

Lighting for long Audax nights – a journey of (self) discovery.

Audax riders are a bit of a funny breed and depending on their riding capability have a wide variety of needs when undertaking Audax rides. When complying with the lighting rules we need to consider how long we could be out on the road, and particularly at what time of day. Any 200km ride requires all riders to comply with the Audax Lighting and reflective garment regulations because the 13 hours 20 minutes time limit and the ride start timing is unlikely to align perfectly with the Earth's rotation, sunrise and sunset. A 300km ride has a time limit of 20 hours – I need most of that when I undertake a 300. Comparing this to the 300 Round the Mountains at Christmas time, I would have just completed a 200 when Nick returned from the 300. Lighting rules still apply regardless.

My first Midnight Century and weekly commuting in the dark got me thinking about what I wanted from my equipment. The end result is a somewhat enlightening, speculative and possibly contentious journey of discovery about cycling lighting – from an Audax point of view.

Most reviews for bicycle equipment is focused on the general commute where people live no more than an hour's cycle from their destination. For me it is 1 ½ hours. Audax on the other hand is a special challenge that can find us many hours from self help, and possibly hours from the pickup after the phone call for help. We are a hardy bunch but sometimes there are limits.

Apart from a roadworthy bike and a helmet, Lights are the other essential item that we need that has variety. Hi Vis only really comes in a few types so whilst equally as essential as the other three, isn't part of this journey.

My riding history is pretty short at the moment but a couple of years ago I planned a route to work that I could cycle in relative safety on the days that I could – sometimes up to 5 days a week. This is good for the health but the downside for the lazier cyclist is that the energy source for the lights has a tendency to deplete when you are halfway between charging locations (ie work and home) unless you replace batteries or charge several times a week. For my first winter I was on the road for about 3 hours a day in the dark – 15 hours a week. This makes lighting selection bit of a challenge as most lights only run for a third of a week before requiring a charge.

I don't think I am alone in thinking about long duration lights but I looked at a modern alternative to the standard bike shop fare – no, not hydrogen fuel cells (although that would be really neat) and disappointingly for Mark Riley – still Lithium Ion and LED but the other modern alternative – Chinese made products. I have a collection of these that form part of this article, and more are on order. To be fair, most riders I see have name brand lighting that are robust and have a long life – those I have had access to are included here for reference – some I have had the opportunity to test, others are from other rider's experience. Where possible, I have made a visual comparison of the light output and pattern – others will be the information from riders.

A few notes – There are plenty of websites that have light comparisons – Have a look around to see what these look like – some even have side by side comparisons. These are an important reference to see what a variety of lights look like. What I haven't found yet is one that compares a wide range of brands on one page that includes non mainstream lights.

What I am not going to go into too much depth about is the 'to see or be seen' types, or too much depth about rear lights. What this article is about is the 'to see' category because that is what our primary use of the lights are. I am not discounting the importance of improved conspicuity gained by the 'to be seen' category and rear lighting – we just don't see the road by these in the middle of the night.

I will admit to being a bit biased by my own methodology of lighting selection (cheaper) but it may provide a different point of view for some riders (refer to the contentious caveat earlier.)

Most lithium ion bicycle lighting systems have some electronics that manage the battery charge and discharge to protect the battery and give the best life out of the batteries. These have one interesting characteristic in that when the battery is considered flat, the electronics disconnect the battery. I use this characteristic when testing my systems – all of mine have batteries in a separate pouch. I use a programmable microcontroller to capture a voltage representation (doesn't give voltage) that does tell me if the battery turns off and I capture once per minute until I stop the test. This can be five minutes or days depending upon what I am testing. It is simple, I can export to Excel to make a nice graph but mainly I look at the raw data, find the minute the battery turned off and use that as my endurance.

For commercial products, I will use the manufacturer's information. For companies like Ayup, Cateye and Lezyne I will trust the manufacturer's website because their reputation is at stake but any statement about a generic bicycle lighting item off web selling sites (ie ebay) should be checked for accuracy.

The Chinese methodology for LI-ON batteries at the moment is to report what the manufacturers data sheet for the base product implies, not that of the manufactured product. A good example is that you cannot buy a 50,000mah battery bank that weighs 240g. The best battery at the moment is made by Panasonic, rated at 3400mah (I have a couple to play with) and weigh 50g each – a real 50000mah would weigh in excess of 750g. A similar methodology for determining the light output (luminous intensity or lumens) may be similarly reported based on what the LED is capable of, not the light fitting once manufactured which is what actually gets measured.

During my research on this journey I have noticed a change from bulbs to LED lighting and the change from watts to lumens for the brightness of lighting. This in reality means we look at a different set of numbers that relate to the light we see, not how much energy goes into producing the light. This does make it harder to relate battery capacity to longevity of the battery and light combination as the design features of the lights and electronics behind it can make a real difference to the lumens.

