

CALCUTTA STATE CENTRE

Course on Frontiers of Lighting and Human Factors

October 2013, KIIT, Bhubaneswar

Calcutta State Centre organised a six week visit by former CIE President and International lighting expert, Prof. Wout van Bommel to deliver lighting courses to engineering students at KIIT in Bhubaneswar in October and Jadavpur University in Kolkata in November. In addition Prof. Van Bommel agreed to do a workshop at the National Library in Kolkata.

The objective of the course was to introduce students to all professional lighting application fields:

- Office lighting, both from a visual and non-visual biological (lighting and health) point of view.
- Shop lighting as an example of how to deal with the emotional effects of lighting
- Road lighting, from a safety and thus visual performance point of view, from a personal security point of view (crime prevention) and from an aesthetic and city image point of view (the latter being another illustration of the emotional effects of lighting)
- At the start of the course, discussion on the properties of different light sources from an application point of view with special emphasis on solid state light sources
- Sustainability in lighting was the key item in all lectures.

The ultimate goal was to provide students with sufficient background information to be able to specify the properties of future lighting equipment: lamps, electrical gear, luminaires and control devices to judge their suitability for use in different lighting applications and to start making lighting designs.

The start of the course in Bhubaneswar was delayed by a couple of days because of Cyclone Phalin which struck the east coast of India just then.

The course was extremely well received in Bhubaneswar. Given below are reports by two of the students who attended the course, Arnab Mitra and Umesh Kumar. Reports on the Kolkata leg of Prof. Van Bommel's visit will appear in the next issue of the newsletter.

Arnab Mitra

Wout van Bommel Sir, first started with the basics of light and vision where we were given a overview of the electromagnetic spectrum where

visible light spectrum was given much preference. Then we moved on to Maxwell's electromagnetic theory which finally led to the quantum theory. The discussions happened on the eye with preference given on fovea centralis (bright spot) as well as rods and cones. Being a biology student in my higher secondary I knew most of it. But, the slide which appeared most endearing in the discussion of the eye was the slide describing the sensitivity of rods and cones and how the response of each cone cell can be traced to its source which is not possible in the case of rod cells. Quite interesting was that discussion!!!! Finally we moved on to the spectral eye sensitivity curve, a curve specifying that yellow light has maximum sensitivity for vision which reduces drastically for blue and maroon light.

Slowly we moved on to the lighting units where sir talked about luminance, illuminance, luminous flux and a wide variety of formulas for calculating lumens for open fields and offices. We even discussed the utilisation factor table in photometric data. We discussed a lot about colour triangle and CRI finally moving on to subtractive and additive colour mixing. It was awesome to know that for paints darker and darker colour shades can be produced while for light lighter and lighter shades finally giving way to white light. Moving on we discussed age affects, like pupil clouding, decrease in the size of the pupil. Then we talked about another interesting topic directing screening and filtering of light where the discussions on refraction, absorption and interference were quite good. Finally we ended the class with the discussion of right balance between environment and lighting and a rather boring topic of lighting organisations.

Next three classes we talked about the principles of lighting, where we had long interactive sessions on thermal, gas discharge, solid state and induction lighting. Before that we discussed run time and re-ignition time, temperature sensitivity, lamp temperature, environment unfriendly material, luminance and many more qualities that are checked while making a lamp. Sir even pointed out through a graph the present market trends of different types of lights where we noticed that LEDs are leaving all behind in the race, while some forms of lighting are becoming non-existent. We even talked about induction/low pressure lamp, which has a primary and secondary winding across the metal rod. Sir even pointed out that though they are very efficient having a huge lifetime they are very costly but can be used in industries where lighting over constantly working machines are not changed for years at a go. We even talked about low pressure and high pressure gas discharge lamp, CFLs. We even discussed why high pressure sodium lamps are not to be used indoors, moving on to automatic switching which switches on/off depending on

presence. Then came glare and with that unified glare ratings. Also along the way we even discussed indoor lighting.

