STUDIES & DESIGN OF INDOOR LIGHTING IN INDIAN SCENARIO

A THESIS
SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENT FOR DEGREE OF
MASTER OF ENGINEERING
IN
ILLUMINATION ENGINEERING

SUBMITTED BY
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Exam. Roll No.- M4ILN19001

UNDER THE SUPERVISION OF

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RECOMMENDATION CERTIFICATE

This is to certify that the thesis entitled " **STUDIES & DESIGN OF INDOOR LIGHTING IN INDIAN SCENARIO"** submitted by **ANIRBAN CHATTERJEE**, (Exam. Roll No. , Registration No.014068 of 2017-2018) of this university in partial fulfillment of requirements for the award of degree of Master Of Engineering in Illumination Engineering, Department of Electrical Engineering, is a bonafide record of the work carried out by him under my guidance and supervision.

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This foregoing thesis is hereby approved as a creditable study in the area of Illumination Engineering, carried out and presented by **ANIRBAN CHATTERJEE**, in a manner of satisfactory warrant its acceptance as a pre-requisite to the degree for which it has been submitted. It is notified to be understood that by this approval, the undersigned do not necessarily endorse or approved the thesis only for the purpose for which it has been submitted.

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DECLARATION OF ORIGINALITY AND COMPLIANCE OF ACADEMIC ETHICS

I hereby declare that this thesis contains literature survey and original research work by the undersigned candidate, as part of my Master of Engineering in Illumination Engineering studies.

All information in this document have been obtained and presented in accordance with academic rules and ethical conduct.
I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work.

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ABSTRACT

The main motive of the Indoor lighting design is to provide desired Illuminance in the Rooms and with least glare and accurate uniformity. The road lights should provide good visibility condition and reduce the glare. Thus this study on indoor lighting was done to make it more visually acceptable and energy efficient one.

The work starts with definition of indoor lighting design parameters. A brief note on national and international recommendation for road lighting is given.

Indoor lighting consists of mainly Industrial buildings and process, Office,schools,publicbuildings,hospital ,restaurants,surgeries,shops,homes

The work then continues to find the most energy efficient lighting approach. Luminaire with LED indoor luminaires are found to be more effective than luminaire with conventional incandlescent lamps,Fluorescent lamps,compact fluorescent lamps. Nowadays Fluorescent lamps are been neglected for lower efficacy and incandlescent lamps for its short-lasting natureand blackening of glass. . But nowadays LED luminaires are becoming more convenient option having far better CRI Index (>80) and efficacy (>90lm/W). Design has been done with conventional luminaire as well as with LED luminaire.

The final part of the work comparison of the design conventional and LED shows how to minimize the energy consumption by using LED luminaire over conventional luminaire.

A final payback calculation for the design made with LED luminaire is done to prove the superiority of the LED luminaires with respect to the conventional luminaires

This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards, afterthe draft finalized by the Illuminating Engineering and Luminaires Sectional Committee had been approved by the Electrotechnical Division Council.

The primary object. of this code is to indicate the factors which should be taken into account to achieve good lighting.

It confines itself primarily to the lighting of working interiors, such as factories, workshops, offices,commercial premises, public buildings, hospitals and schools, keeping two objects in mind, namely, to make the task easy to see and to create a good visual environment.

Lighting is good only when it is suitable in both quality and quantity for two purposes; for creating good environmental brightness which is at the same time agreeable and beneficial to the user, and for permitting a high degree of efficiency in seeing whatever is of special interest or importance.

Many of the recommendations hold good whether lighting is artificial, natural or combination of the two and, as far as possible, the lighting of a building is regarded as a service which should be main-tained at a high standard whenever the building is occupied.

The conventional methods of planning described herein are still the subject of continual research and in special cases it is felt that planning should be extended to include consideration of the luminance patterns relating to the whole of the visual field.

Provision of a good lighting system calls for co-ordination from the initial stages among the variousparties concerned, namely, the architect, the consultan$ and the illumination engineer. Therefore, it is essential that information regarding lighting should be exchanged between the parties from the stage of planning to installatidn.

This standard applies to the artificial lighting of interints; it applies also, where appropriate to the artificial lighting of areas in the open air, where these areas are used for the same purposes as the corresponding interior premises.

Aim of the Work :

The overall aim of the work is to investigate the required lighting of indoor and in Indian condition.

The objectives of this project are as follows:

1. The first objective is to design and calculate the quantity and wattage of conventional luminaire & LED luminaire required to illuminate a particular part of a Indoor area

And the second objective is comparative studies between conventional & LED luminaires and calculation of the energy consumption

Part 1 General requirements and recommendations for working interiors
Part 2 Method of calculation of the glare'indices for interiors
Part 3 Recommendations for lighting in industries
Part 4 Recommendations for lighting in offices
Part 5 Recommendations for lighting in hospitals
Part 6 Recommendations for lighting in libraries
Part 7 Recommendations for lighting in educational institutions
Part 8 Emergency lighting

IS 3646 was first published in three parts, Part 1 covering principles for good lighting and aspects of design, Part 2 covering schedule of illumination and glare index, and Part 3 covering calculation of coefficient of utilization by the BZ method. Since calculation of coefficient of utilization by the BZmethod has become obsolete, therefore, in the first revision a new method of'calculation of glare indices has been introduced.

Parts 1 and 2 of the standard, when completed, will supersede IS 3646 (Part 1) : 1966, IS 3646(Part 2), and IS 3646 (Part 3) : 1968. Subsequent parts of the standard are intended to coveradditional requirements that should be fulfilled while designing the lighting for a specific area. Withthe publication of these parts, the existing standards relating to code of practices for individual areas will, therefore, be ultimately withdrawn.

