42.5 | 40 | 132.5 | 28.6 | 31.8 |
| 19 | 72.5 | 72 | 40 | 587 | 42.5 | 40 | 132.5 | 28.6 | 31.8 |
| 20.5 | 72.5 | 72 | 40 | 597 | 42.5 | 40 | 132.5 | 28.6 | 31.8 |

### Notes

**Road.** Smallest size is 52cm, because there are too many compromises in 700c wheel bikes below this. If you want a smaller road bike, I can design a 26-inch frame for you, and wave any custom upcharge. Same goes for larger sizes (but with 700c wheel, of course). Double eyelets standard, single or none on request. No change in price.

**All Rounder.** Size close to your road size, and even closer if you always ride drop bars. Moustache H'bars? — you can go a little smaller, but a taller frame allows more stem options. Double eyelets standard, single on request. Zero eyelets by permit only.

**Mountain.** Sized in inches. To convert to metric, multiply x 2.54. All dimensions are metric, so you can compare with other frames, and out of habit. Mtn frames have vertical dropouts. Single eyelets stock, doubles on request, no change in price.

***I may make small changes here or there, nothing major. Custom sizes cost more, except where noted. Priced from $850 to $1,000 depending on options, paint.***

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## Rivendell Road Frame

Most of the changes in road frame design during the past 20 years have been subtle, but the cumulative effect of shorter chainstays, steeper angles, loss of eyelets, and vertical dropouts has made the modern road bike less versatile than a 1970's model. The irony is that it is no more race worthy.

In a road frame, details make all the difference between one that's versatile and one that's not. Issues you don't usually consider, such as the height of the brake bridge, the length of the fork and the distance from the brake bolt hole to the underside of the crown, the internal dimension of the crown and the chainstays just behind the bottom bracket—those are the details that determine what tires the frame will accept. And since tires, more than any other single specification, determine what kind of roads or trails the bike is suited for, and are the most important component of a comfortable ride, tire clearance ought to be a *huge* issue. But in the design and purchase and selling of most road bikes, it never even comes up.

I'm nuts for clearance, but don't get the wrong impression—I'm not advocating turning all road frames into "hybrids." When you design more clearance into a frame, you do not give up any of the qualities that make a good racing bike feel so fine. The Rivendell frame has all the attributes you could ever want in a road frame, even if you never take it off the smooth race course; but it is so much more versatile than a typical racing frame that it's almost like having another frame entirely. The most "radical" dimension on the Rivendell road frame, and one that contributes a lot to its versatility is the chainstay length, from 42cm to 43, with most sizes falling midway between. Those are long chainstays by modern standards, but 42.5cm is the same length chainstays Eddy Merckx rode.

The Rivendell road frame is made from Reynolds' best 753 steel tubing drawn to Rivendell specifications, and is designed and built to ride hard in all conditions for the next 20 years. I designed it with a shallow seat tube angle to keep your weight back, which in turn reduces weight on your hands and

strain on your shoulders, and allows more powerful seated pedaling than you get with a more forward position.

Since the shallow angle shifts your weight to the rear, I've compensated with a slightly shorter-than-normal front-center (the distance between the crank axle and the front hub axle), and used longer chainstays to shift the rear wheel slightly farther back. The combination of a slightly shorter front-center with a longer rear-center is not a magic combination by any means, and it's not my discovery. But most modern frames tend to be too short in the rear, too long in the front, and the feel, if you're sensitive to such things, is a little off. I like longer in back, shorter in front. (Pino does, too!) Other details:

• **Medium length horizontal dropouts** let you slide the rear wheel far back for added fender clearance, or tire clearance at the chainstays. Or you can adjust the screws all the way forward to shorten the wheel base and make the bike turn quicker. The listed chainstay length of 42.5 cm (16.75-inches) is to the center of the dropout. You can adjust it from about 41cm to 43.5cm.

