

## Safe Cycling

The problems, insights and visions about the safety of cycling through the eyes of Prof. Dr. Peter Heilig the ophthalmologist and transport expert are highlighted here.

He cycles for long distances as well as daily commuting and is also operational in the Traffic Commission of the Austrian Ophthalmological Society.

### The bicycle

Without thorough expert advice by an appropriate bicycle technician, cheap products should not be used on the road.

Safety requirements for motor vehicles have now achieved high standards, in comparison; the bicycle is a Cinderella area.

This also applies to bike servicing and controls. Children's bicycles require special attention in this context.

### The helmet

In their career, many doctors have seen traumatic injuries as a consequence of accidents and they recommend from experience that it should be advisable or even mandatory to wear a helmet when cycling.

This would be comparable with the use of a seat belt in the car - even driving for a short distance.

A statutory helmet law is described as being "problematic".

### Chin guards

Modern helmet chin guards interfere significantly less than older models. Bike helmets should protect similar to motorcycle helmets.

After a fall from a bicycle the kinetic energy, skull impact (even on the face), is usually little different from forces in a fall with a motorcycle or motor scooter with consequences of fractures and (probably severe) injuries.

### Saddle

The "sore" point - in truest sense of the word.

Racing cyclists testosterone driven, are sitting 'on the back of knife thin' racing saddles, in a deep crouch - and suffer unspeakably - permanent damage can not be excluded.

"Bad" ("un-ergonomic") saddles make cycling a torment in a very short time. Saddles which do not damage the pudendal nerve, squeezing blood vessels, etc. are preferable.

### Lighting

The weakest link in the chain. All too often cyclists are observed on unlit roads and are ignorant of what dangers they pose for themselves and how much they endanger other road users.

Even if the standard bicycle lighting systems are used, they disappear in the light orgies of super-bright car headlights and Hi-brightness LED DRL.

Particularly vulnerable is the bicycle side ("side impact crash").

Virtually no bicycle lighting system improves the conspicuity of the side view of a bicycle. (new: bicycle spoke illumination on the market)

The good old dynamo is not powered when stationary and side illumination on a bike is almost an avoidable luxury.

According to experience, the rule seems to be that batteries are just unexpectedly drained when they are needed and spare batteries are rarely available at the time! A charging system is needed for battery powered lights.

### Light colour

"Modern", brighter glare-free bike headlights are preferable. Blue wavelengths should not dominate the spectrum.

Subjectively, bluish-white is perceived as notably bright, it is scattered at a higher degree and in particular does not deliver more or better (higher contrast) visual information.

Yellow light reduces the chromatic aberration increasing the contrast and appears less irritating.

Flashing bike headlights cannot be recommended - should be avoided.

A stationary light function is essential and should be mandatory.

In the legislation, for Austria are white or pale yellow cycle headlamps with at least 100 cd \* and a red taillight with at least 1 cd required.\*\*.

\* cd = Candela, photometric unit of luminous intensity, a ordinary household candle has a brightness of 1 cd.



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\*\* Comment: 100cd are about a factor of 10 too dim - a common EU definition would be desirable.

### Security

Since the introduction of Daytime Running Lights (DRL) ("Tagfahrlicht"), cyclists are "overlooked" more precisely they are virtually unnoticed.

The lives of cyclists are endangered by DRL.

Pedestrians are no better in this respect, children primarily are particularly endangered by DRL and headlights during daytime light conditions.

Above a critical number of dynamic light stimuli in visual fields such over-accentuated stimuli may incapacitate cognitive and perceptual processes.

Cyclists are adversely affected particularly in "mixed traffic" - lit and unlit vehicles (without rear lights), dipped headlights, more and more mis-aligned 'squinting' headlights, excessively bright HI-LED DRL scattering light into all directions, unlit cars and passengers, poor direction indicator discipline etc.

For cyclists, DRL are a threat and a deadly danger.

"Eye-tracking" studies revealed that over bright beams, dazzling lights of oncoming vehicles severely impair visual behaviour. Bluish-white flashing lights can be remarkably bothersome.

Eye movements fixed by blinding light beams, evasive movements, or such as "hypnotic" repeatedly gazing into oncoming spotlight causes additional disorders of cognition and perception - for lots of "weaker" traffic participants, and in particular, the case of cyclists.

### Conclusion

Additional lighting of motorised vehicles under daytime light conditions such as DRL will definitely not improve traffic security. Licht am Tag ('Lights on during the day') put cyclists and pedestrians at risk.

In limited visibility - under reduced sight conditions - low beam headlights should be switched on as all the "traffic-relevant objects" and road surface need to be illuminated adequately.



Both front and rear bicycle lights should emit dazzle free light from the side to reduce "side-impact" accidents. Superfluous "distraction" (avoidable irrelevant signs of any kind, moving adverts, commercial lighting) can, like daytime running lights, adversely affect cognition and perception thereby provoking accidents.

### Conspicuousness of The Cyclist:

In relation to the current trend of increasing light levels and light loads on the eyes including "bluish-white light" which plagues and blinds motorists, cyclists should be seen and perceived better than they currently are (see accident statistics since the DRL 'experiment'). Wheel spoke reflectors increase conspicuity too little, too late or not at all - especially in relation with daytime running lights. DRL does not activate reflectors.

### Behaviour of The Cyclist:

Extra caution and common sense has priority - in their own interest and the interests of all road users.

### Summary

The full-featured, future-oriented bicycle as a means of transportation requires a number of systematic and overdue optimizations:

### Technology:

Material & Roadworthiness: servicing, frame settings, brakes and anatomical - ergonomic - equipment are important:

Lighting: must be completely reconsidered, including side lighting.

Conspicuity: must be improved

Helmet: should always be worn, even for short distances.

Chin guard: recommended.

Cycle network: expert planning needed (accident researchers, international bodies etc.)

### Legislation:

Vehicle daytime running lights (DRL): reject (Worldwide) - especially to protect children (with or without bikes), particularly at the ("Schutz"-Weg) protected zebra crossing

### Literature

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