In the preparation of this standard, ,assistance has been derived from draft CIE-Publication on InteriorLighting, DIN 5035 (Parts 1 and 2) : 1979 and CIBS Code for Interior Lighting, 1984.

1> INTERIOR LIGHTING DESIGN PARAMETERS

1. Consideration of luminous efficacy. Luminous efficacy is ratio of lumen output from the lamp to the electrical power (in watt) input to the lamp. The required Illuminance must be provided by the lamp in conjunction with the lighting economically.
2. Consideration of the life of the lamp must be done by the designers. They should think what may be the difficulties to replace burned out lamps and whether group replacement of the lamps is the better choice economically or not.
3. The lumen maintenance of the lamp is an important factor. Question can arise if it is important to have a certain minimum level of Illuminance at all time.
4. Again another important consideration is color, the factor of appearance. Although all the lamps listed produce “white” light, their CCT and CRIs differ. Designers should consider the importance of the colors of the seeing task and its surroundings to be faithfully reproduce.
5. Auxiliary equipments required along with the lamps make a big question. As we have seen, all gas discharge light sources require ballast, where as incandescent lamps do not. The types of ballast used can affect lamp output, life, starting reliability, system efficiency and occupant comfort.
6. Designers should think about what may be the other miscellaneous, i.e. whether any other factors are present in the particular environment or not, temperature is a problem or not and whether the area must be free from stroboscopic effects or not, electromagnetic interference disturb the activities going on in the space, the fumes are present which could produce corrosion or an explosive atmosphere etc.

Luminous Efficacy Consideration

The comparison of the first three factors for the four common lamp types is shown in the above table. Let discuss the lamp efficacy first. For incandescent lamps the efficacy ranges from 12 lm/W for the 40 W standard lamp to 22 lm/W for the 500 W standard lamp. For the incandescent lamps with the design kept unchanged, the lamp efficacy increases with the lamp wattage. It happens largely because the thicker filaments of the higher wattage lamps may be operated at higher temperatures for the same life. PAR (Parabolic Aluminized Reflector) and R (Reflector) lamps have generally lower efficacy than the standard lamps of same wattage. This is because PAR and R lamps are designated to have longer lives.

The fluorescent lamps provide much higher efficacies than the incandescent lamps inspite of having ballast losses. As an example, the 40 W standard cool white fluorescent lamp emits 3150 lumen initially and its ballast consumes 12 W. Thus the efficacy are 3150/40 = 79 lumens /watt initially and including ballast lost total wattage is 52 W and hence 3150/52 = 61 lumens / watt overall. This overall efficacy rating is being used for the latter figure in the market. In the lighting design scheme the Fluorescent lamps are used to be operated in pairs with single ballast to improve overall efficacy. For example, each of the two fluorescent lamps consumes 40 W and their common ballast consume 12 W, giving an initial efficacy of 68 lumen/W overall. In case Preheat fluorescent lamps the lamp efficacies are very low. In this modern age, fluorescent lamp ballast are so designed that they are considered as energy saving lamps with the highest luminous efficacy.

Metal halide lamps have higher efficacies than the mercury lamps. It is because of the addition of halide salts into the metal halide lamps. As an example 400W metal halide lamp emits 34000 lumen initially and its ballast consumes 460 W. It is giving an initial overall efficacy of 745 lumen/W. So the lower wattage sizes give the lower efficacies.

Again in case of high pressure sodium lamp, they provide the high efficacy. But the low pressure sodium lamp having higher efficacy is not suitable for interior lighting. It is because of poor color rendering properties. As an example, the 400 W sodium lamp emits 50000 initial lumens and its ballast consumes 75 W. So whole set up consumes 475 W. Its initial luminous efficacy is 105 lumen/W. By composition, the 100 W sodium lamp emits 9500 lumens, consumes 135 W, and has an initial efficacy of 70 lumen/W.

Life of the Lamps Consideration

The second column of the above table shows the life of the lamps in hours. We always assume that the operations of the lamps are at their rated voltage and normal temperature. The lives of the lamp depend on the lamp types. The life rating of the standard incandescent lamps is of 750 or 1000 hours. Again PAR and R lamps are rated at 2000 hours. For the fluorescent lamp, their life ranges are based on 3 burning hours start where as Preheat fluorescent lamps have life ratings at the low end of the range, namely 7500 or 9000 hours. Instant start lamp is durable for 12000 hours. Again the life of rapid start lamp lasts for 18000 or 20000 hours.
The metal halides lamps life is dependent on the number of burning hours per start. Their life ratings are for 10 hours per start. As an example the 400 W metal halide lamp has the longest life i.e. 20000 hours. The 1500 W lamp has shortest life i.e. 3000 h. Again all high pressure sodium lamps have a life of 24000 hours when they are used with the specially designed ballasts. High pressure sodium lamps are used in place of mercury lamps due to less wattage and higher life span. Mercury Lamps has 12000 hours life span.

Percentage Lumen Depreciation

The percent lumen depreciation of the lamps is shown in the table.
In case of Standard incandescent lamps, it depreciates in lumen output by 10 to 22% during lamp life.
In case of the fluorescent lamps, the 100 hours lumen value is called initial lumens and the lumen depreciation is calculated from that point onward and is based on 3 hour per start.
The mean lumen factor is the percentage of the initial lumens to be

expected at 40% of rated life. Lamp lumen depreciation factor is the percent of the initial lumens to be expected at 70% of rated life.

For example, the 40 W standard cool white fluorescent lamp gives 3150 initial lumens at 100 hours and 2650 lm at 70% of rated life (14000 hours). Thus its lumen depreciation factor is 0.84 or 16% depreciation in lumen output.

