BRAUN

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Fig2: *Render of the assembly of the custom made titanium Hone bicycle frame. The lugs of the frame are made with topology optimisation technology.*

1.1 Braun-cycling

Braun cycling is a company that builds tailor-made, custom bicycles. The small brand is family owned and run by Herman Braun and his son Dave Braun. Located in the province of Zuid-Holland, the company is a well-known brand within this region. Herman and Dave believe that a road race bicycle should not only be fast, but also comfortable and made to last. These principles are reflected in the classical diamond shaped frames made out of the traditional bicycle material: steel.

Herman Braun

Herman is the founder of Braun cycling. Most of the time, he takes care of the bicycle assembly and customer services. During his years of working as a mechanic, Herman gathered an unimaginable amount of knowledge on bicycles. The mix of the feedback from professionals, the hours of tweaking the frame geometry and the vast amount of bicycles he built, gave Herman an almost instinct driven building method. 'Knowledge by vast amounts of experience' is a phrase that fits Herman Braun best.

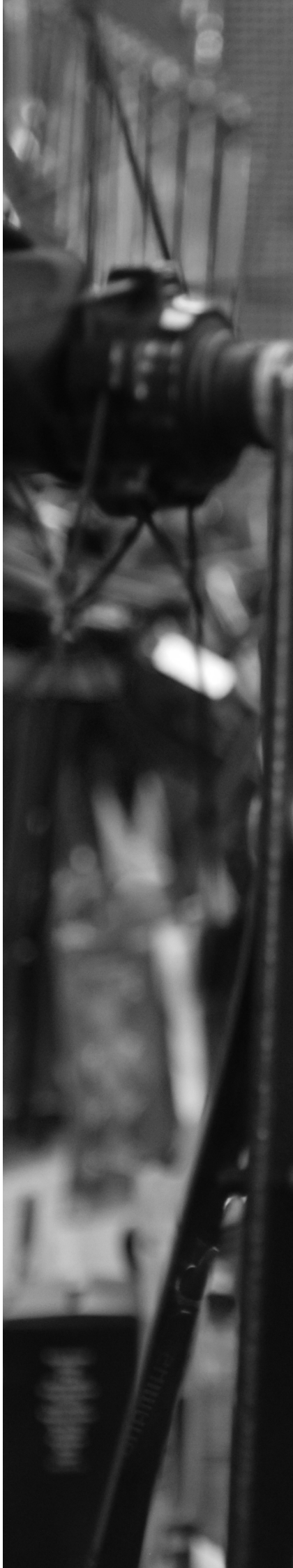

Fig8: *Herman Braun placing and checking the exact position and alignment of the spokes in a wheel*

Dave Braun

In 2010, the son of Herman, Dave Braun, entered the company. Being educated as a welder, it seemed a logical fit that Dave became the builder of the frames at the Braun company. Dave strives for perfection in his work and does so in a very tidy and orderly fashion. Every step in the building process of a frame is carefully written down in multiple books by Dave. Normally, manual labour has its freedoms that give room for creativity but, more importantly, room for mistakes. However, the workflow of Dave, following his workbooks, guarantees that everything that is done by hand is made to perfection.

Fig9: *Dave Braun milling a bicycle tube to the exact length for a custom steel bicycle frame*

Working with metals

Steel and other metal-alloy road race bicycle frames are surrounded by prejudice and seemingly disadvantages (heavy, slow, cheap, flimsy). Still, the Braun-cycling company makes custom metal-alloy frames that are in no way old-fashioned or second-grade.

Someone unfamiliar with road race cycling and the Braun-cycling company might ask why Braun cycling does not change its bicycle frame material, mainly due to all of the developments that have been made in carbon. If we look at other tailor-made road race bicycle frame companies, we can see that a lot of them are working with metal alloys, but why? Milling tubes of steel and welding them together to make a frame is much faster than layering carbon-fibre sheets, putting them in an oven, etc. This makes the production of a metal-alloy frame less costly than a carbon frame. The stacking of the carbon layers is a precise and critical job. Doing it wrong will lead to a faulty material structure and could cause frames to break very easily. This makes creating metal-alloy frames much more suitable for a small market in which every order is in a different size. That is why many custom frame builders still work with metal-alloys.