Vertical dropouts make the most sense on mountain bikes (for reasons explained on p. x), but the main reasons they've taken over on road bikes are (1) indexing's requirement that the hub axle-to-derailleur relationship be limited to a short range; and (2) many chainstays have gotten absurdly short—you can't slide the wheel forward to remove it, because it hits the back of the seat tube. One less-than-ideal solution to this is steepening the seat tube; you can see what a can of worms this is. Much better to give the chainstays enough length to let a whole slew of good things happen. The horizontals I'm using are entirely index-compatible (they're made by Shimano), but if you ride friction, you can take advantage of the longer slots.

• **Clearance for 35C tires, or 28C tires with fenders.** Most modern road bikes are compromised when they're off the race course, because they don't have clearance for practical street tires. Rivendell road frames are good for all roads, because they clear tires up to 700C x 35. *Even if you don't plan to ride tires that large, you'll benefit from the clearance.* If you break a rear spoke and your wheel wobbles, wouldn't it be nice if the tire didn't rub the chainstays? If you move to Seattle, wouldn't it be nice if your bike could fit fenders? Commuting, touring, dirt- and rough-road rides—there are times when the smallest practical tire is a 28, and I designed these frames with that in mind.

The dropouts have eyelets for carrying a rack or fenders, too, making these frames even more versatile. If you want to mount both a rack and a fender if

you like, just use a longer mounting bolt. If you just can't live with eyelets, I can leave them off. But if that's what you decide, please allow me one letter or phone conversation to talk you back into them. I can't imagine your ever regretting having eyelets. I know so many riders and racers, including me, who have an old favorite racing bike that they don't want to retire, but find its use limited by lack of eyelets. Eyelets can make it a useful all-weather commute bike, or a touring bike. If you're like so many people, you'll end up collecting a small stable of bikes over the years, and if none of them have eyelets, you've got yourself a lot of one-trick ponies. Enough said--you know how I feel about eyelets, but it's your bike.

• **Low bottom bracket.** Conventional wisdom says a lower BB makes a bike handle better and easier to control at high speed, and in my experience that seems to be the case. In BB heights, 10.25 inches is considered very low, and 10.75 inches is considered high.

But the term "bottom bracket height" makes sense only on a bike with tires on it, since the height of the bottom bracket grows and shrinks as tires get fatter or skinnier. (It drives me up the wall when frame brochures specify bottom bracket height without a tire reference.)

When you design a frame you work with *bottom bracket drop* (usually called hanger drop), which is the distance the center of the bottom bracket falls below the centerline of the front and rear dropouts. I don't know how other people design frames, but when I do it, drop is the very first dimension I specify, and everything else builds off of it. To determine the bottom bracket height you subtract this distance from the wheel radius (hub height). In the case of a road bike with skinny 700C tires, the wheel radius is about 13.25 inches. On a typical road frame with a hanger drop of 2.5 inches, this yields a bottom bracket height of 10.75 inches. If you put a far more useful 28C tire on this bike, the BB height jumps to 11 inches—strong evidence that the typical road frame is designed for hard, skinny tires, which aren't all that useful. Remember, a Ritchey 700c x 28 with a kevlar bead weighs just 220g, and is a faster than a skinnier tire on all but the smoothest roads.

I designed the Rivendell road frame for a practical tire. The frame has more hanger drop—almost 3 inches—so the bottom bracket is 10.5 inches with a typical 700C x 28 tire. With a racing tire it'll fall to about 10.3 inches. This is low by any standards, but it makes sense. Almost everyone rides clipless pedals these days (not me), and the cornering clearance gained by

cliplessness allows you to ride a lower bottom bracket. If you're still riding toe clips, then you probably won't be bothered by a measly half-inch reduction in BB height. That was my thinking, at least.

• **Rear dropouts spaced 128mm apart.** Until about 1975, almost every ten-speed was a true ten-speed, and the five rear cogs fit into dropouts spaced 120mm apart. In the mid-to-late 1970s, the birth and popularity of six-speed freewheels, which required 126mm spacing, made the old ten-speed obsolete. In time, six grew to seven which still fit into 126mm, and all was fine until the more-is-better crowd spread the dropouts further apart to make room for cog numero ocho.

