LIGHTING UP TIME

AUTUMN: TIME TO PLUG IN THOSE RECHARGEABLES OR CHECK OUT YOUR DYNAMO SETUP. CHRIS JUDEN PRESENTS A GUIDE TO LIGHTING AND THE LAW

It's that time of year again – and a long time since 2002, when Cycle last tackled this subject in its entirety. A lot has changed in 12 years. Flashing lights are now legal on bikes, LEDs are now the only source of light worth having, rechargeable the only sensible type of battery, and the only place for a 'dynamo' is in the hub. But we are *still* waiting for the Department for Transport to accept that most lamps don't conform to any recognised standard.

Headlamps

To find your way on an unlit road, you don't just need to navigate the potholes, you also want to see far ahead to anticipate corners. That calls for a very bright central spot, tapering off to the sides and downwards so that nearer objects are not distractingly bright. The traditional way to do this is with a mirror to gather and focus the light emitted in all directions by a bulb filament and send it straight ahead, through a lens that lets some central light continue directly forward whilst diverting varying proportions of the surrounding beam in other directions. Light that misses the mirror then comes out the front at random, providing conspicuity ('be seen by' light) rather than illumination.

But now we have an LED and that's different. Light only comes out the front of an LED, so the lens must do both the focusing and light distribution. An LED, being bigger than the filament of a bulb, cannot be focused as precisely. Soft focus isn't all bad: it smoothes out the stripy effects we used to get with some halogen bike lamps. And in spite of the optical difficulties, some torch-like (LED pointing forward) bike headlamps achieve a bright enough central spot without over-illumination of the near field. Designers of this kind of lamp, however, have a difficult task to reduce the amount of light scattered above that central spot.

Any headlight bright enough to see where you're going will always scatter enough light off the front of its lens to be seen by. Any more upward light is a waste of energy (unless you're off-road and need to see that low branch), and too much dazzles other road users. The idea of a bike lamp dazzling other road users would have been laughable ten years ago, but now it's happening and opposition to over-bright bike lights is growing. The internationally accepted limit is 200 candela above the horizontal. And many of the (best?) rechargeable battery bike lamps on the market would have to be aimed at the

ground only a few metres in front of the bike in order not to exceed it. Read more on this at ***ctc.org.uk/dazzle***. For an explanation of Watts, Lumens, Candles, and Lux, meanwhile, see ***ctc.org.uk/WattCandle***.

Dynamos do it with mirrors

State-of-the-art dynamo headlamps put as much as 8000 candela (advertised as 80 lux) in the beam centre. To cut that to less than 200cd at only 3½° above, when the source of light is an LED, is a considerable optical challenge. The way it's done is to point the LED backwards, so no ray of light comes out the front without first being re-directed by a computer-designed mirror. It's the same for high-tech car headlamps, so no surprise that this technology is employed by firms like Busch & Müller, who make those too.

LED mirror headlamps were initially just for dynamos, but since Germany relaxed its dynamos-only rule, you no longer need a dynamo in order to have a really bright front light that doesn't dazzle other road users. There are also a few German-approved (with a K number) headlamps with a forward-facing

● **(In the photo)** In well lit areas, lights offer conspicuity more than illumination (Photo by Alamy.com)

All of the battery-powered non-approved headlamps have a forward-facing LED – and a tendency to dazzle. It's a problem

LED. But they are not the brightest.

Hubs are now where dynamos are at. You can still get headlamps that'll work with an old-fashioned bottle, but you won't get the benefit of features such as automatic switching between night and daytime modes. All good dynamo lamps (front and rear) now feature a 'standlight', that shows a 'be-seen-by' light for at least 4 minutes of standstill. Some headlights do this with additional forward-facing LEDs. And some have a DRL (daytime running light) mode, in which these extra LEDs are fed full dynamo power to show up in bright conditions. Some lamps even have a USB outlet, to keep your phone or GPS topped up whilst riding. For more about dynamos, see ***bit.ly/1uGfneO***.

