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TLCI-2012 NEWS, DEFINITELY NOT 'WHAT WE DID ON OUR HOLIDAYS'

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ABSTRACT

The Colour Rendering Index (CRI) has many flaws and is unreliable especially when new high efficient lights are introduced (e.g. LEDs). Even when used for its original intended purpose, assessing lighting for industrial and architectural situations. It is even less meaningful if used in a television environment. Even Correlated Colour Temperature (CCT) meters are misleading and inaccurate if used with fluorescent or LED light sources.

In the framework of the EBU's LED group, Alan Roberts (retiree from BBC R&D) helped put together the Television Lightning Consistency Index (TLCI-2012) as a solution to this problem. Although not an approved international standard yet (it is currently under standardisation within the SMPTE 10-E Group), the EBU recommends the method.

This article will be of interest to those looking to find out more about how these measurements came to be. The TLCI-2012 results are supplied by Alan Roberts from his measurements conducted on various lighting fixtures.

INTRODUCTION

The eagle-eyed amongst you might have noticed a small change in the results presented on the Guild site at http://www.gtc.org.uk/tlci-results.aspx. There's a reason … if you don't want to know it, skip to the last paragraph now.

Clark-Berry lamp

In the beginning, I had only a cheap spectroradiometer, and a dubious calibration from an expensive calibration source which I had to buy. When it became obvious that the TLCI was taking off, I invested in a better spectroradiometer, but was still stuck with the relatively poor calibration, so I decided to do something about it. When I retired from the BBC, I'd managed to rescue some stuff that was bound for the skip (don't we all?) and one such item was a beautiful lamp made as a reference source and calibrated at the NPL, but never used. I bought a modern power supply (15V at 40A to feed this monster at 13.99V 26.00A) and then couldn't set the current accurately. So I dived into the power supply and changed the main control for something better, and bought a 4.5-digit voltmeter and a resistor to monitor the current. The problem now was not "how accurate is the lamp?", but "how accurate is all the rest of the kit?" As is so often the way of things, the lamp then broke – so I was stuffed.

INVESTIGATIONS CONTINUE

Luckily, a colleague in Norway (Per Bøhler, just retired from NRK), was doing almost exactly the same. He also had a Clarke-Berry lamp and power supply, and an ancient 0.01Ohm resistor made in Croydon. This was the only accurate piece of equipment we had between us, accurate to better than 0.01% (we need 0.1% to get the lamp current right to be within 1 Kelvin). So a plan began to emerge: I'd take all my kit to Oslo and compare things and, hopefully, establish a good calibration standard between us. In the meantime, I got hold of some more meters from the web and a dealer, but they all gave slightly different results, so which one was right?

The old-boy network provided one solution. John Sykes (ex BBC R&D) has similar metrology kit in Coulsdon, so we did a comparison in my garage and again in his spare room, and one of his meters agreed with one of mine to 6 decimal places. This looked promising. So the next thing was to plan a trip to Norway. Oh, and Claire decided she'd be the co-driver.

We booked the Harwich-Esbjerg crossing, then looked at the maps, took a deep breath and started to work out how we could drive 1200 miles in 6 days and leave enough time for the work. The ferry arrives at Esbjerg at 13.00, so we reckoned we could get as far as Gothenburg in that afternoon/evening, then on to Oslo next day. A cheap hotel was easy, Google to the rescue. For the return, we'd drive to Copenhagen and do an over-night there, which made an opportunity to see Mogens Gewecke of Bico who I'd met a while back and fill him in on our progress.

