

DIRK ZEDLER ON: FORK STEERER TUBES MADE OF CARBON

THE NUMBER ONE CAUSE FOR RECALLS

Light and ultralight road bikes, time trial bikes, cyclocross and gravel bikes usually have carbon steerer tubes. For 20 years, such steerers have been the number one cause for recalls in the cycling industry. Manufacturers, dealers and users are equally called upon to ensure their bikes are safe.



The biggest names in the cycling industry are always competing to achieve the best ergonomics, handling properties and, of course, the lowest weight. It comes as no surprise that carbon with its captivatingly good properties is the most sought-after material for lightweight builds. Early attempts to use the material for frames and forks during the late 1980s and early 1990s were often unsatisfying, making aluminium the most popular lightweight material for a number of years. In 2003 Scott pioneered the first large-scale production frame weighing less than 1,000 grams with its CR 1, and since then the carbon wave has been unstoppable.

Tremendous progress has been made with carbon as a bicycle material. Nowadays, no user of any well-established brand needs to be afraid of the once dreaded 'sudden death', i.e. abrupt and total failure of their frame. The rims of disc brake wheels, cranks, handlebars and seat posts have also become very reliable. Only steerer tubes keep causing problems.

What exacerbates the situation is that expander steerer tube failure often occurs on the inside, i.e. under the stem, spacers and headsets, invisible from the outside. We know from the many related recalls we were involved in over the years that riders do not notice the impending failure. The deterioration becomes apparent only once the handlebar including the stem comes off in the rider's hands – a picture known from many a spectacular race-day photo. Unfortunately, with the handlebar detached from the fork, crashing is unavoidable.

Hidden defects with many potential causes

There are many reasons why this high-performance material is difficult to

master when used for steerer tubes. The influencing factors include:

1. The quality of the steerer tube
2. The quality of the expander or compression plug
3. The quality of the stem
4. The installation conditions
5. The quality of installation and maintenance

All this means that manufacturers have a hard time getting to grips with the problem. In cases where all components are left as they were in series production, the manufacturer is able to optimize points 1 to 4, leaving only installation and maintenance. This is where the trouble starts. Many tinker with bikes without the right tools (e.g. a good torque wrench) and useful aids, which in this case is a carbon-specific assembly paste to increase friction between the components.

The installation conditions are another point that often leads to deviations from the bike's original state. Bicycles are typically supplied with 30 to 45 mm worth of spacers underneath the stem. Riders aiming for a more competitive position take out the spacers and place them on top of the stem. It is a recipe for disaster because the stem is no longer clamped tight at the height of the expander and the steerer tube can fail over time due to pressure at a soft spot. Therefore, having the steerer tube cut by a professional after a trial ride is indispensable. This means no more than a 5 mm spacer should remain on top of the stem.

Simply opting for a different stem can also lead to failure. Some stems have sharp edges on the inside and their clamping surface may be too small, which can also reduce the steerer tube's service life. Selecting a stem without checking it for

compatibility with carbon steerers potentially adds a breaking point to the bike.

Deficient standard

One of the reasons for the many recalls could be that some manufacturers strictly adhere to the bicycle standard. Until recently, the standard did not prescribe any checks in this area, although the author of this article published details on the risks and causes of carbon steerer tube failure as early as February 2000. Publications on helpful test procedures have been available, and our lab has for years housed nine testing systems designed to investigate carbon steerer tubes very realistically in their original setups, i.e. with their specific headsets, adaptable head tube and stem lengths and any number of spacers.

The recently updated standard disappoints once again. Instead of adopting the load cycles and forces which stems and handlebars have undergone for many years according to the standard, the numbers used for steerer tubes were significantly reduced. Under these circumstances, we will never see carbon steerer tubes that are truly safe for all purposes.

Manufacturers would do well to stringently test carbon steerer tubes as part of the system with the rest of their components. Additionally, they need to inform dealers and users and let them know what they should pay attention to for any required ergonomic retrofitting or maintenance tasks.

Users should never tinker with a high-tech material like carbon. Without the requisite know-how and special tools, they will only put themselves in harm's way.

■ Dirk Zedler



DIRK ZEDLER

Since 1993, Dirk Zedler has been an analyst and expert witness on bicycle accidents and product failures for courts, bike and insurance companies, and private individuals. He got his start in the industry by working for a large bike shop from 1986 on, and now holds the respected advanced engineering degree known as "Diplom-Ingenieur."

Courts have recognized Zedler as an officially appointed and sworn expert on bicycles since 1994, and on electric bicycles since 2014.

The Zedler – Institute for Bicycle Technology and Safety has used this wealth of knowledge, derived from his and his teams work in thousands of court proceedings and expert's reports not only in Germany but from the US to all over Europe, to enhance research and development in the bicycle industry.

The Institute sets the standards for the bicycle industry. It develops and builds testing equipment that is used by manufacturers to improve the riding performance and safety of their bikes, and by leading European bicycle magazines to test them. The Institute's work provides a basis for European and American manufacturers to communicate with their Asian suppliers. Manufacturers can buy test equipment from the Institute or use its state-of-the-art testing labs.

The Zedler Institute also prepares risk analyses, conformity papers, workshops, recall papers and user manuals for bicycles and pedelecs. These manuals, now available in more than 40 languages, help consumers use their bikes properly — and in many cases have protected manufacturers from liability.

Our experts draw on the wealth of experience gained through several thousands of expert's reports to train experts from in and outside the bike industry, such as automotive experts.

What we have learned from court cases, the proceedings of the market surveillance authorities and recalls is the content of our training courses for bicycle manufacturers. As a result, they are in a position to set up CE conformity processes internally.

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