High intensity discharge lamps have their initial lumen ratings at 100 hours. Lumen depreciation for these lamps is given in terms of mean lumens, which is the lumen output to be expected at about 70% of rated life. Metal halide lamps show greater lumen depreciation than do high pressure sodium lamps.

Color of the Lamp Lumens Consideration

Color of the lamp lumen is the fourth factor which is always considered by the designer. To measure the color, CCT (Correlated Color Temperature) and CRI (Color Rendering Index) are calculated to provide a suitable color appearance in the lighting design scheme.

CCT or Correlated Color Temperature means the temperature of the black body at which this black body radiation color is equivalent to the color of the lamp lumens.

CRI or Color Rendering Index means degree of closeness of the color of lumens from the lamps to the standard Lumen color. Standard lamps are, as per CIE recommendation, A, B, C, D_{55}, D_{65} and D_{75}. The type A is the tungsten filament lamp at 2856 K and the type B and C are tungsten filament lamp with some filter. D_{55}, D_{65} and D_{75} are the day light type.

There are five types of “white” fluorescent lamps available in the market. The first three types i.e. warm white, cool white and day light lamps and they are with high efficacy to provide reasonable color rendition. Next two types are the two deluxe lamps which have only 70% of the efficacy but they provide improved color rendition. The words warm, cool and daylight are chosen in the sense that a warm white lamp emits yellowish white light and makes a space feel warmer. Whereas, a cool white lamp emits a bluish white light and it tends to create a cooler atmosphere. Again the daylight lamp is a very cool appearing source and it is a close match CCT to an overcast day.

2>LIGHTING REQUIREMENTS AND WORKING FOR INTERIOR(INDIAN STANDARD: IS 3646 (Part 1) : 1992 and *IS 3646(Part 2):1996*)

This code (Part 1) covers -the principles andpractice governing good lighting in buildingsand relates chiefly to the lighting of &workingareas' in industrial, commercial and publicbuildings, hospitals and schools.

For the purpose of this standard, thefollowing definitions shall apply.

Adaptation

The process by which the properties of theorgan of vision are modified according to theluminances or the colour stimuli presented to it.The term is also used, usually qualified, to denote the final state of this process. For example, 'dark adaptation' denotes the state of the visual system when it has become adapted to a very low luminance.

Candela (cd)

The SI unit of lumin&s intensity, equal to onelumen per steradian.

Colour Rendering

A general expression for the appearance ofsurface colours when illuminated by light from a given source compare?, consciously or unconsciously, tiith their appearance under light from some reference source. $Good colour rendering'implies similarity of appearance to that under an acceptable light source, such as daylight.

Colour Rendering Index (CRI)

A measure of the degree to which the colours of surfaces illuminated by a given light source confirm to those of the same surfaces under a reference illuminent. Suitable allowance having been made for the state of chromatic adaptation.

Colour Temperature (K)

The temperature of the black body that emits radiation of the same chromaticity as the radiation considered.

Contrast

A term that is used subjectively and objectively.Subjectively, it describes the difference in appearance of two parts of a visual field seen

simultaneously or successively. The difference may be one of brightness or colour, or both.

Objectively, the term expresses the luminance difference between the two parts of the field by such relationship as: -

Contrast = (Lo – Lb)/Lb

Lb is the dominent or background, Lo is the task luminance.Quantitatively, the sign of the contrast is ignored.

Contrast Rendering Factor (**CRF**)

The ratio of the contrast of a task under a given lightmg installation to its contrast under reference lighting conditions.

Contrast Sensitivity

The reciprocal of the minimum perceptible contrast.

Correlated Colour Temperature (Unit : K)

The temperature of a block body which emits radiation having a chromaticity nearest to that of the light source being considered, for example the colour of a full radiator at 3500 K is the nearest match to that of a bWhite' tubular fluorescent lamp.

Diffuse Reflection

Diffusion by reflection in which, on the macroscopic scale, there is no regular reflection.

Diffused Lighting

Lighting in which the light on the working plane on an object is not incident predominantly from any particular direction.

Direct Lighting

Lighting by means of luminaires with a light.distribution such that 90 to 100 percent of the emitted luminous flux reaches the working plane directly, assuming that this plane is unbounded.

Directional Lighting

Lighting in which the light on the working plane br on an object is incident predominantly from a particular direction.

Disability Glare

Glare which impairs the vision of objects without necessarily causing discomfort.

Discomfort Glare

Glare which causes discomfort without necessaries impairing the vision of objects.

Emergency Lighting

Lighting intended to allow the public to find the exists from a building with ease and.certainty in the case of failure of the normal lighting system.

Flicker

Impression of fluctuating luminance or colour.

General Lighting

Lighting designed to illuminate the whole of an area uniformly, without provision for special local requirements.

Glare

Condition of vision in which there is discomfort or a reduction in the ability to see significant objects, or both, due to an unsuitable distribution or range of luminance or to extreme contrasts in space or time.

Illuminance (E)

At a point of surface, quotient of the luminous flux incident on an element of the surface containing the point by the area of that element.(Unit : Lux, lx).

Illumination

The application of visible radiation to an object.

Indirect Lighting

Lighting by means of luminaires with a light distribution such that not more than 10 percent of the emitted luminous flux reaches the work-ing plane directly, assuming that this plane is unbounded.

Light Loss Factor

Ratio of the average illuminance on the working plane after a specified period of use of a lighting installation to the average illuminance obtained under the same conditions for a new installation.

Local Lighting

Lighting designed to illuminate a particular small area which usually does not extend far beyond the visual task, for example, a desk light.

