The biggest troublemakers in the industry: low step-through pedelecs

They're unisex, convenient, and they let just about anybody become a cyclist no matter how athletic. They are pedelecs with low step-through frames, and they have become the top sellers on the e-bike market.

Testing equipment at the Zedler Institute

Even without knowing exact sales figures, it's easy to see that this style is the No. 1 pedelec on the roads of Germany.

A central tube that curves very low to the ground for an easy step-through makes these bicycles available to broad target groups. That's a welcome development, because it enables people who are overweight or have a disability to start cycling. That's healthy for them and gives them more mobility.

Young mothers can reach the saddle easily and comfortably. When riding with a mounted child seat, they don't have to risk the shaky business of throwing a leg over the top tube, as is the case with conventional frames.

In short, low step-through pedelecs have a lot going for them.

Pedelec physics. Unfortunately, they have a lot going against them, too. No other frame design has seen more recalls than low step-through frames — with or without electric motors. Most of these are made of supposedly reliable aluminum.

There have been many cases of frames breaking, resulting in falls that have sometimes severe consequences.

Products recalled by reputable companies are only the tip of the iceberg. As bicycle experts, we know of many other problematic frames whose problems are being ignored.

Why are these rider-friendly frames at such high risk of breakage, especially when used as a pedelec?

According to research and from personal experience, riding a pedelec increases a cyclists' average speed by about 5 kmh (3 mph). That doesn't sound like much, does it?

However, this means a typical 250-watt pedelec is constantly traveling with 75 percent more kinetic energy than a conventional bicycle. Impacts and bumps therefore affect pedelecs more severely than regular city bikes.

Other factors contribute to the problem:

- Pedelec riders tackle terrain that is more challenging than they are used to. In other words, pedelecs let cyclists climb mountains that were previously insurmountable to them. The problem isn't going uphill; it's that they eventually have to come back down as well.
- Pedelec users do not sit athletically in the saddle, but crash into every bump and rumble over every curb.
- Pedelecs are heavier and therefore under more strain. The electric assist encourages cyclists to carry heavier loads.
- Low step-through frames are not redundant. In other words, if one tube fails, there isn't another tube to hold the bicycle together. The rider falls head first onto the road.
- Pedelec users ride more often, according to research by several manufacturers.

A broken frame on a step-through pedelec

Taken together, this demonstrates that the potential for damaging a pedelec is significantly higher than for a conventional city or trekking bike.

The e-bike components add to the problem. With the weight of a motor and a rechargeable battery, typical pedelecs with low step-through frames mutate into genuine wobblers.

Inexperienced, less athletic cyclists — the typical clientele for these kinds of bikes — fall more because they often cannot cope with the pedelec's handling.

A wobbly pedelec doesn't necessary unseat its rider like a balky horse. Instead, riders alarmed at their bike's shaking may brake too hard in panic, or ride the brake as they creep down a hill. That can cause the brake to fail, leaving the pedelec totally out of control, and there we go!

Stepping up to the challenge. The good news: It is entirely possible to design stable and durable pedelecs with low step-through frames. To do so, the designer, product manager and testing institute have to treat the pedelec as something other than a conventional trekking or city bike that just happens to have a motor attached.

It does take some effort, but with the help of CAD systems and testing laboratories, safe pedelecs with low step-through frames are possible.

There isn't a simple recipe, such as adding an additional gusset or a welded-in cross tube. It requires the sum of many improvements, such as an adapted frame geometry, optimized tube dimensions, sophisticated welding procedures with thermal finishing treatments, a solid mounting of the bicycle rack, and functional cable routing.

It is possible to improve the riding characteristics of these kinds of pedelecs so customers can feel safe without shimmying. The safer these riders are, the fewer accidents they will have.

In addition, the durability of a low step-through pedelec can become comparable to that of a mountain bike that is made to endure hard use.

Only then will these kinds of pedelecs be able to cope with the increased strain of a heavy motor, heavy loads and heavy cyclists on a permanent basis.

■ **Dirk Zedler**

The Zedler Institute

Dirk Zedler

Since 1993, graduate engineer Dirk Zedler has been an analyst and expert witness for courts, insurance companies, corporations and individuals concerning bicycle accidents and material failures. Since 1994 he has been a sworn expert on bicycles, and since 2014 on electric bikes. His team publishes about 800 experts' reports every year.

Zedler – Institut für Fahrradtechnik und- Sicherheit makes testing equipment for bicycles. Manufacturers can buy the equipment or use it in the Zedler Institute's laboratory.

The Zedler Institute has complied the findings from thousands of experts' reports and court proceedings to develop comprehensive user manuals. The manuals help consumers use bicycles and pedelecs appropriately, and help release manufacturers from liability. For more information, visit www.zedler.de.