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A Case Study on Analysis of Insufficient Lighting in Substation in Dialux Software

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***Abstract*— The paper describes the floodlighting in the Substation where the conventional lights were placed at different points. The paper deals with a case study of flood lighting used in the Switchyard where lighting was not sufficient the substation chosen was of 220/132/66 KV. Flood lighting of the substation which was installed with conventional lights. Designing of the flood lights lighting scheme used in substation is displayed in the paper by using DIALux software and LUX was calculated and results were obtained and then gray area analysis was carried out and then the whole section was replaced by more lights as were required for proper illumination in the switchyard.**

I. INTRODUCTION

Over centuries artificial lighting has made a significant progress from candles, gas to Kerosene Lamps to today's incandescent, fluorescent Lightings. As a result the overall operating cost of light has been reduced to 4.3 orders of magnitude since the 1700s [1]. The world uses 0.72% of GDP in the Light, World GDP of 63.12 T$ (USD). Which means 455 B$ in Lighting [2]. Hence Lighting should be such that will reduce the cost for that energy efficient Lighting is the best possible solution to reduce the overall cost. For that energy auditors and engineers are focusing on the use of energy efficient lighting devices which will help in the reduction in the overall cost of Lighting. Recent trends witness companies incurring a one-time cost to install LED lights in place of halogen bulbs, implement real time energy monitoring and measurement software tools, etc. Physiological changes that occur as a person ages include reduced pupil size, cloudier lenses, and reduction in the amount of photoreceptors that play a dominant role in low-level lighting, all have a significant impact on visual performance as light levels decrease.

Because the physiology of the human eye is such that visual performance degrades as a person ages, implementation of lighting systems that can account for that degradation is critical[3].As the age of the ground staff varies from 20 years to 50 years the certain degradation in that Ferber is taken in to consideration and proper illumination is needed to be provided so that they would carry out the maintenance work and at the same time it is needed a proper lighting is essential for maintaining the security of the assets in the substation.

In India the BEE is the prime institution which keeps the Lighting parameters into consideration hence the LUX is needed to be maintained accordingly. Yet the transmission companies need to maintain the proper LUX taking in to consideration various standards of Lighting as been specified in IS.

II. CONVENTIONAL LIGHTING

The conventional Lighting basically deals with the Halogen Lamps, mercury vapour lamps and Metal Halide used in the Substation for carrying out maintenance at night [4]. The halogen lamps have its own permutation and combination for instance a 400 watts fixture is used for lighting in the Substation and mercury vapour lamps are of 250 watts used in the substation lighting. Halogen is from the family of the incandescent lamps. The Lamps are used for providing Lighting for critical equipment which is 50 Lux (substation Specification) to be maintained for carry out the maintenance during the night.

Mercury Vapour (MV): MV was the first HID lamp developed and is commonly used for "security" lighting. MV lamps are a quartz tube filled with pressurized mercury vapor that produces light when an electrical current passes through the vapor. Although it has long lamp life, its efficacy is quite low.

Metal Halide (MH): MH fixtures are another reliable source of HID light. They often are used in sports facilities or where accurate colour rendering is required. MH lamps operate similarly to HPS, but use metal salts instead of gas in the arc tube to create a blue-white light.

III. DIALUX SOFTWARE

DIALux is continuously being developed by a team of 20. You can plan in DIALux with the luminaries of the world's leading manufacturers and therefore have the greatest possible freedom in the design process. And the list of international partner companies is getting longer and longer[6].

Benefits of the software:

The software gives the layered structure of the whole system then it will help in selecting the no of lights required for the project will help in selecting the types, height, angle, development of LUX required for the project.

Simple, effective and professional light planning gives the following additional benefits:

•Latest luminaries data of the world's leading manufacturers

•Latest state of the art software always available free of charge

•Energy evaluation at the drop of a hat

•Coloured light scenes with LED or other colour changing luminaries

IV. DESIGN OF SYSTEM & RESULT OBTAINED

The software interface was used to design the lighting in the substation. The conventional lights are laced at different location in the substation and the values are obtained of the particular section. The thing that was kept in mind was that the LUX required is been maintained or not . Now here we have tried to place the lights on the location as been displayed in switchyard taken for the case study in order to obtain the output and would help us getting the no of lights required in the substation.

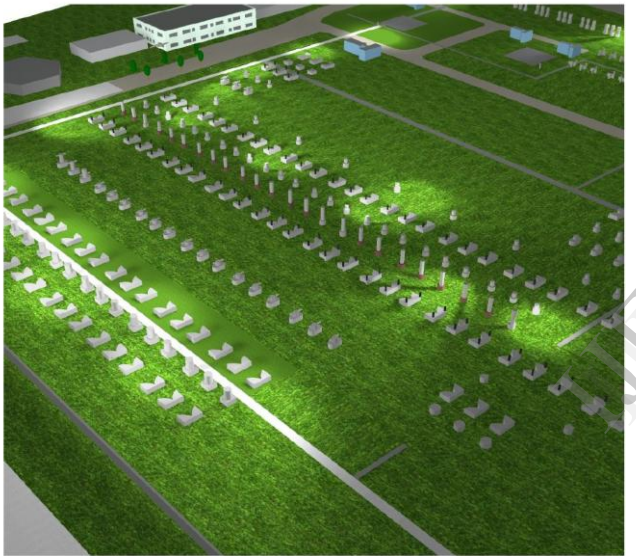

Fig 1 Design in DIALux Software

As been seen in Fig 1 a replica of substation was created and the Lighting was placed at different points at the gantry in order to get the proper illumination in the substation as been seen in the case study. Here Conventional lights (MH, Mercury lights) were placed and the false colour is obtained (the following is the interface present for assessment in the software).So when proper assessment was carried out by placing the lights it was found that those were not sufficient which is resembled in the following results obtained .