Localized Lighting

Lighting designed to illuminate an interior and at the same time to provide higher illuminance over a particular part or parts of the interior.

Lumen (lm)

Luminous flux emitted within unit solid angle(one steradian) by a point source having a uniform luminous intensity of 1 candela.

Luminaire

Apparatus that distributes, filters or transforms the light given by a lamp or lamps and which includes all the items necessary for fixing and protecting these lamps and for connecting them to the supply circuit.

Luminance (L)

In a given direction, at a point on the surface of the source or a recepter or at a point on the path of a beam.

Quotient of the luminous flux leaving, arriving at, or passing through an element of surface at this point and propagated in direction defined by an elementary cone containing the given direction and the product of the solid angle ofthe cone and the area of the orthogonal projection of the element surface on a plane perpendicular to the given direction (Unit : Candela persquare metre, cd/ma).

Luminous Efficacy (Unit : lm/W)

The ratio of luminous flux emitted by a lamp tothe power consumed by the lamp. When the power consumed by control gear is taken into accou nt, this term is sometime known as lamp circui Y luminous efficacy and is expressed in.

lumens/circuit watt.

Luminous Flux ( )

The quantity derived from radiant flux by evaluating the radiation according to its action upon a selective receptor, the spectral sensitivity of which is defined by the standard spectral luminous efficiencies (Unit : lumen).

Luminous Intensity (I) (Of a source in a given .direction)

Quotient of the luminous flux leaving the source propagated in an element of solid angle containing the given direction, by the element of solid angle (Unit : candela, cd).

Lax (lx), Lumen Per Squtie 'Metre(SI Unit of Illuminance)Illuminance produced by a luminous flux- of one lm uniformly distributed over a surface ofarea one square metre.

Service illuminance

The mean illuminance throughout the mainte-nance cycle of an installation, averaged overthe relevant area. The area may be the whole of the working plane or just the area of the visual task and its immediate surround, depending onthe lighting approach used.

Specular Reflection - Regular Reflection

Reflection without diffusion in accordance withthe laws of optical reflection as in a mirror.

Stroboscopic Effect

Apparent change of motion or immobilizationof an object, when the object is illuminated bya periodically varying light of appropriatefrequency.

Uniformity Ratio

The ratio of the minimum illuminance to theaverage illuminance. In some instances, theratio of the minimum to the maximum illumi-nance is quoted. The ratio usually applies to values on the working plane over the working area.

FUNCTIONS OF LIGHTING

a>To ensure the safety of indivudal

b>facilate performance of visual task

c>help the creation of appropriate environment

Safety is always important but the emphasis given to task performance and the appearance of the interior will depend on the nature of the interior. For example, the lighting considered suitable for a factory toolroom will place more emphasis on lighting the task than on theappearance of the room, but in a hotel loungethe priorties will be reversed. This variation in emphasis should not be taken to imply that either task performance or visual appearance can be completely neglected. In almost all situa-tions the designer should give consideration to both these aspects of lighting.

Lighting affects safety, task performance and the visual environment by changing the extent to and the manner in which different elements of the interior are revealed. Safety is ensured by making any hazards visible. Task performance is facilitated by making the relevant details of the task easy to see. Different visual environments

can be created by changing the relative emphasis given to the various objects and surfaces in an interior. Different aspects of lighting influence the appearance of the elements in an interior in different ways. However. it should always be remembered that lighting design involves integrating the various aspects of lighting into a unity appropriate to the design objectives.

LIGHTING REQUIREMENTS

Lighting requirements are based on the follow-ing lighting engineering criteria:

- Lighting level,

- Luminance distribution,

- Glare restriction,

- Direction of incidence of light and shadow effect, and

- Colour appearance and colour rendering.

A lighting installation can satisfy the requirements laid down, only if all !he quality criteria are complied with; one or other quality criterion may be given priority, depending on the nature and difficulty of the visual task or on the type of room.

Visual Task:

-Size of the critical details of the task:

- Their contrast with the .background,

- The speed at which these details have to be perceived

- Desired reliability of recognition.

- Duration of the visual work

The quality requirements of the lighting increase with the difficulty of the visual task.

The selection of nominal illuminance for particular activities has to take into account economic aspects too. Although a higher level of lighting involves greater overall costs, these may be more than out-weighed by increased productivity and lower accident rate. A compromise has often to be made between desirable illuminance levels and those which are possible due to the economic climate prevailing. In consequence, it may be necessary to accept a

lower standard of. lighting than that which would be required from. the point of view of performance.

The overall costs of a lighting installation can be reduced by using lamps having a high luminous efficacy and luminaires having a high efficiency and suitable light distribution.

Illuminance:

The lighting level produced by a lighting installation is usually qualified by the illuminance produced on a specified, plane. In most cases this plane is the major plane of the tasks in the interior and is commonly called the working plane. The illuminance provided by an installation affects both the performance of the tasks and the appearance of the space.