Combined with the shortening of chainstays, this trend has led to sharper chain angles between the front chain rings and rear cogs, which increases wear and worsens shifting. The irony of eight cogs in back is that, with the shorter chainstays and all, the chain angle is such that with most cranks and bottom brackets, you're effectively cross-chaining when you're on the small front ring and either of the two smallest rear cogs. So you don't have the full benefit of the extra cog. And, although eight-speed clusters that have a top gear of 13t are available, they are rare. Stock bikes almost always have 12t top cogs matched with 53t big rings, and that's a pretty tall gear for mortals.

Then there is the problem of wheel dish—standard eight-speed wheels have virtually no dish on the right side—the spokes are nearly vertical, and this causes all kinds of wheel problems. Better spokes, rims and nipples have mitigated the situation a little, but the fact is that an eight-speed wheel on a 130mm axle must be built with wildly different spoke tensions on each side. Even spoke tension does more for a wheel than anything else, and it's eight-speed wheels make it impossible. Consequently, the wheel doesn't want to stay true, and requires constant tension adjustments throughout its life.

It's far better to do without the eight rear cogs, the problems they bring, and the fairly useless 12t rear, and instead stick with a seven-cog cluster in back with a top cog of 13t. You get a stronger wheel, a better chain angle, and a longer-lasting drive train. The 128mm spacing on a Rivendell frame takes seven-speed wheels with ease, and will spread 2mm to accommodate an eight-speed wheel. Although, if you're willing to spread the frame to 130, a really smart thing to do is use a 6- or 7-speed cluster and ride with much less wheel dish.

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## Rivendell All-Rounder

Ever since the 1992 XO-1, this style of bike has been a hard sell in the mainstream market. I can't understand why. It's just a light road frame with an extra stout downtube, built around 26-inch mountain bike-sized wheels. I honestly thought this type of bike would revolutionize the common "hybrid," but instead it just became a symbol of not fitting in. Anyway, the combination of road geometry and 26-inch mountain bike-sized wheels lets a lot of wonderful things happen.

The 26-inch wheels are inherently stronger and lighter than 700C wheels, and allow you to fit a huge range of tires to meet any condition, with plenty of room left over for mudguards (with tires up to 26 x 1.5"), so if the mood hits, you're ready to venture off on a lengthy, rocky, rainy tour. The beauty of this bike is that it'll take so many truly useful tires, up to mountain bike size. That's a big deal, since tires and wheels make a bigger difference in the ride than any other component.

The main visible differences between this frame and the 26-inch wheeled Bridgestone XOs are a larger-diameter downtube, horizontal dropouts, Reynolds custom-drawn 753 tubing, and unique lugs and crown.

The larger-diameter downtube is not a big deal. I could say it gives the frame more strength for off-road riding, and added stiffness, but the XO's, with their standard diameter downtubes do pretty well off-road. The stiffness issue is even less important—those of you who know how I feel about frame stiffness know I don't put much stock in it as the end-all of bicycle performance. The real reason I went with a 31.8mm down tube was to save tooling costs—this bike shares more lugs with the mountain frame than it could have with the road frame (because of the wheel size), and going to a 31.8 down tube saved me between $8,000 and $10,000 in tooling costs. Both this frame and my mountain frame use the same Waterford-designed BB shell as Waterford mountain frame, and I like this shell.

The Bridgestone frames are excellent in all ways, very well-built production frames, and I'll continue to ride my XO-1 daily. Rivendells are handbuilt by one of five 753-certified builders (John, E.J., Marc, Chris, or Wendy), and nothing has been withheld any step of the way. The miters, where the tubes fit together under the lugs, are perfect. The lugs are lighter and extra care has gone into making them pretty and stress-free. The tubes are treated like babies from start to finish. In the case of the painted (as opposed to powder-coated) frames, they are painstakingly masked and pin-striped. Finally, they are treated with a special rust-preventative, so you don't have to spray melted beeswax down the tubes. Bikes don't have to be made this well.