So, what makes a good Audax light? Hopefully the following will agree with your expectations:

- Endurance to last the time you will be riding at night before your next re-charge (or more importantly – to last the full Audax time limit).
- Provides a good spread of light to allow you to see the hazards on your route
- Provides a little light to the side as well so you can see the bushes and road side (makes a person feel comfortable)
- Has a good 'be seen' capability (particularly the side). The front seems to look after itself in the dark, the rear lights we tend to use are respectable) but the bit of side light is important for the cars seeing us from the side.

Assessment methodology

Assessing lights is more subjective than objective but I didn't assess any of the lights by myself. The one common element is my lighting system which I am using as the reference. I have compared the test lights with Queensland Riders David and Peter using lights from them and Keith. Scott also supplied me with some information but I haven't caught up with him to do some tests.

The visual test method was to put both bikes side by side then compare the light pattern and brightness and overall satisfaction with the results. The switching from one light to the other was simply putting a hand in front of one then the other. These tests were static – this made comparing a dyno hub lighting system very difficult. Peter held his Moulton on a stool when we compared the lights. This one comparison was not satisfactory because I couldn't adequately turn the wheel to compare and we were a little lazy and didn't go for a ride to test.

One light I didn't compare is my 7.4v light set from Ebay. The battery life is only a few hours but it can cook kangaroos at 2km on the brightest setting. My Daughter driving the opposite direction to me had to stop once because she couldn't see due to the amount of light coming at her.

The lights compared:

Tested Units:	Notes	Cost
Chinese no name brand	(2000 lumens), external battery (labeled 4200mah-6800mah) 3.7v	\$28-\$34 (Recently scored a 8800mah battery for \$41)
Aldi Trail light	1000 lumens (4400mah battery)3.7v	\$39
Moon X500	500 lumens, 2600mah battery, 3.7v	\$115
Moon LX360	360 lumens, 2600mah battery 3.7v	\$109
Cateye Volt 300	300 lumens, 3.7v (replaceable battery)	\$60. No longer manufactured – replaced by the Volt 400.
Ayup Road	700 lumens, 2000mah, 7.4v battery*	\$286
Ayup Run	700 lumens, 2000mah, 7.4v battery*	\$253
Y66	(Chinese version of a Fly 12 – manufacturers specs only), has 6800mah battery, usb charging port for phone internal battery	\$69
Aldi Lighting kit	1000 lumen 'torch' with 2200mah battery and rear light.	\$29
Untested units (rider's opinion):		
Scott provided information on lights he has used:		
Bontrager ION 700	700 lumens, 2900mah, 3.7v	No longer manufactured, replaced by the 800R
Knog Blinder Road 250	250 lumens, battery unknown	\$99
Fly 12	600 lumens, 4200mah battery	\$340-\$400

*7.4v battery packs have double the available power of an equivalent 2000mah 3.7v battery. Power = Volts x Amps.

So, how do the lights rate?

Firstly, some important questions about an essential part of our lighting selection:

- What do we do when something goes wrong with the light? What support do we get? Our care factor does up with the purchase price of the lights – support for a \$300-\$500 light is very important whereas we may not be too fussed when our \$40 light stops working after a few years.
- A second thing that is relevant is changing models or components – what to do when your favorite light or component changes or is no longer available. I for one have limited handlebar space (flat bars) and real-estate is at a premium.
- What compromises are we willing to make with our selection?
- How do we test drive some lights?

The results of the lighting comparison:

My Chinese no-name branded lights were used as the baseline for comparison. Personal opinion is that the light is very good, 3 settings and a flicker mode. Low setting works well on country roads or urban, medium when I am descending on country roads. I rarely use the high setting. Flicker mode is used during the day and when commuting 'to be seen'. Some that I have ridden nights with are impressed by their ability to light up the road.

Tested Units:	Comparative light	Run / charge time	Pro's and con's
Chinese no name brand	These were used as the basis for comparison and on low setting	4400mah Flicker 12h 6400ma low 12h 8800 low 20h All are charged overnight using a wall charger.	+ Good light dispersion (circular) with dimmer outer cone. + Easily changeable / replaceable batteries - No longer available -battery packs are not water proof
Aldi Trail light	Light is more focused and a little dimmer comparatively	6400mah low 6 hours then low power (dimmer) til 12 hours	+ low power mode will give light to get home at slower speed +smaller (25mm diameter) +available once a year -draws more power
Moon X500	Light is a little dimmer but has a wider beam (standard setting)	4 ½ hours. Takes 4 hours to charge	+compact unit +good visibility with wider beam -limited run time (can get 11 hours on low)
Moon LX360	Light seemed a little brighter (standard setting) This may be because of the narrower beam width.	Almost 6 hours run time (standard setting), 3 ½ hours charge time	+compact unit +good visibility with wider beam -limited run time (can get 15 hours on low – limp home lighting)
Cateye Volt 300	Slightly narrower beam, similar light level on medium setting.	8 hrs run time on medium, 18 on low. Charge time 6 hrs	+compact unit +good visibility with wider beam +Reasonable run time +interchangeable battery optional. -limited run time (can get 18 hours on low – limp home mode)