Scale of illuminance

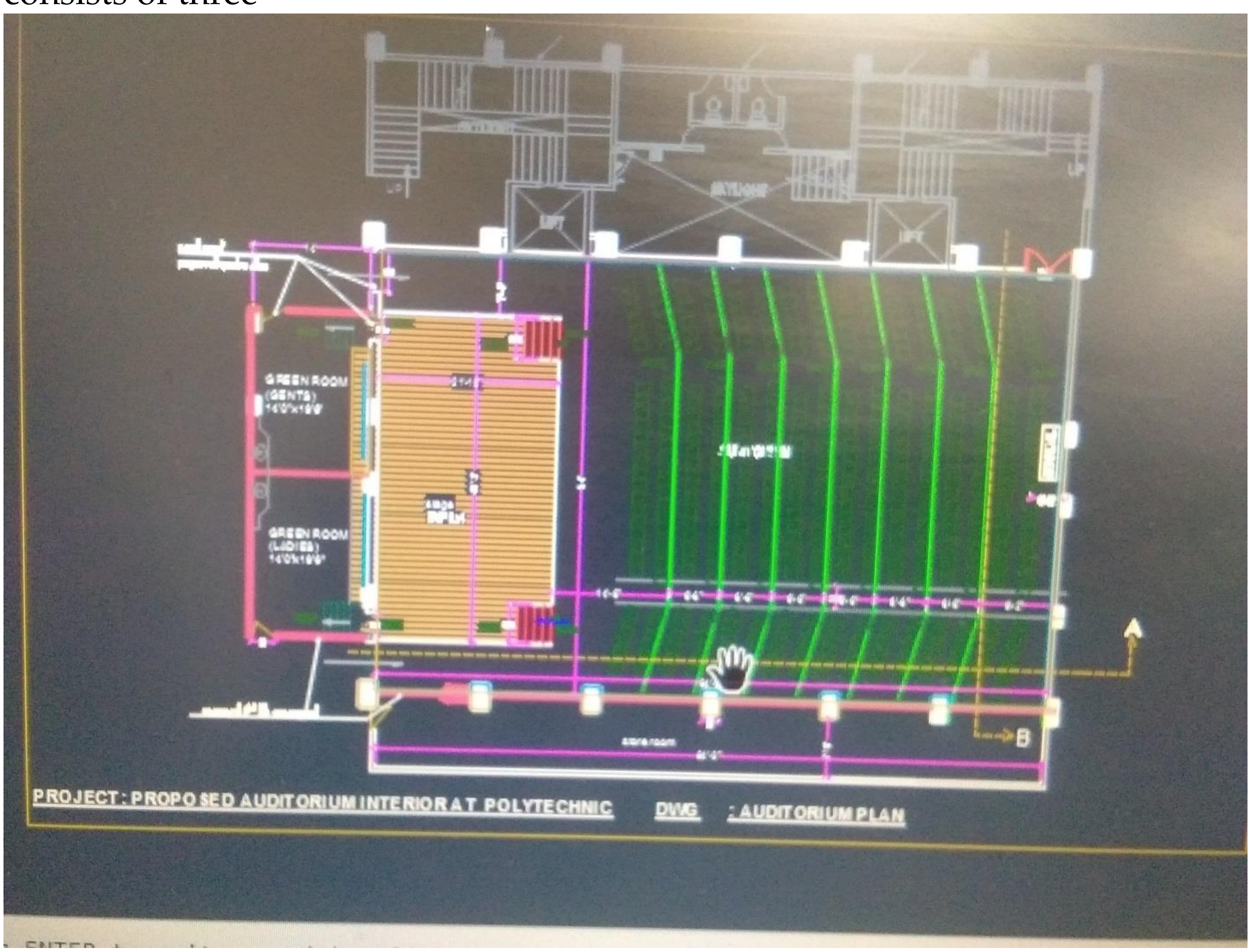
In order to be able just to discern features of the human face, a luminance of approximately 1 cd/m” is necessary. This can be achieved under normal lighting conditions with a horizontal illuminance of approximately 20 lux.

So 20 lux is regarded as the minimum illuminance for all non-working interiors. A factor of approximately 1.5 represents the smallest significant difference in subjective effect of illuminances. Therefore, the following scale of illuminances is recommended.

20-30-50-75-100-150-200-300-500-750-10001 500-2 000, etc, lux.

Illuminance ranges

Because circumstances may be significantly different for different interiors used for the same application or for different conditions for the same kind of activity, a range of illuminances is recommended for each type of interior or activity intended ,of a single value of illuminance.Each range consists of three



successive steps of the recommended scale of illuminances. For working interiors the middle v&he of each range represents the recommended service illuminance that would be used unless one or more of the factors mentioned below apply.

The higher value of the range should be used .

- Unusually low reflectances or contrasts are present in the task;

- Errors are costly to rectify;

- Visual work is critical;

- Accuracy or higher productivity is of great importance;

The visual capacity of the worker makes it necessary. Lower value of the range may be used when:

- Reflectances or contrasts are unusually high;

- Speed and accuracy is not important;

- The task is executed only occasionally.

For example a part of **AIRBUS** LAYOUT which has been designed by **CROMPTON** Lighting is shown below

Design parameters were :