Compared to the Rivendell *road* frame, the head tube angle on the All-Rounder is slightly shallower, and the top tube and wheel base is slightly longer—a perfect match with the smaller-diameter wheels, which quicken the steering. I've often described the ride as "just like a nice road bike," but in fact there is a difference that I can't describe, and I've never known anyone who didn't like it.

The All-Rounder has enough clearance at the chainstays and fork crown to accept tires up to 2 inches wide, so although it is not technically a mountain bike, any rider with good skill and adequate judgment can ride it on most trails. (The World 24-hour Off Road Record is held on this frame's predecessor, the Bridgestone XO-1.) Build it with either Moustache H'bars or Drops, and it will be the bike you ride more than any other, I promise.

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**The Rivendell Mountain frame**

This is a light, strong, balanced, beautiful trail frame. It is not "suspension compatible," it is not available without a fork, no part of it is patented or patentable, and nobody gets paid to ride it.

This frame is laid out a lot like the Bridgestones were, but the seat tubes are half a degree shallower, because most riders shove the saddle as far back on the rails as they can, anyway. Slackening the seat tube angle half a degree lets you achieve this position and still grab the seat rails closer to the center, which means both the saddle and the seat post clamp will be stressed less if you land hard. It's unlikely that you'll want to put the saddle further forward than the slightly slack seat tube will allow.

I like steepish head tubes on mountain bikes, because they allow a longer top tube (for a stretched out position) while limiting the bike's front-center (between the cranks and the front hub). A shorter front-center improves traction and handling. I've always thought and many times even said that if I didn't feel pressured to publish geometries and I knew nobody would measure, I'd make a mountain bike frame with a 73-degree head tube. And here I am not doing it. (The All-Rounder was born partly out of this frustration—by not calling it a mountain bike, I could put a steeper head on it.) Anyway, the Rivendell frames have the familiar Bstoney head tubes and geometries because, numbers aside, the Bstones ride right.

The frame is just one of many things which affects how comfortable the ride is, and it still doesn't make as much difference as the wheels and the rider. Still, a frame that is light and not overly rigid seems more comfortable to ride than a heavier, stiffer frame. Maybe it's because light bikes are more maneuverable. I think a light front end is particularly important, because it lets you lift up over bumps and make last-second maneuvers faster than you can with a heavy front end. I suspect that suspension fork riders hit more bumps and hit them harder because they can't maneuver as well, and can't lighten the load up

front as easily. They just go stubbing along, thanking goodness for hydraulics. But for some riders, suspension forks are a panacea, etc.

But the Rivendell mountain frame/bike is perfect for a riding style which acknowledges that certain rocks are to be avoided, and that part of the reward of off-road riding is learning to use your judgement and skill to overcome technical challenges at your own private speed. With the direction most racing mountain bikes are headed, I don't expect many racers will buy this frame. But you can still go real fast on it.

The mountain frame, like all Rivendell frames, it is built with mature technology, proven materials, and the best craftsmanship. It would be futile to try to sell this style frame in the mainstream market, so strong are the forces against nonsuspended frames. But if your riding style emphasizes skill and judgement more than speed-at-any-cost, and you prefer attractive, high quality toys uncomplicated by technocracy, this may be the frame for you.

---

I don't like it when people refer to bikes with non-suspended rear ends as "hard tails" and non-suspended forks as "rigid." Those names are misleading.
The Rivendell fork, like many other fine off-road forks (including the Ritchey Logic, and the recent Bridgestone) is <u>not rigid.</u> It resists twisting enough to provide good direction, but it still absorbs shock because it flexes (without bumpers or hydraulics or independent blade movement. It weighs at least a pound less than even the lightest suspension forks, which is nice for reasons already stated. There are trails that you'll ride faster with a suspension fork, and if pure downhill speed is your thrill, the menu if vast.
Speed aside, there have been studies that "prove" that you use less energy riding a suspension bike, even if it weighs a little more, than you do on a normal bike. You use even less energy coasting. Bicycles are already the most energy-efficient form of transport ever devised, and out of the competition arena, it gets ridiculous to rate equipment based on the relatively small diffferences in energy expenditure between different sub-25lb bikes. If you have to prove a difference by measuring it with scientific equipment, then it hardly matters, anyway.

