EFBe and why Thylacine gives it a thumbs down.

On a way too frequent basis in conversation and in online forums, someone inevitably mentions the German EFBe tests as being some kind of indicator of how good or otherwise a frame is. I'm generally of the opinion that the tests are fundamentally flawed and biased, so I thought I would write a brief article outlining my opinions. I fully realise this will not stop consumers from regurgitating the results espoused by the tests, but I'm hoping it will at least allow some critical discussion about the relevance and validity of the tests as there is a real danger that the results will become dogmatic.

Below are my opinions on the tests in no particular order. As I'm compelled to do more research and reading, I will add to them when I can.

One. Method

I'm not satisfied with the tests from a methodology point-of-view for a couple of reasons

1) The frame is fixed at points during the tests that are not fixed during regular use. Loads applied in those areas in the real world would be distributed to other components, and not concentrated on the frame. This places frames under static loading modes whereas in reality they would be dynamic.
2) The test is applying unrealistic load cycles to the frame. 270-300 pounds per cycle is unrealistic and not a figure any designer would account for. This is especially true when designing a frame in steel or ti as it is imperative that the loads be under the materials fatigue limit.
3) The tests time frame is a mere 72hrs and the frames are subjected to huge loading cycles to expedite the process to failure. This favours frames that are overbuilt and designed to counter certain materials inherent poor fatigue characteristics. This is a

totally unrealistic and biased proposition, as frames are subjected to unrealistic loading over an unrealistic timeframe in an unrealistic manner.

4) The test has no scientific statistical relevance simply because it only tests frames given to the testing bodies. To hold up to even basic scientific scrutiny, there would have to be criteria such as –
    a) Taking random, similar size samples from a large cross-section of manufacturers
    b) Test a substantial cross section of frames
    c) Testing of frames with similar design criteria
    d) All results would be published, not just the ones manufacturers want published.
    e) Test procedure would have to emulate real-world environment and have no systematised bias towards certain materials.

    These facts mean that from a scientific point-of-view, the test has no universal scientific application or relevance.

Two. One fundamental flaw.

Of course, the biggest problem with the test is that each frame is loaded to induce a failure. Good frames aren't actually designed to fail. They're designed to give the customer a satisfying cycling experience over many, many years.

Unlike Aluminium and Carbon, Steel and Titanium have a fatigue limit. Although somewhat over simplified, what this means is that if you cycle one of these frames under that limit, it will theoretically cycle forever. Naturally, this kind of sucks when you're trying to induce a failure, so what the EFBe tests do is exceed this limit with a test that not only does not simulate the real world but also subjects frames to massive static loading.

So what do we see happening? Steel and Ti frames tend to not fare well.

Naturally, the average person would say to themselves "Well, I don't want my frame to fail, so I'll buy one of these Aluminium frames from one of these big manufacturers. Even if it does fail, I still

have a warranty to back it up." The simple problems with this mentality are twofold. Firstly, many companies who sell Aluminium bikes don't cover 'fatigue failure' as part of their warranty-able factors. Fatigue is generally the cause of all those Aluminium frame failures you see out there on the web or out the back of your local bike shop. The second factor is that it's an incredibly wasteful and consumerist mentality to have. Would you rather have a frame that you'll be happy riding in ten years, a trusty companion and friend; or some product that cracks every 2-3 years, gets thrown in the trash and the company swings you a new one so instead of jumping online and saying 'This bike is crap' you espouse 'This company is great! They sent me a new frame!'? This is totally out of touch with my world view or my view of a sustainable future.

So what's the bottom line?

Basically, the EFBe tests are fundamentally flawed, have no statistical relevance and do not stand up to scientific scrutiny. They do not emulate the real world, and are biased simply because of the methodology used to test the frames.

The interesting point is, is that if you had a test that covered all these bases – emulated the real world, had scientific rigor etc. – you'd actually see the frames that do well in the test fail before the Steel and Titanium samples, despite the fact that a statistically irrelevant number of modern examples have been tested.

So why is this? Simple. Materials that have no fatigue limit must be as overbuilt and rigid as possible to give them longevity. One cycle applied to them now, is one less cycle it can take in the future. Materials that do have a fatigue limit can theoretically be cycled under that limit - which you can design for – infinitely. However, if you place these frames under massive static loading as the EFBe tests do, they will more than likely fail before the frames that have a fatigue limit, which is the opposite of what we see happening out there in the real world.

Realistically, we have a good benchmark for frame testing. It's called 100 years of rich cycling history and the mechanical properties of materials. However, if the engineering of the past holds

no relevance to you, then there are several software programmes that will do the FEA analysis giving the same results. Failing that, there's always the anecdotal evidence – go you your local bike shop and ask them if they've seen many unbroken sub 3lb Aluminium frames with considerable mileage on them recently. Chances are, they'll have a pile of broken ones out the back.

Having said that of course, the harsh reality is that most modern frames – regardless of material – will survive long enough to satisfy the overwhelming majority of riders' riding until the next shiny-shiny object du jour comes along. The problem is, is that that's not a good reason to buy a bike, and neither in my opinion is the EFBe tests for the reasons I've outlined.

Warwick Gresswell

May 2005