The procedure was not too complex as initially the conventional lighting were placed at different location in the substation and then the lighting was observed it was found that the section where white surface is obtained there proper LUX is maintained and where there is red purple and green proper LUX is not maintained. Hence the no of lights are needed to be increased in these sections.

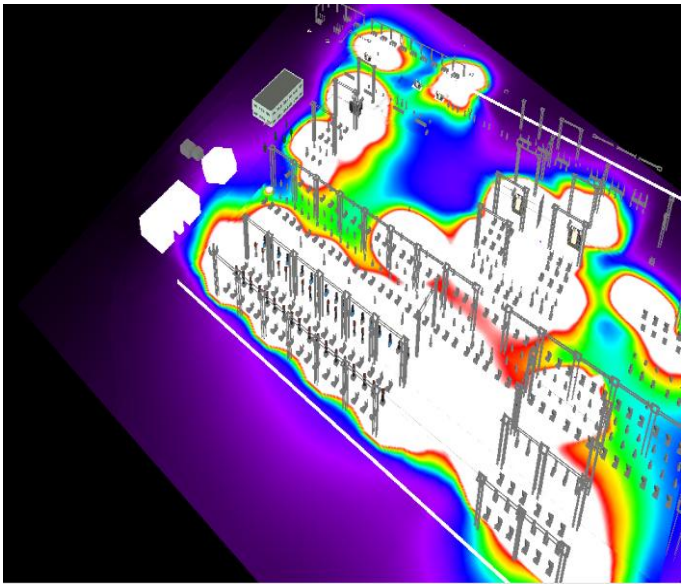

Fig 2 False colour Obtained with conventional Lighting

The following are the results obtained by the section of 220 KV section and the LUX is obtained accordingly and hence the results shows that the values are obtained by placing the lights as they prevailed in the present system . The analysis was made and the whole section was noticed and then seen from different dimensions taken in to consideration the height which is given in the following table:

220 KV	Height of gantry 45 feet
132 KV	Height of gantry 35 feet
66 KV	Height of the gantry 15 feet

Table 1

The following is the gray area obtained in the section and the following design has been seen and the lights are required for those section and hence lights are needed to be provide in these section for the proper illumination . Hence the conventional metal halide used in the substation was insufficient in the substation as been displayed by false colour data. There were 56 Lights in the section.

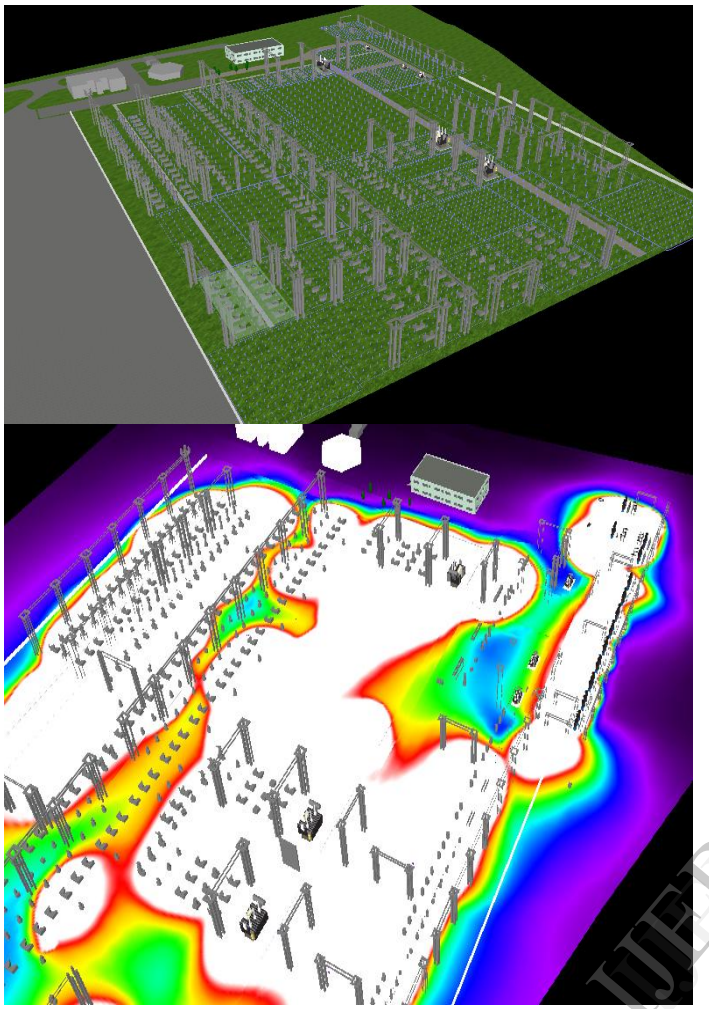

Fig 3 & 4 GRIDS & Illumination Analysis in the Switchyard

The following section is taken into consideration and the grid is been placed in it and the system was seen by placing the LED lights and then visualizing how the system will behave when the LEDs are placed and accordingly the LUX is maintained in the system such that the output is as per our requirement. Then the whole section was lit by LED lights and proper illumination is maintained in the substation. 80 Lights were placed and results were obtained at different location to maintain the proper LUX level in the substation.

CONCLUSIONS

The conventional Lights are used in the switchyard. The Analysis was carried out in the section and a grid was placed then the whole section was analyzed and conventional lights were placed in those sections as been placed in the present system in the case study but were found that the lighting placed were insufficient and proper illumination was obtained by placing the LED lights in those section. Hence appropriate amount of conventional lights were placed and the results obtained that the switchyard requires 80 lights instead of 59 lights.

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