The knowledge of Braun-cycling behind the bicycle as it is right now is something that has been evolving over countless custom frame productions. Up to the point that there is 40 years worth of knowledge invested in perfecting the geometry. All of the knowledge and production methods of Braun are based and perfected on building with metal-alloys. Many ex-professional cyclists ride the custom frames of Braun. There are even stories of Braun frames that are badged over with competitor logos, which are then used in pro-competitions and championships.

If Braun-cycling would change the frame material, a whole new production technique needs to be created and optimised. To create such a technique would be time-consuming and costly. The strength and uniqueness of the Braun-cycling company are its 40 years of knowledge and experience, the strength of the company will go unused when switching to new materials. Next to the unused company strength, we could also note something else. There is a potential demand for metal-alloy road race bicycles. The metal-alloy bicycle makes for a very versatile bicycle as, the material is less fragile and delicate than carbon. Looking at big bicycle retailers like Mantel.com, it could be concluded that carbon bicycles are often built with one goal: either climbing, time trial or long distance riding. This is shown by the separate categories of time-trail, tour and climbing bicycles. A bicycle that is optimised for one goal is very suitable for professional ‘sponsored’ cyclists as they need to perform at the highest level and do not pay for the bicycle themselves. As more people around the world focus on becoming more sustainable, it is relatively easy to create a platform for a more multifunctional bicycle. This development could create a bigger market for a metal-alloy bicycle.

Fig10: *Herman Braun, mitering the chain-stays of a custom steel bicycle to make an precise before welding the chainstay to the bottom bracket*

Bicycle tube manufacturers

There are only a handful of 'real' road race bicycle tube manufacturers left in the world. Most of them are located in Italy or Japan. Upon visiting two of these tube manufacturers (Dedacciai and Columbus) located in Italy, the impact of the change of bicycle materials became clear. These companies, once giants of the road race cycling industry, were reduced to a big factory hall full of machinery and some racks stacked with tubing.

Dedacciai had switched to producing mainly parts for sporting goods, instead of bicycle tubes. Both companies started selling carbon frames next to their existing metal-alloy frames, as the market has shrunk drastically.

Shapes and sizes
Not every bicycle tube has the same shape, some are oval and others are round. The tube manufacturers make these tubes different per order for each company. Changing shape requires new tools with high investment costs and techniques. Thus new shapes can only be ordered per large quantity. Some of the shapes are 'off-limits' for other companies, as there are verbal agreements that only the owner of the shape can use the tube.

Most metal-alloy bicycle tubes are made lighter via a process called butting (patented by Reynolds in 1987). Butting can be compared to stretching out the tube to make the wall very thin. The ends of the tube are kept a bit thicker, as this guarantees a better weld. In the hay-days of the metal-alloy road race bicycle, tubes were butted in the sizes small, medium and large (length sizes). This was done so that the smallest and largest frame sizes could all be made as light as possible. With the fall of metal-tube sales, the stock needed to shrink. Nowadays, only large butted-tubes are produced. If a company wants other lengths of butted tubes, large quantity orders must be placed to change the production process.

Fig28: *(left) A rack full of bicycle tubes at Dedacciai*
Fig29: *(right) The tube fabrication hall of Columbus*


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1.4 Conclusion analysis

The core strength of Braun-cycling is making high-quality custom metal-alloy bicycle frames. A signature trademark of a Braun bicycle is its classical geometry, which is a thing that has been developed and optimised over time to give the bicycle better handling characteristics. The current Braun user group is mainly existing out of the purist cyclist group. The Braun bicycle is liked by the current consumer because of its high quality and classic look. Because of the long lifespan of a Braun bicycle, the purist market is getting saturated. This calls for a new product with a new focus/target group. With the developing trend of nostalgia, a new target group for Braun cycling arises, the lifestyle cyclist. This target group uses cycling and bicycles as a way of expression and fashion statement, this opposed to performance-minded cyclists. This makes a high-quality Braun bicycle with a classical look a suited product for the lifestyle group.