Adding secondary lamps is fine. For the rear, it's advisable

Focus on rechargeables

All of the battery-powered non-approved headlamps have a forward-facing LED – and a tendency to dazzle, which is okay for off-road nightriders but a problem for road users. In contrast to their optical simplicity, their electronics are often sophisticated, offering lots of different power levels and flashing modes. On their lowest setting, some of these bike torches (by my calculation) probably won't dazzle. But they don't dip at the flick of a switch like car headlights – most go through a sequence of other levels, usually including flashing and off! – so the only practicable way to use one of these hundreds-of-lumens bike torches responsibly is to shade it with one hand when another road user approaches.

It's wasteful to run a headlamp on disposable batteries, unless it's just a little blinky be-seen-by lamp. If you're buying separate batteries, get NiMH rechargeables if possible. Due to their lower voltage, these cells may not give quite such a bright light as brand new disposables, but they'll maintain that level, whereas disposables will be dimmer as they approach exhaustion. A few lamps won't run at all on rechargeables, whist others electronically stabilise input power for constant light regardless of battery type, until its dead flat.

The snag with NiCad and NiMH is self-discharge: they go flat even if you're not using the light. No problem for commuters who use and recharge daily; a big problem for those who grab a lamp when they need it. Good news: you can now get low self-discharge NiMH that hold their charge much longer. They're usually sold as ready-to-use rechargeables. A bit more costly and lower capacity, but much more convenient.

Most of the lamps sold as rechargeable units, like modern phones, cameras, etc. come with an integral Lithium-ion/polymer battery. These hold their charge well and hold much more than the same size or weight of NiMH cells. They can store so much energy that powerful lamps don't always have a separate battery pack and can get a reasonable runtime from an integral battery without being too bulky. These integral batteries are often charged by USB, just like a phone: very convenient.

Rear lamps

Not so much has changed about rear lamps, which were LED already 12 years ago, except the LEDs have become even brighter and better. One new thing in dynamo rear lamps is a feature that monitors dynamo frequency to sense when you're braking and gives the light a boost. But what cyclist needs a brake light? I suppose if you're riding in a group at night, or an unusually (in this country) busy bikepath, it might just possibly warn another cyclist not to run into you. As for drivers, they're going faster when you're *not* braking too. If you want a brighter brake light for protection from following cars, you want it all of the time!

One new thing in battery rear lamps is an integral Li-ion battery, charged by USB. So all the electronics you take cycling can now be charged by USB: sorted!

Dynamo and dynamo-derived rear lamps invariably conform with German regulations, so they tick the legal approval box and incorporate the retro-reflector you also need by law. But German regulations don't allow flashing, so they won't do that.

A flashing red light is eye-catching and is not allowed on any other vehicle, so it helps get you noticed against all the other lights in a city *and* identified as a cyclist, which is important for traffic behind you. You don't want to be even momentarily mistaken for a faster vehicle when approached from the rear. So it's a good idea to fit a rear flasher even if you've already got an excellent rear light. Likewise if you've only got a flasher: fit a steady light too. It's easier for an observer to track and predict your position.

How to fit?

As a rule, dynamo headlamps fit to the fork-crown and battery lamps on the handlebar. If you want to hang a dynamo lamp off the handlebar or any place else, you'll have to seek a hard-to-find bracket or make one yourself, which may nevertheless be quite easy and neat, since dynamo lamps don't weigh much and usually attach to their bracket by a simple 6mm bolt. If you want to fit a battery lamp elsewhere, you'll have to buy or make some kind of dummy handlebar-like bracket, which will be relatively heavy, goofy and/or hard to make yourself.

The same apartheid applies to rear lamps. Dynamo lamps bolt sensibly onto the rear carrier or mudguard, where they will not be obscured by anything else on the bike. Battery

Photo: Steve Behr/Stockfile

Helmet lights: very useful off-road, annoying on road

Photo: Seb Rogers

rear lamps usually clip onto the seatpost, where lots of things can obscure them, even a jacket. Some also have a seat stay mounting option, which sometimes works okay but often isn't very secure on such a slim tube, so the lamp pivots around to point sideways then downwards, or even goes in the spokes!