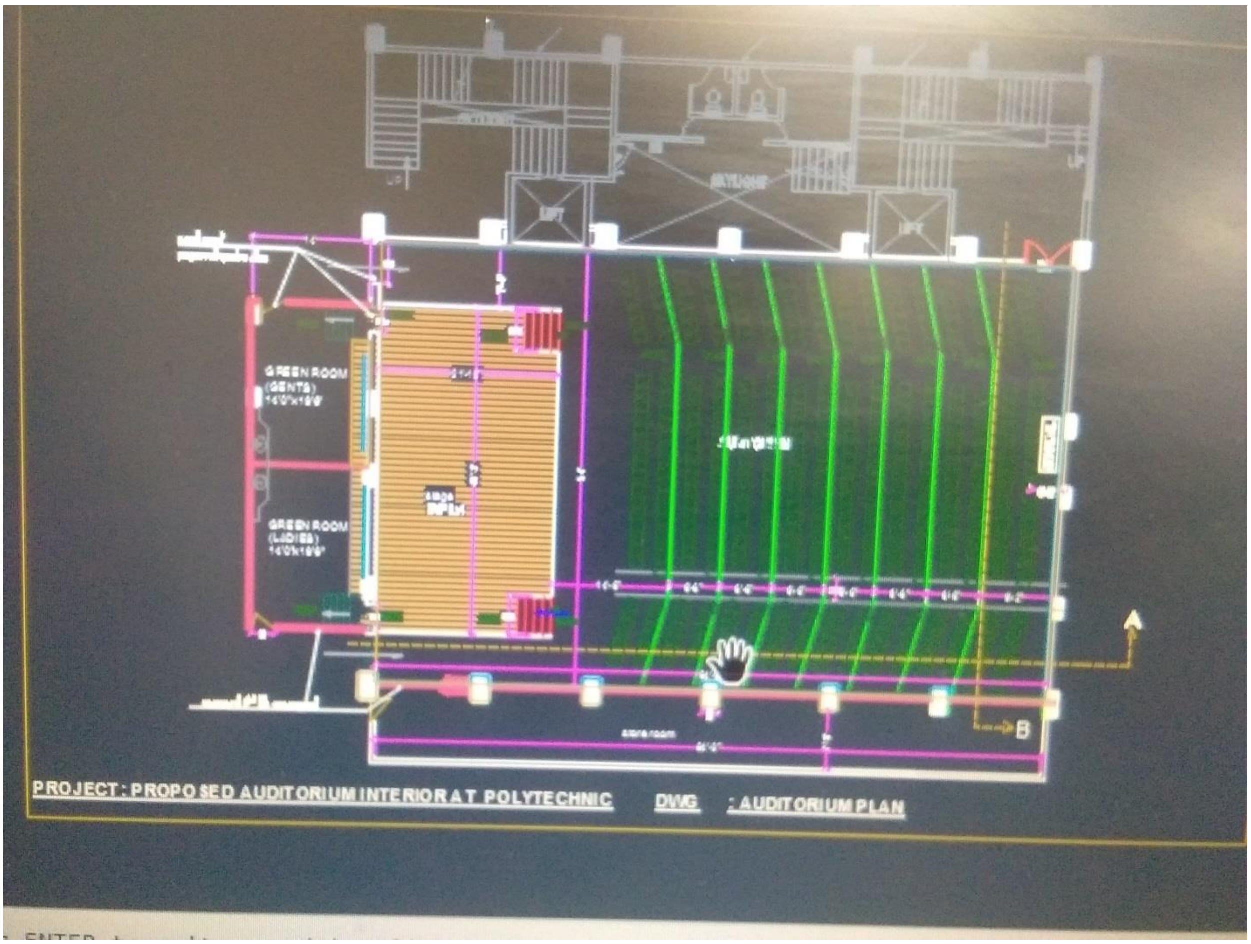
Illuminance=300-350 lux

Uniformity>40%

UGR<19


4th floor Lighting layout-R1 - LTG

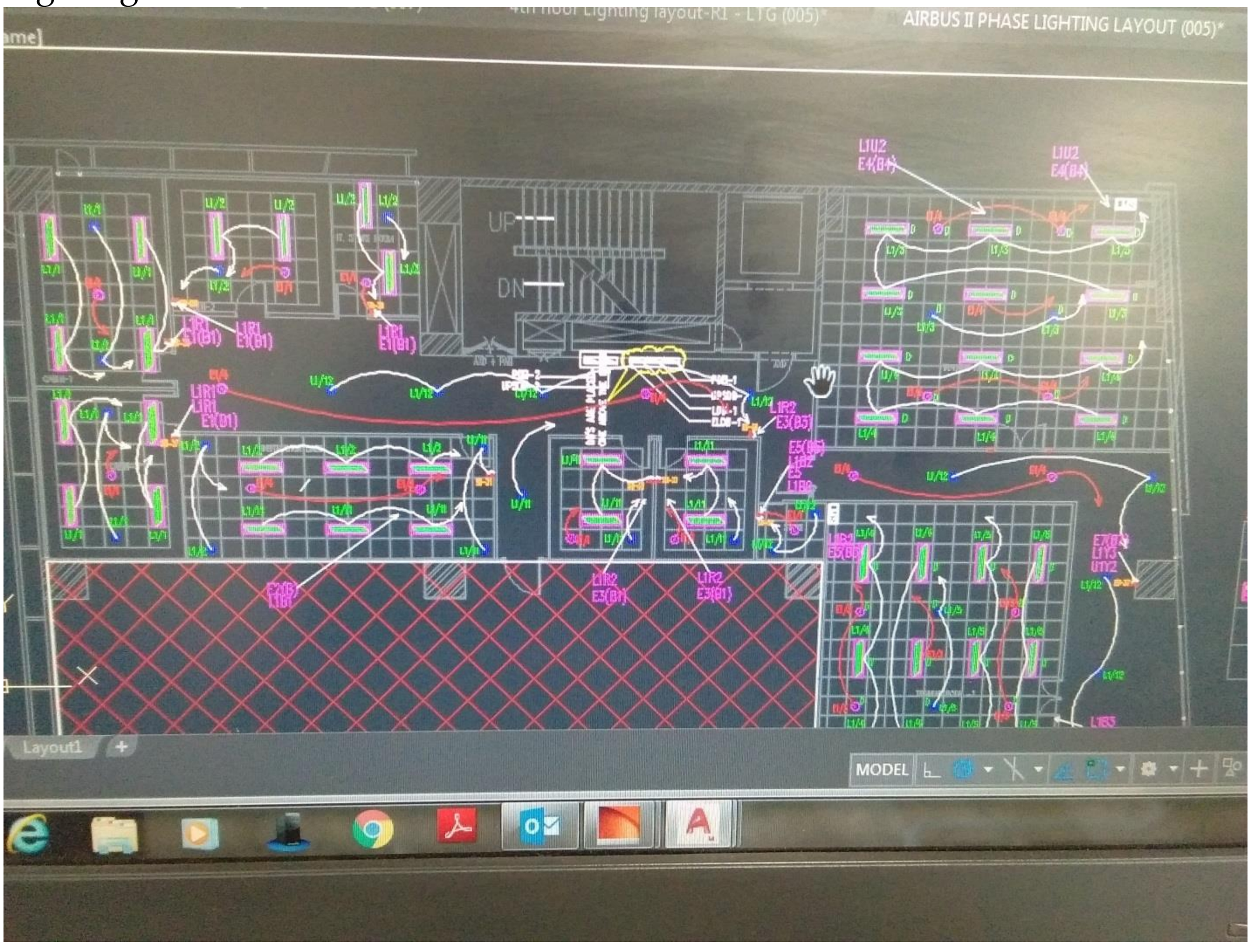
Here the reflectances considered were 70% for Celing,50% for Wall and 20% for floor and MAINTENANCE FACTOR=0.8.