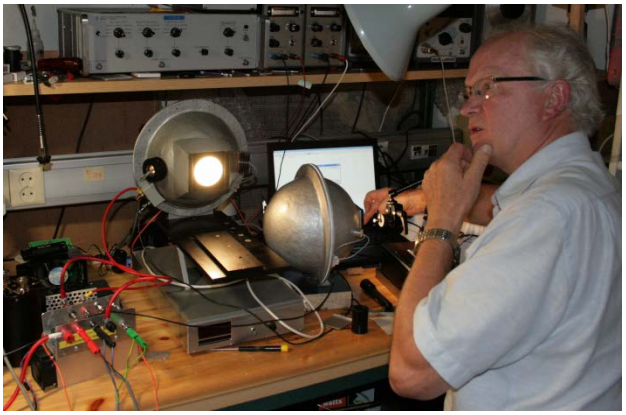
The Øresund bridge

Came the day, we set off for Harwich and it all went like clockwork. The crossing is 20 hours, like a mill-pond, and the drive across Øresund ('The Bridge') is spectacular though expensive. From Gothenburg upwards the countryside gets ever-more frilly. Driving in Scandiwegia is easy, people seem to stick to the speed limits (possibly because of draconian laws, you lose your licence at the road-side if you get caught), and everybody speaks English even though we didn't meet a single UK car north of Copenhagen.

A MOMENT OF TRUTH

Anyway, in Per's basement, we set up all the kit and started work. It took a day and a half to establish what we now hope is the truth. My meter (the one which had agreed with John Sykes' meter) agreed with Per's meter to 6 decimal places. Since it's highly improbable that three different meters have all changed calibration by the same amount in the same direction, we think we're entitled to assume that they're near enough right. So we managed to get the conversion factors between the 'good' meters and my other one (I took only two, one modern second-hand, one old ex-NATO, I left the other four at home). We also established that the monitoring resistors (nominally 0.01 Ohms) are actually 0.009975993 Ohms and 0.00996991 Ohms, and that another resistor I have is 0.20006002 Ohms. These resistors have to be mounted on wind-tunnels to dissipate the power. So far, so good.

Per's basement 'lab'



Per thinking about integrating spheres

Then we ran up Per's Clarke-Berry lamp, at 25.293 Amps. We could set that with a precision of 1mA, which would change the colour temperature of the lamp by about 0.09K, close enough for jazz. Of course, we had first to leave all the kit powered up for at least 6 hours to make sure it was stable, but that's metrology for you. So now we knew that the lamp was running under the conditions in which NPL had calibrated it, many years ago, and it meant that we could calibrate our spectroradiometers (I have two, Per has one and he'd borrowed another from NRK).

SECONDARY CALIBRATION SOURCES

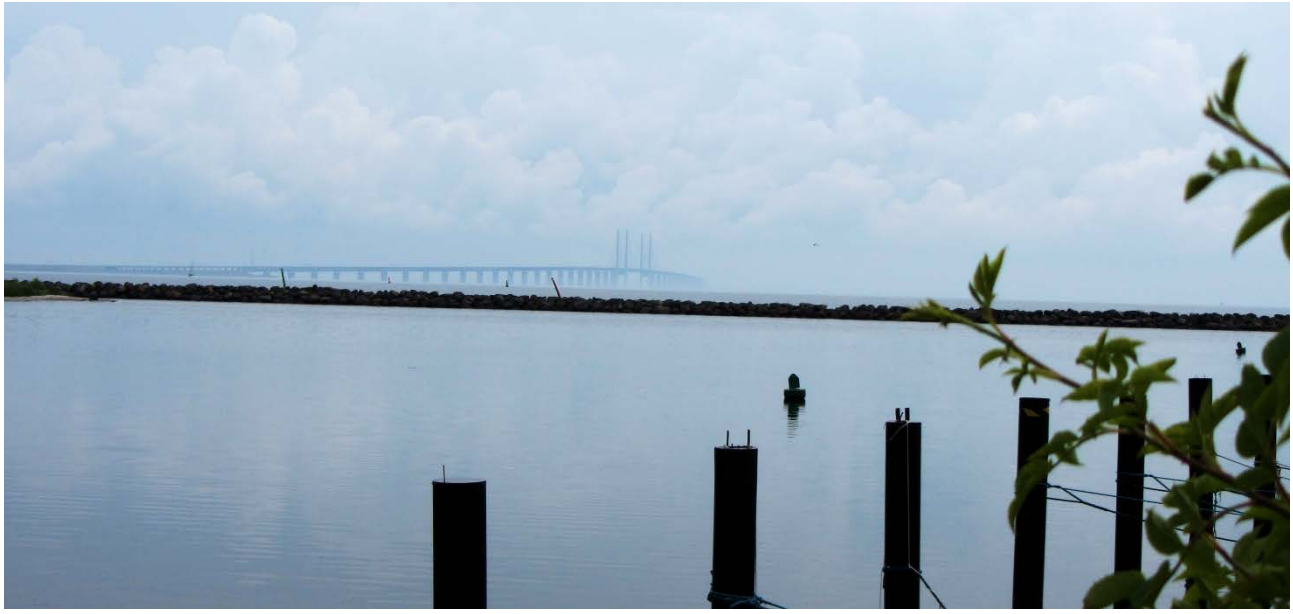
The next step was to complete some secondary calibration sources which we can move around (you wouldn't want to move a Clarke-Berry lamp around, or the power supply, not unless you have access to several very strong but delicate gorillas). NRK had made an 'integrating sphere' some years ago (about 30) and had enough spare bits left over to make another one for me. So Per had assembled the second one, sprayed the interior with special Kodak paint containing $BaSO_4$, and fitted it with a couple of sockets for miniature 6V 10W quartz bulbs. We already knew that these are stable after a burn-in period, so they make jolly good portable standards. Calibration of those was straight-forward since we now had four calibrated spectroradiometers to play with. All that was left was to pack it all back in the boot of my Mini and drive home but, not before a little rest and relaxation.