Good news for practical cyclists who don't want a dynamo: battery versions of dynamo rear lamps are available that likewise bolt onto any carrier that has the standard European fixings – two rear-facing 5mm holes, horizontally separated by either 50mm or 80mm. Mudguard-fixing battery lamps can also be found, but their weight does tend to accelerate the failure of plastic mudguards.

CatEye supply lots of alternative brackets for their lamps and unlike some brands, don't change designs at the drop of a hat and have okay spares availability. So you'll probably be able to fit one of their lamps where you want, even if you change bikes in a year or two.

In my last lighting article, I wrote what a useful thing a head-torch is, for illuminating road signs and fixing punctures. I never imagined how compact and yet powerful LED lights would become. It's unavoidable that a light on top of a person's head, aimed towards the ground, is at some point going to cross the eye-level of another person – and usually when they're close enough to get properly dazzled.

Unless you're heading into the woods for an off-road lark in the dark, please mount your main headlamp on the bike

So unless you're heading into the woods for an off-road lark in the dark, please be kind to your fellow cyclists (as well as everyone else) and mount your main headlamp on the vehicle where it belongs, whilst limiting your head-torch to the minimum necessary (as a rough guide, between 10 and 50 lumens) to illuminate signs and provide extra conspicuity. Thank you.

We're all breaking the law!

I exaggerate. A few of us are riding legally at night: those of us with pedal reflectors, a rear reflector marked BS6102/2 (or ECE 1 or 1A), plus front and rear lights, each of which satisfies one of the following criteria.

Option 1: It conforms with and is accordingly marked 'BS6102/3'. The last number, indicating part 3 of the standard, is the lighting part. A lot of rear lights incorporate a reflector, marked BS6102/2, which only means the retro-reflector performance is approved.

Option 2: It conforms to the approval regime of another EC country, but only if that approval provides an equivalent level of safety. That's a tricky one, because no public official will say which other country's standards are at least as demanding as BS6102/3. So I asked a bunch of international bike lamp experts at an ISO standards meeting. They were unanimous: German traffic law (StVZO) approval, that's all. Almost any dynamo lighting equipment you might buy will be marked with a K~ number, indicating German approval.

Option 3: If it's a flashing light (front or rear) and *only* a flashing light, that flashes at the legally permitted rate of between one and four flashes per second, and is completely incapable of emitting a steady light, it'll be approved if it emits at least 4cd (candela). And 4cd isn't much: most decent LEDs do that. But most flashing lamps also have a steady mode,

SHINING LIGHTS

Note: the reflectors on the top two are required in Germany, not here.

DYNAMO HEADLAMPS

1) B&M LUXOS U SENSO PLUS £155
Light the road with up to 90 lux, or have daytime running lights, or charge your USB devices via the remote handlebar switch. For those who want complete 'off grid' autonomy and can afford the best, this is it.
amba-marketing.com

2) AXA LUXX 70 STEADY AUTO £61
Value for money autonomy: most of the above features for less. Seventy lux is still impressive and the 'Intelligent Beam' adjusts with speed. The USB socket is useful only in dry weather and above 14kph.
axa-stenman.com

3) TRELOCK LS695 BIKE-I UNO £20
As little as 10 years ago, we would have been delighted by 20 lux, and at that price, complete with standlight, you won't be complaining.
trelock.de

DYNAMO REAR LAMP

4) B&M SECULITE PLUS £22
Lightest lamp that'll fit (and hence be less likely to break) a mudguard. With standlight and reflector, it does the business on bikes without a carrier.
amba-marketing.com

CJ's current (sic) favourites: the Eyc T senso plus (£54) and Toplight Flat S Plus (£16), both by B&M and distributed by amba-marketing.com

We've waited too long already for our pettifogging regulations to catch up with commercial reality

which then requires BS or equivalent approval.