Moving on we discussed Non-visual biological effects of lighting where we had an interesting discussions on Leonardo da Vinci and his contributions to biology, in a way to lighting. He was the first man to say that the light reaches the back of the brain. He had a passion for studying human bodies and his portraits clearly specified the huge research on human body he has done. We discussed another nerve from the eye which connects to the pineal gland on the way connecting to the biological clock leading to discussions of body rhythm of 20 to 24 hours.

Finally in our last class we discussed shop lighting, a very interesting topic. Here we started the discussion with shop formula discussing what type of lighting an exclusive shop should have and what a general departmental shop should have. Gold items look most attractive when warm white light is used while silver items look best in cold white light. We were taught an interesting trick of how to view a diamond by placing it under a white piece of cloth. The conclusion we had was that the items are best viewed if the surroundings are of the same background rather than a contrasting background. We discussed accent factor. Sir showed us images of how an object looked under different colours of lighting. Sir even spoke to us about a curator in a museum in Netherlands and interpreted his speech.

And above all, the unplanned visit to the lighting park of the management campus was an awesome learning endeavour. We got to know the thought process that goes in lighting of various structures, and which part to highlight and which to hide. He clearly specified which colour of light would suit which structure thus proving that the choice of lighting that had been made was perfect.

The two weeks of our lighting journey has been a good one for me and I sincerely hope that in the remaining two days I would be able to take back a lot more about a topic I personally had scarce knowledge about. And not to forget the break discussions and the after class discussions the whole class had.

Umesh Kumar

One of the best gifts that God has given to the humankind is vision and to view the things around us, light is the most essential factor. Since the advent of scientific developments light and lighting have enthralled the great thinkers. Here in this training/workshop we got to learn a lot about the past, present and future of lighting.

Firstly we learned about the functioning of the human eye and how our brain processes the light signals. Yellow light of 555nm wavelength is most sensitive for the cells called cones and greenish blue light of 507nm is most sensitive for rods.

Using the Lumen method the concept of indoor lighting was made clear.

Lamp spectra was a really interesting topic as it explained how different types of light can have different colours. This topic was made even more appealing by the introduction of Colour Rendering Index which explained what appearance different colors can have under different kinds of light sources. The concept of colour temperature, was bit complex to understand but once understood it was very interesting.

Light and the Environment: Sustainability, this topic focused on the duty of the light manufacturers and customers to use the right sort of lighting to promote efficient use of energy and sustainable development.

Study and classification of light sources was a topic of great interest as it took me through a walk along the development of various light sources and lighting technology. Also, during this study I learned various factors (efficiency, lifetime, lumen depreciation) that govern what light source will be used in what place. I was especially interested in the working of various gas discharge lamps and amongst them CFL was my favorite. Working and design of LEDs in the recent times has been a topic of great interest for the whole of the lighting industry and green engineers and so does it interest me also. The most recent member in the LED family is OLED (Organic LEDs) which can be the future to many lighting solutions in my view.

The topic of non-visual biological effects of lighting was completely new so there was a different sort of keenness for this topic and as was expected it was very absorbing. The fact that a lot needs to be discovered in this field makes this field even more interesting. Probably there could be some day when many of the physical and psychological problems of humans could be solved by using light as a therapy. The most recent developments in dynamic lighting will one day make humans perform better not only at their offices, but in their homes and public places as well. Usage of light to optimise the sporting performance of the Dutch swimmers at the Beijing Olympics is a good example of how light can influence the human body and brain positively.

Indoor lighting is a topic that involves a very precise study of the environment that needs to be lighted. Lighting should be apt according to the usage of the space as improper lighting can make the space look

unsuitable for the desired job. As most of the office work involves visual input to the brain so visual performance should be optimum and to achieve a good visual performance the workplace should be well lit. Generally lighting levels for offices should be 500 lux. There are still many other factors that govern office and indoor lighting.

Shop lighting has not got any strict rules for lighting as it very much depends upon what's in fashion. A shop that looked appealing few years may no more look as appealing because it may be out of fashion. Still for the present scenario the shop formula works well. Accents, light incidence direction and modelling play a very important role to attract customers towards the products.

Being part of this training program was a very great opportunity for me to broaden my view about technology application in daily life. Under the care and guidance of Wout van Bommel Sir I learned many things not only related to lighting technology but also to the world around us.