Cricketers in Frogner Park

Per and Unni Brit's summer cottage

Claire had really hit it off with Per's wife, Unni Brit, so we escaped into Oslo for a day. Per and I went to see a colleague at NRK (he'll be taking over some of Per's colour work), while the girls went round Oslo. We'd arranged to meet in Frogner Park for a stroll

among the statues, but that's when the fun started. The weather forecast had promised a light shower, nothing serious. So when the rain started, we just stood under a tree until it went away.



Øresund bridge from Dragør

In the meantime, I got accosted by a couple of chaps dressed up as cricket stumps and a ball (honest) who were doing vox-pops to get help for the Norwegian cricket teams (you couldn't make this up). When we'd escaped from them, the rain really started, 72mm in 2 hours. I've never been quite so wet, but it was a lot of fun. The next day we headed for the hills, or rather the lake, to the 'summer cottage', had a cracking boat trip and time to bask in the glory we knew we'd just acquired, in time to start back for home.

The trip back was largely uneventful. We met Mogens Gewecke in Copenhagen and went off to Dragør for breakfast and a natter. Much food and coffee later, we parted and strolled around the harbour to see 'The Bridge', and then set off for home. The rest of the trip wasn't uneventful, but that will have to wait for a later epistle.

CONCLUSION

The reason that there's been a small change in the TLCI results is because we now have good calibration data. It doesn't make a huge difference, but I feel a lot better about it now. So the new measurements look slightly different (anybody wanting this better calibration should contact me to discuss it). At the top-right of the result screen, there's an ident which can be customised if you've got permission (from me). All my results carry my name, so anything that doesn't carry my name must have come from somebody else, like the recent De Sisti results. My latest results will all carry '- Oc' after my name, to signify 'Oslo calibration'.

I just thought you might like to know.

My kit at home

REFERENCES

[1] The Guild: http://www.gtc.org.uk/tlci-results.aspx

AUTHOR BIOGRAPHY

ALAN ROBERTS

Alan Roberts joined the BBC's R&D Department in 1968 as a Research Engineer, and worked on a wide variety of projects, including standards conversion, teletext, digital video processing and surface-wave device fabrication, before specialising in colour science and production technology.

He was part of the team that worked on the Eureka95 HDTV project and represented the BBC on EBU and Eureka committees as a colour scientist. From this HDTV work in the 1980 and 90s he developed the "film-look" favoured by drama and wildlife programme-makers, devising ways to use the new technology to lower production costs without compromising quality.

Now in retirement, he continues as a consultant on colour science and HDTV matters, advising manufacturers and programme-makers on HDTV developments.

(Please note that Matilda the wombat, while friendly, is not available for consultation)

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