sidebar: Historically, competition has been used as a testing ground for technology that eventually did trickle down to the rest of us. But most of today's modern high-tech race bikes are inbred permutations that have evolved in the specialized world of competition, and are as appropriate for general riding as an electric carving knife is for slicing an apple; workable and novel, but not the best tool. I've no bones to pick with racers or racing, but it's time to take them off the pedestal. Scientist and philosopher Joseph Priestley might as well have been talking about bicycles when he said "We don't get grace from gadgets."

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**A sidebar to nothing in particular**

The experience of riding goes far beyond the hardware, but a bike frame really is sensitive to seemingly minor changes in angles and lengths. How sensitive you are to these differences depends on how much you've ridden, how many different bikes you've ridden, and of course—as every salesperson knows—how susceptible you are to suggestion. It may not be a good thing to be so sensitive to the difference in a 40cm chainstay and a 42.5cm chainstay, but sensitivity isn't the issue when you can't fit the tire you want in the bike with the shorter stays.

Some comments about "responsiveness."

How should a bike behave? Most people agree it should be pleasant to ride, fun, relaxing, exciting, assuring, predictable, controllable. Obviously there are some contradictions there. Cycling ads, articles, and catalogues unwittingly steer cyclists towards "more responsiveness," and most people are happy to be lead, since "responsiveness" is something we look for in so many animate and inanimate objects in our lives, anyway. Another word for unresponsive is broken, and a body that is *not* responding is dead, so we are wired to lean towards things that respond, and we habitually think more of a good thing is better. Then there is the analogy of the bicycle as wild stallion or bucking bronco or sports car, and there is a certain amount of puffery that goes along with taming the beast.

The issue ought to be controllability, because that's the difference between exhilaration and terror. If you're a pack-filler criterium racer on a short course with lots of 90-degree corners, and one hairpin just to make things interesting, and the course is wet and there are Botts dots all around, you need a bike that goes where you look, that reacts to a muscle-twitch—provided you've learned how to drive this bike. But do you want the less experienced rider in front of you to be on the same bike? Would you want to ride that bike loaded with 10 lb. of gear down a long, straight downhill on a narrow road with lots of traffic and gusty crosswinds? Probably not. You want a bike you can control well and quickly for the kind of riding you do, period.

Tire compatibility aside, I'm not trying to make you sensitive to ride differences caused by my particular pet geometry, but I believe there is a difference, and $1,000 is a lot of money to spend on a frame without knowing all the details. The frames won't be quite that much, however. It's looking like anywhere from $875 to $990 with headset, seat post, bottom bracket.

**Frame Tubes...Rivendell Frames.....for a brochure...when i get some time...**

Reynolds 753 is a manganese-molybdenum steel alloy, like Reynolds' famous 531. It is not chrome-moly. The magic of 753 is that it has been heat treated for extra yield and tensile strength—nearly double that of standard, high quality chrome-moly—yet is has nearly the same elongation. *Elongation* is the ability for a material to stretch (or bend) without rupturing (a rubber band has high elongation; styrofoam, almost none). A metal that can do this is usually called *ductile*, and ductility is critical to bike frame materials.

In most metals, including most bicycle tubing metals, as strength increases, elongation decreases; usually in the same proportions. The magic of 753 is that its strength is so very high, and the price paid in elongation was so very little—it is still plenty ductile for use in a bicycle frame. Reynolds introduced 753 in the early 1970s, making it the first of the bicycle super steels. Reynolds developed it for super light road and time trial bikes, and in a storybook debut, it was ridden to victory in the Tour de France in its rookie year.