Similarly this is the Layout of an Auditorium where 2ftx2ft square luminaire is used to achieve Illuminance=200Lux and uniformity >40% by **CROMPTON**

Lighting with cat-reference LCTLRN-36-FO-CDL Luminaire.

Lighting with cat-reference LCTLRN-36-FO-CDL Luminaire.



The distribution of luminance should be regarded as complementary to the design on the illuminance at in the interior. It should take into account the following aspects:

- Luminance of the task and its immediate surroundinigs;

- Luminance of ceiling, walls and floor;

- Avoidance of glare by limiting the luminance of luminaires and windows.

Luminance Distribution in the Task Area

The luminance of the immediate surroundings of the task should, if possible, be lower than the task luminance, preferably not less than l/3 of this, value. This implies that the ratio of the reflectance of the immediate background of a task to that of the task itself should preferably be in the range 0.3 to 0.5. The average luminance in the peripheral field of view should, if possible, be not lower than 1/10th of the task luminance.

Reflectances and Illuminances

In working interior, in order to reduce the contrast between luminaires and surrounding ceiling, the ceiling reflectance should be as high as possible. In order to avoid that the ceiling may otherwise appear too dark, the ceiling illuminance should not be lower than l/l0th of the task illuminance**.**

In order to obtain a well balanced luminance distribution, the ratio of the minimum to the average illuminance should not be less than 0.8.

The average illuminance of the general areas of a working interior should normally not be less than l/3 of the average illuminance of the task area(s).

The average illuminance of adjacent interiors should not vary from each other by a ratio exceeding 5 : 1.

3>AIR INDIA PROJECT BY CROMPTON LIGHTING,Bangalore:

Design Requirements by Client=To achieve 200-250 Lux by using Pillar Mounted Flood Light at 16m mounting height for the Import-Export Area by 500W Crompton Light at Uniformity>40%

And to achieve 100 lux at the Parking Area by using Highbay Crompton Lights of 70W at 12m mounting height at uniformity minimum 20% at parking

AIR INDIA

REFLECTANCES=50:30:20 for CELING:WALL:FLOOR respectively

MAINTENANCE FACTOR=0.68(Environment conditions of room: Polluted and
Considering Maintenance interval of room: Annually)

MOUNTING HEIGHT=16m FOR import/export area

and 12m for BASEMENT AREA

Partner for Contact: Syed Javeed Iqbal
Phone: 9900165500
:
:

Date: 11.03.2019
Operator: ANIRBAN CHATTERJEE

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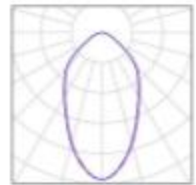
IMPORT AND EXPORT / Luminaire parts list

125 Pieces Crompton Greaves Ltd. 01 LFLPI-500-CDL/60
Article No.: 01
Luminous flux (Luminaire): 54374 lm
Luminous flux (Lamps): 54380 lm
Luminaire Wattage: 501.8 W
Luminaire classification according to CIE: 100
CIE flux code: 66 92 99 100 100
Fitting: 1 x LFLPI-500-CDL/60 (Correction Factor 1.000).

See our luminaire catalog for an image of the luminaire.



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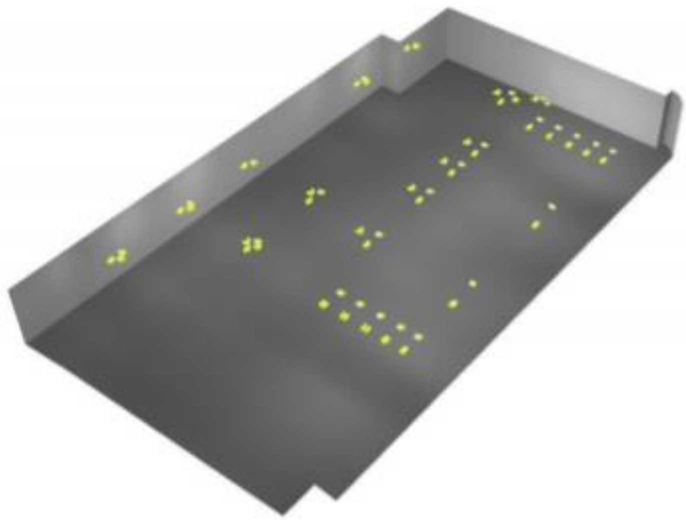