Tested Units:	Comparative light	Run / charge time	Pro's and con's
Ayup Road	Similar light levels, each light is slightly narrower beam width.	6 hours high / 12 low / 24 hours on flash Expect 4-5 hours to charge battery.	+movable angle on each light +good run time +local support +interchangeable batteries +car charger adapter +has a red cover to use as rear lights +brightness controlled from battery pack -nothing really
Ayup Run	Different beam width so slightly dimmer	6 hours high / 12 low / 24 hours on flash Expect 4-5 hours to charge battery.	+movable angle on each light +good run time +local support +interchangeable batteries +car charger adapter +has a red cover to use as rear lights +brightness controlled from battery pack -nothing really
Y66	More focused and dimmer beam	Camera will run 14 hours without light. Light will run 8 hours without camera	+long camera run time (will do a full day) +has a USB charging port to charge other devices +a couple of hours of light after a day's recording -poor quality mount (vibrates) -no image stabilization -32Gb storage maximum. At full resolution is only 5 hours recording time -large and heavy
Aldi Lighting kit	Slightly brighter, wider beam	6 hours on low, 3 high, 6 flash. 4-5 hours charge time	+slow flash mode +wider beam for better side visibility +rubber quick clamp -limited run time
Untested units (rider's opinion):			
Bontrager ION 700	Similar brightness* narrower beam	1.5/3/6 hrs (HML) and 5-11 hours charge time	+compact +reasonable run time -need two for night rides (for extended time) (replacement 800 has a remote)
Knog Blinder Road 250	Rider is satisfied with the light output	1-2.5 hours	+compact -low run time Blinder 400 has approx twice the run time for the same light output.

Tested Units:	Comparative light	Run / charge time	Pro's and con's
Fly 12	Rider is satisfied with the light output	Up to 8 hours with camera running (#)	+light is a bonus (camera plus light) +adequate run time (#) +Can interface with apps -Large size and weight

*based on extrapolation using the comparisons on <https://www.bikelightdatabase.com>

based on information from manufacturer's website

Where does this leave us riders?

Interestingly, I wanted to write an article but instead have been on a journey which is not where I intended to go as I summarise my findings. I do pose a question in preparation: so what does all this information mean to you as a rider?

Selection of any part of your riding kit is always a compromise between what you really want and what you can match with a product at a price – all based on cost vs risk – do you want to risk an unknown product or go with an established brand that others have experienced and 'have pedigree'? Do you want to go with the expensive brand that is all the rave in the web or take a risk on some cheap product?

Overall I have been impressed by the price of the 'alternative' products -their quality has been quite good within limitations – the batteries are shrinkwrapped (not waterproof) – something I have remedied, the lights have rattled and required a small spacer to be fitted inside (lucky I have a 3d printer). These things alone may put many riders off exploring cheaper products as not everyone is a tinkerer. In addition, just as I find a product I am happy with, it disappears from sale (my second light was the last of its model I could find on eBay anywhere in the world) but I did find an Australian retailer of the 3.7v battery packs I use – in a waterproof hard case with larger runtime which took me several hours of surfing the net to find. All in all, if you converted my 'research' time to a cost, my alternative products are comparatively expensive.

I am impressed by the quality of the brand name products – as an entire product set (all the bits in the box) they generally run rings around the cheaper alternative products in overall product set build quality but they all have the same longevity problems (batteries tire and cables break) but for me I can repair most of mine.

The journey's end

I hope I have offered some insight to help others along the journey of selecting products. The samples above give a small subjective look at popular lights.

- Start with what you need to achieve - for me it was lights that run all night (between the two mandatory units per the lighting rules) that can support my commute whilst charging once a week.
- Talk to other similar riders directly or via social media to see what others are using and determine if it will suit your purpose. If possible, do night rides with some to compare products.
- Be willing to research other alternatives – I researched a dyno hub option (this is on the back burner- I will buy a new bike before going down this path)
- Recognizing that brand name products are well established but opinions and reviews vary and can be subjective (just like this article) and
- if your budget and time permit, have a look at the cheap website products but be wary of the numbers that are associated with them – be prepared to burn a small amount of funds on unsuitable products if you go down this path (Roo burgers anyone?) and steer clear of anything with a USB plug and high Lumen / mah numbers.

This is my second Audax season and third year of riding (again) and by careful consideration hope it will be some of many more seasons and years to come.

John.