The second trend that will come forth in the new Braun product is the trend of uniqueness. The bicycle industry is always trying to balance between optimising products for their performance and optimising the products for their looks, this where the consumer tries to be unique by using parts and colours that no one else has. Two examples of developments that improved performance but made bicycles more alike are the switch from lugged to welded frames, and more recently, the trend of aerodynamic integration of parts. Furthermore, it is very important to be unique in the custom bicycle sector. Most custom bicycle producers have metal-alloy frames with a classic look. This makes the consumer see the custom bicycles as a product group with the same qualities, this where in reality, variations in quality and price in between custom brands can be big.

As the consumer has a bias about the weight of the bicycle, the main focus of the new bicycle design will be to make the bicycle lighter, or at least appear lighter, than the conventional custom Braun bicycle. This implicates that aerodynamic optimisation will not be included for the design. Aerodynamic optimisations would require very expensive tube shapes which are unaffordable for a small company like Braun-cycling.

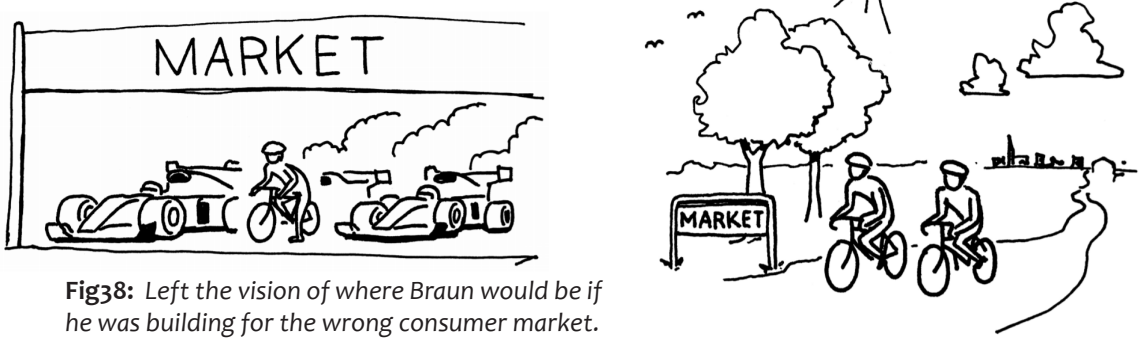


Fig38: *Left the vision of where Braun would be if he was building for the wrong consumer market. right the experience minded markt where braun is en should sell his product to.*

