



DESIGN BEHIND THE BIKE

MATERIALS

INTRODUCTION V.O.

The first bicycles in the early 1800s were made from wood. By the late 19th century, steel was widely used. Since then, advancements in technology have brought aluminium, titanium and carbon fibre to the bike industry. Developments have not stopped there with a recent resurgence in the use of steel tubing.

1. THE MATERIALS

BEN SPURRIER, HEAD OF DESIGN, CONDOR

The biggest change in terms of technology and manufacturing over the last 50 years has been in materials and those influences very often come from other industries such as the motorsport industry, aviation industry. These are all areas which will use high end materials and also manufacturing processes such as the use of carbon fibre, the use of alloys.

2. STEEL

V.O.

Steel was historically the material of choice in bicycle manufacturing due to its particular properties, with British company Reynolds being at the forefront of steel tubing design and production.

TERRY BLACKWOOD, RALEIGH UK PRODUCT MANAGER

We tend to use steel on our lower end bikes because it's affordable, it's easy to build with and it still makes a great product.

PHIL HAMMILL, BRAND DIRECTOR, GENESIS

Steel frames offer us a lot of benefits in that we're using cutting edge Reynolds 953 tubing, which is super light. A great benefit with steel is the safety factor in that steel doesn't just fail catastrophically.

KEITH NARONHA, REYNOLDS

You've got a very durable material, one that can be recycled, one that certainly as far as we can see, a rider theoretically could still be riding that bike 20, 30 or 40 years from now and still find the ride quality good.

3. ALUMINIUM

TERRY BLACKWOOD, RALEIGH UK PRODUCT MANAGER

When it comes to more performance orientated products, aluminium starts to come into the field. Again it's relatively affordable, so we can build good, lightweight bikes at good prices. It is also a material that with the new hydra forming techniques that you can build some really complex shapes.

PHIL HAMMILL, BRAND DIRECTOR, GENESIS

Aluminium offered the opportunity to use much bigger tube sets for increased stiffness, also created quite a new look for bikes.

TERRY BLACKWOOD, RALEIGH UK PRODUCT MANAGER

Aluminium is one of the greatest materials to building bicycles out of, it's cheap, it's light, it's strong and if you use it properly you can build an absolutely fantastic bike.

KEITH NARONHA, REYNOLDS

We do work in aluminium especially alloys known as 6061 and 7005 but for Reynolds they don't have the very high strength to weight ratio we would use for the higher end frames that tubing that we produce for our customers.

4. TITANIUM

V.O.

Titanium is used in the aerospace, military and automotive industries to produce lightweight alloys. This low density and high strength material, comparable to steel on a stiffness to weight ratio, was introduced to the industry to build light, strong bikes with a good fatigue life.

PHIL HAMMILL, BRAND DIRECTOR, GENESIS

Titanium is a really great material, really super light but also a little bit flexy so you don't get the stiffness but you get really good weight and also good durability out of it.

TERRY BLACKWOOD, RALEIGH UK PRODUCT MANAGER

Titanium is one of those wonder materials that has a great ride quality to it, so does steel, but a titanium bike would be probably twice as expensive, if not three times as expensive and only marginally lighter, so what are the benefits to that rider in building that bike out of titanium if they can't afford it?

KEITH NARONHA, REYNOLDS

The techniques for welding titanium are, have to be actually very precise because you can actually, if you don't know what you're doing with a titanium frame, you can actually have a very poor weld so there are very few people who make very good titanium frames but the cost of the material can be very, very high.

5. CARBON FIBRE

PHIL HAMMILL, BRAND DIRECTOR, GENESIS

Then came carbon fibre which pretty much revolutionised the whole road bike industry because that allows designers to achieve shapes and weights that was never possible with aluminium or any other material before that.

BERNARD HINAULT

In 85 with the Tapie Group we started working with carbon and that's where we really started to evolve. We researched every are to be able to have the lightest possible with the highest level of performance.

BEN SPURRIER, HEAD OF DESIGN, CONDOR

Carbon fibre is in many ways the ultimate material for a performance machine. There are very few materials around at the moment which combine the same levels of strength, lightweight and versatility in terms of manufacturing. You know if it's good enough for a Formula 1 car then it's good enough for a bicycle as well.

BERNARD HINAULT

The best today above all is carbon. Because carbon is a constant material. It's tissue with resin and once you've shaped it, it stays in shape.

ALBERT STEWARD, PRODUCT MANAGER GENESIS

Carbon because of the flexibility it gives you tube shapes means its ideal, ideal for exploring aero designs.

BEN SPURRIER, HEAD OF DESIGN, CONDOR

The downside of carbon fibre is that it's an expensive process. It's an expensive process, an expensive material to work with because it's fairly labour intensive.

JOHN HERETY, FORMER PROFESSIONAL CYCLIST

You feel every bump in the road on a carbon fibre bike. The steel frame is a little bit more forgiving.

6. RESURGENCE OF STEEL

V.O.

In light of the disadvantages of working with carbon fibre, steel has seen a recent resurgence in bicycle manufacturing even at a high performance level.

KEITH NARONHA, REYNOLDS

It's very encouraging to see steel back in the pro peloton. The UCI weight limit 6.8 kilos for a bike can easily be achieved with a steel bike with standard components that are around now, so the weight per say is not an issue.

ALBERT STEWARD, PRODUCT MANAGER GENESIS

In recent years we've seen a series of dubbed super steels arrive on the scene which offer, offer an incredible tensile strength, which means we're able to draw the tube wall diameters very thin, so achieve weights that were previously unachievable.

TERRY BLACKWOOD, RALEIGH UK PRODUCT MANAGER

What we are seeing from the likes of Reynolds and other quality tubing manufacturers is some great lightweight, quality tube sets coming along. So you're seeing an increasing number of performance bikes with steel in them.

KEITH NARONHA, REYNOLDS

Over the years the strength of metals have changed dramatically. Even the Reynolds 531 invented in 1935, the tensile strength of cold worked 531 was up at 750 to 800 megapascals back then. Our Reynolds 853 is up at the 1200 megapascals and we've been doing that tube for about 15-20 years now and when we move onto the Reynolds 953 we're looking at between 1800 and 2000 megapascals

7. PRODUCTION TECHNIQUES & CHOICE OF MATERIALS

TERRY BLACKWOOD, RALEIGH UK PRODUCT MANAGER

Material choice is a whole balance of different scenarios into what we use the material, what price point and what bike. Price of material is probably the principle one, but then it's also what is the ride quality we want at the end of it.