The high strength and ductility of 753 allows you to use thinner and lighter tubes than you would with lesser tubes, without worrying that the frame will break in normal use. (Or, if you want to keep the ride qualities and weight about the same, you can use the same tubing gauges and get a stronger bike in the bargain. Almost no one does that, but I think it is an honorable objective).

Every materials discussion talks about tensile strength, but most people don't know what tensile strength is—they understand *strength*, but not *tensile*. In any case, tensile strength is not as consequential as you might think. It is measured in a pull-apart test conducted on a solid bar of material, like a rope in tug-o'-war. A material can have a high tensile strength but still be unsuited to a bicycle frame. Plate glass is an example. Its tensile strength is 500,000 psi—five times that of standard CrMo steel, but . But glass doesn't fail in tension—it fails because it isn't tough. It cracks easily, and the cracks propagate quickly. No part of a bicycle frame is stressed solely in tension, and when you consider that even the weakest frame materials have tensile strengths of 44,000 lb., it's clear that lack of tensile strength isn't to blame in most frame breakages. It plays a role, but durability is always a combination of qualities.

Reynolds 753 has more than enough tensile strength to satisfy the most paranoid tensile strength police, but what is more important, it is ductile enough to resist cracking under the kinds of twisting and bending that bicycles see every day. Its ability to flex without cracking allows the frame builder to put a certain controlled amount of flex in their designs, so the bike feel alive and essential. Admittedly, "alive" and "essential" are unquantifiable terms, but they are the difference between the muscley* feel of fine steel

frame and the rigid-but-dead* feel of a board stiff, fat-tubed frame of some lesser frame material. *to use other unquantifiable terms

Reynolds 753 is also reasonably easy to fabricate, which helps keep costs in line. It is tough, like all steels, so it doesn't mar or dent too easily, and as long as it isn't abused, it retains its good qualities as it evolves from raw tube to frame joint. Also, because it is so workable, you can straighten it after a crash or even replace entire tubes with little or no consequence, especially if the frame is lugged and silver-brazed.

But in any case, a good starting material alone is not enough. No less an authority than Richard Sachs has said, "In bike-making, material is the least consequential thing on the planet." Of course it matters, but once you're in the ballpark of acceptable materials, the key is good design that minimizes inborn stress, and good joinery and finishing.

I also think bike frames should be pretty, and I've always liked lugs. I admire the skill that goes into a tidy TIG weld, to be sure, and I recognize that welding can make a stalwart frame—and there may even be a TIG-welded Rivendell some time. But to me, lugs honor the craft of the builder and acknowledge that bikes are important in and of themselves. I even like really fancy lugs, but the trouble with them is that they take too long to braze, and that's not good for the tube.

Rivendell's road lugs were designed by Richard Sachs, and their ornate curves and swooping points belie that they braze up fast and coddle the joint. Note the supportive, large-radius spoon on the underside of the lower head lug—it will never "can opener" the down tube. The window serves as a feed slot for the silver, reducing torch time and making it easier to tell when all the silver has been sucked up.

I supplied Richard with blank lugs, which he then carved and filed by hand into the prettiest contours I've seen on any lugs. The lower head lug alone took him eight hours. Hank Folson, whom you may know as Henry James, translated Richard's drawings to paper, because the casters work from paper.

I designed the road crown to complement the lugs, and if you look closely you'll see that the inside tangs that rest against the fork blades, are shaped to match some of the "leaves" on the lugs. I was tempted to put a fancy R on the flat crown shoulders, but went with the less egotistical, more classical "epaulets," as seen on so many old French crowns, as well as military uniforms, notably that of the famed Russian, Alexander I (according to my dictionary.) (leave this inanity out of the real brochure)

I couldn't be happier with the crown. I had a lots of help from Chris Fiorini of Waterford. Chris was a custom builder himself, and put in several years at the old Trek before hooking up with Schwinn's Paramount division. Besides being a custom builder,

he's a phenomenal freehand artist (he illustrates for the Rivendell Reader), and a whiz at Auto Cad.