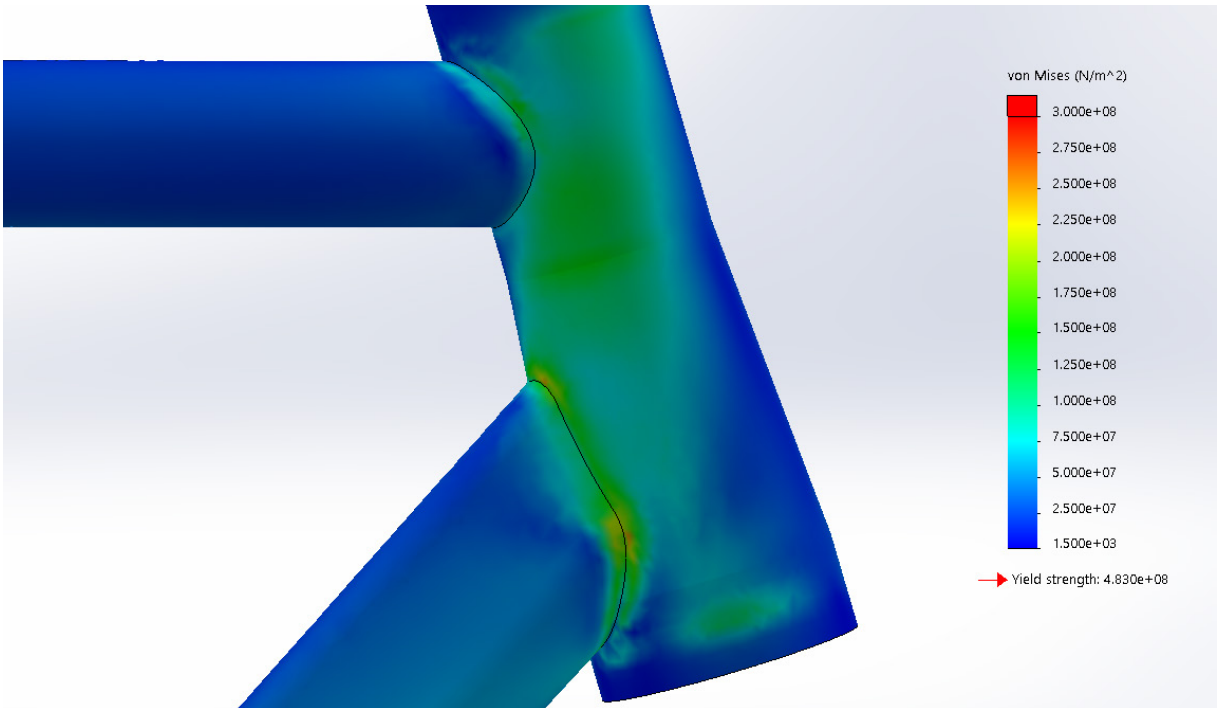
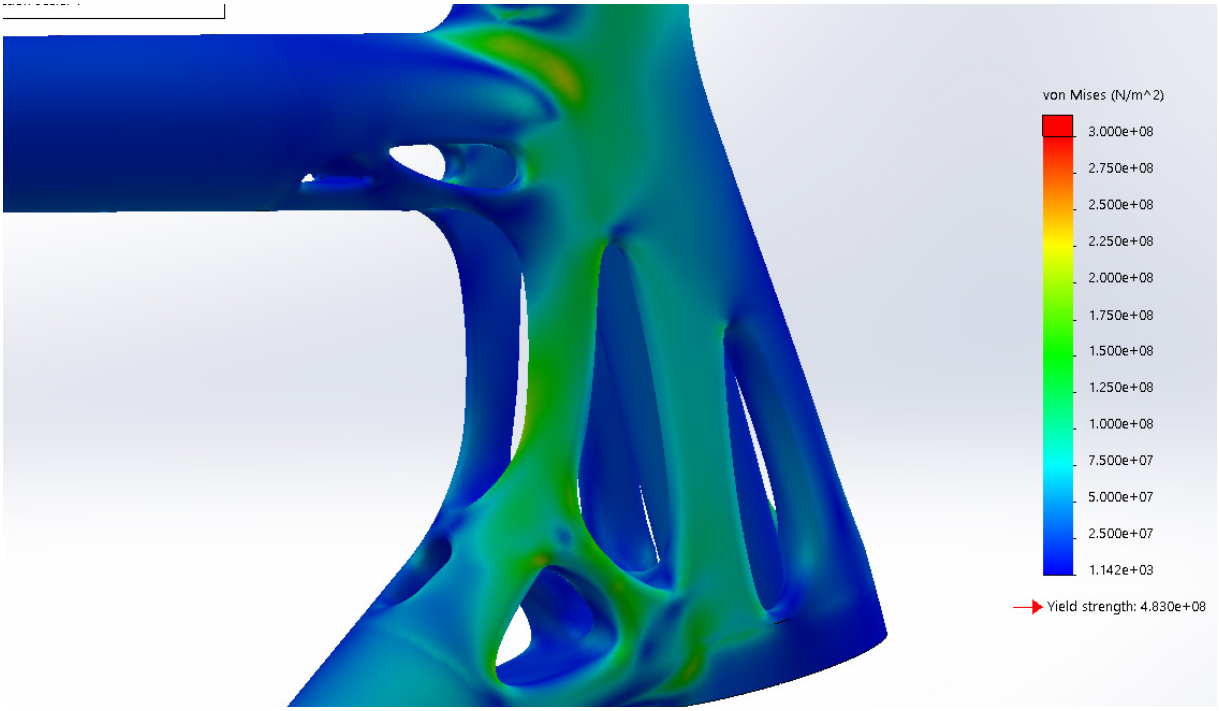


Fig83: *(above) The yield strength simuation results of the current titanium bicycle. We can see smal peak stress point coloured light red.*
Fig84: *(below) The yield strength simulation results of the new bicycle. we can see that there are less (high) peak pressure points.*



6.0 Hone titanium bicycle