So dynamo users with pedal reflectors and very few others are riding legally at light. The rest of you, no matter how bright your lights may be, are scofflaws! Given the needle-in-a-haystack task of sourcing approved battery lights on the British cycle market, most police forces take the pragmatic view that it's not in the public interest to enforce the letter of the law on this point. White light in front, red behind, flashing or steady, and you're very unlikely to be challenged – never mind a lack of rear or pedal reflectors. In the event of an accident however, the unobservant driver's insurer will look for any excuse not to pay out.

Standard lamps?

Last year, Germany relaxed its dynamo-only rule to allow StVZO-approved battery lights to be used on all kinds of bikes, not just racers. Meanwhile, Germany and France are cooperating on a new ISO for cycle lamps, which is likely to be adopted by Europe and will then replace the confusion of different national standards. We're beginning to see more battery lights on the market that have the same well-designed optics as German dynamo lights and these should become more widely available in future.

For at least two years, DfT has been promising to reform our completely out of date and unfit-for-purpose cycle lighting regulations. Why does it take so long? I don't know. Maybe they're waiting for that new European standard to replace BS6102/3? Whilst I personally am content to presume the approval of my German lights and await the eventual confirmation of that by a Franco-German CEN standard, I cannot ignore that the majority of British cyclists, doing their honest best by fitting lights that are good and bright, and which the police recognise as such, are nevertheless breaking the law.

We've waited too long already for our pettifogging regulations to catch up with commercial reality. We must either revert to the pre-1989 requirement: 'visible from a reasonable distance', or else extend the simple 4cd minimum to steady lights as well as flashing. If it's good enough for flashers, why not? And at the same time, let's forget about pedal reflectors, or allow the alternative of a second rear lamp, so there's one of each, flashing and steady. And let's do it *now*, for goodness sake. Is anyone listening?

Until then, our list of Shining Lights focuses on lamps that are *already* approved and/or address particular problems for road cycling. It's unavoidably German heavy. If you can't find them locally, UK retailers such as Spa Cycles, Bike Plus and St John Street Cycles may carry them. If not, German websites such as rosebikes.co.uk or bike24.de will.

SHINING LIGHTS (cont)

RECHARGEABLE HEADLAMPS

5) EXPOSURE STRADA MK5 £270
Perhaps the only high-power cycle-lamp that can be toggled between max, dim, max etc. like a car headlamp, thanks to its remote switch and sequence options. This 800 lumen twin LED (spot and flood) lamp lasts 3-36hr. use1.com/exposure-lights

6) SUPERNOVA AIRSTREAM 2 £175
The 'Terraflux' lens puts more light on the ground and less in the sky than most high-power rechargeables, limiting dazzle, earning it StVZO approval, and enabling it to punch above its 205 lumen rating. amba-marketing.com

7) B&M IXON CORE £52
Our pick of a bunch of new dynamo-derived, German-approved battery lights: this neat lamp puts a USB-charged Li-ion behind Eyc's fine optics to give 3 to 15 hours of 50 to 12 lux dazzle-free output. amba-marketing.com

BATTERY REAR LAMPS

8) B&M TOPLIGHT FLAT-S PERMANENT £14
Busch & Müller's 'Toplight' range have carrier-mounted lighting covered. This is the battery version of CJ's favourite rear light. The new –S version spreads the light better than the old 'Toplight Flat'. rosebikes.co.uk

9) CATEYE TL-LD610 £22
A good example of the non-approved but nonetheless plenty-bright-enough battery LED rear light, which can be adapted to fit most places thanks to CatEye's comprehensive range of brackets. zyro.co.uk

10) PDW FENDERBOT £16
One of the only battery-powered (2×AAA) rear lights that'll fit on a mudguard. It incorporates a reflector. The cheaper Smart TL260RG appears to be very similar but is harder to get hold of. paligap.cc