Chris and Marc Muller and I collaborated on the mountain and all-rounder lugs. I tried their patience with changes, and I must publicly thank them for putting up with the ordeal. The big breakthrough came about halfway through the design process when I submitted the idea of the curl on the side. Mark and I liked it, but Chris had strong reservations, and Chris has excellent taste, so I was confused. Then Marc and Chris put their heads together and submitted a design which met the original requirements all along. I am so happy with them. They have old, classical details, because they were influenced by old, classical lugs—but aren't a copy of anything. As usual, my talent is in hooking up with the right people.

Rivendell frames are light, but not as light as titanium frames, or aluminum ones, or even the lightest steel frames. Most of the tubes were drawn to my specifications, and my goal wasn't to compete with thin-walled aluminum or even butted titanium; it was to build a light frame of extraordinary beauty and exceptional strength and toughness that you can ride hard for many years without worrying about dents, fatigue, or buckled tubes, even if the frame is accidentally abused.

Bear in mind that steel frame tubing dimensions have stayed pretty much the same for years and years, and no theoretical, computer-aided design or finite element analysis testing can take the place of millions of miles of riding by hundreds of thousands of riders over the past century. To ignore steel's history would be foolish, and to see lightness as an end-all—and to think you can just strip several ounces from a down tube without paying for it down the road would be more foolish, still. Where I've gone thinner (and therefore lighter), I've done so cautiously. My tube thicknesses generally fall between standard Reynolds 753 and Reynolds 531. Somebody, sometime is sure to sum up the frame as simply a "retro" statement, or think I've "missed the mark" because I'm not pushing the limits of lightness, but *that* misses the point.

A tube's diameter to wall-thickness ratio bears watching. Over the years, traditional steel tubing hasn't exceeded 50:1 (28.6/0.6=47.66). But most of today's supersteels have higher yield strengths, and can exceed that a certain amount. It is true that going oversize with a thin wall is a good way to make a tube stiffer and stronger, but all things equal, a smaller diameter tube with a thicker wall resists dents better than a large diameter tube with a thin wall. High wall-thickness-to-diameter ratios are particularly scary in aluminum; and yet this is the "secret" behind some of today's featherweight aluminum frames.

In a front-end impact, the most highly stressed portion of a bike is the downtube, so, against today's trend, my downtubes have full-length butts. Downtubes are stressed in torsion (twisted) when you pedal hard, so I've kept the bellies thicker, to better resist the torsion. (Waterford does this, too—and now is a good time to mention that I've relied heavily on Waterford's experience with all brands of frame materials. Marc still thinks I'm too conservative, and he may be right.)

The mountain bike chainstays are a full 1.0mm thick, better to withstand the wear of chains. I could have used a thinner left chainstay, as I did on the road bike, but I was already asking for many custom tubes, and I didn't want to push Reynolds over the edge.

Rivendell frames are still light, though, and every gram of metal is well-placed. I'm not saying you can pile into a two-foot wall at 20mph and not expect any damage, but Rivendell frames have a little extra strength in the critical places, and I suspect they'll survive certain abuses that would destroy many other lightweight frames. Barring anything major, your Rivendell frame will be going strong twenty, thirty years from now.

**Sidebar:**

**Most thin walled, heat-treated steels like 753 are more sensitive to heat than standard chrome-moly or 531. Since Reynolds didn't want the reputation of its premium steel to suffer at the torch of a less than premium builder, it required frame builders to pass a test in order to become certified.**

**So you bought tubesets from Reynolds, built up a couple of frames, then sent the frames back to England for testing. If the frames passed, you got your certificate, and could buy and build with 753. You could try until you passed, and many notable builders had to try several times.**

**These days, 753-hopefuls can buy from Reynolds a small kit consisting of a bottom bracket and four tubes, which they braze up, send it off and wait for the test results. But since 753 is so expensive, and must be brazed with silver (at $7 per ounce, compared to brass, at $6 per pound) not many builders are aching to become certified. They just opt for unrestricted tubing, which costs less to begin with and doesn't require a test.**

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