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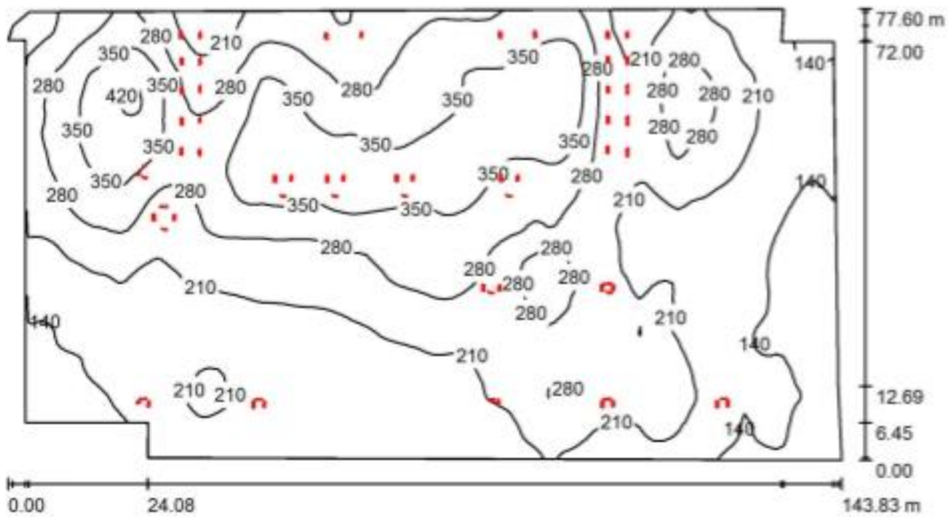


Height of Room: 16.000 m

Values in Lux, Scale 1:1029

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	243	105	432	0.435
Floor	20	243	103	429	0.425
Ceiling	50	129	33	47965	0.256
Walls (13)	30	235	51	702	/

Workplane:

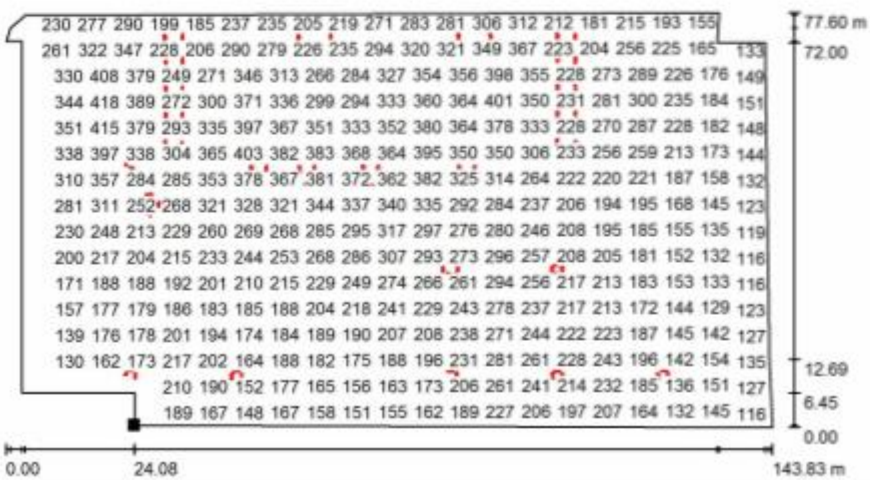
Height: 0.000 m
Grid: 128 x 128 Points
Boundary Zone: 0.000 m

Illuminance Quotient (according to LG7): Walls / Working Plane: 0.969, Ceiling / Working Plane: 0.521.

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	125	Crompton Greaves Ltd. 01 LFLPI-500-CDL/60 (1.000)	54374	54380	501.8
			Total: 6796690	Total: 6797500	62725.0

Specific connected load: 5.90 W/m² = 2.43 W/m²/100 lx (Ground area: 10632.21 m²)



Values in Lux, Scale 1 : 1029

Not all calculated values could be displayed.

Position of surface in room:
Marked point:
(59.694 m, 121.162 m, 0.000 m)

Grid: 128 x 128 Points

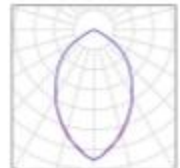
E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
243	105	432	0.435	0.244

Fax
e-Mail

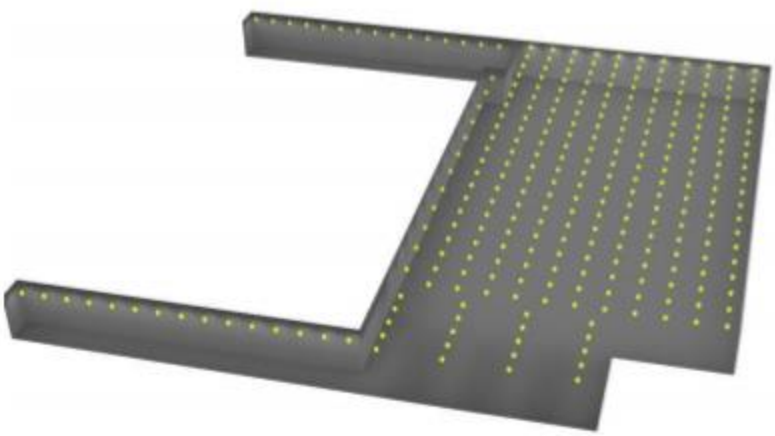
PARKING / Luminaire parts list

293 Pieces Crompton Greaves Ltd. 01 LHB11-70-CDL/60
Article No.: 01
Luminous flux (Luminaire): 7293 lm
Luminous flux (Lamps): 7293 lm
Luminaire Wattage: 69.3 W
Luminaire classification according to CIE: 100
CIE flux code: 64 94 99 100 100
Fitting: 1 x LHB11-70-CDL/60 (Correction Factor 1.000).

See our luminaire catalog for an image of the luminaire.



PARKING / 3D Rendering



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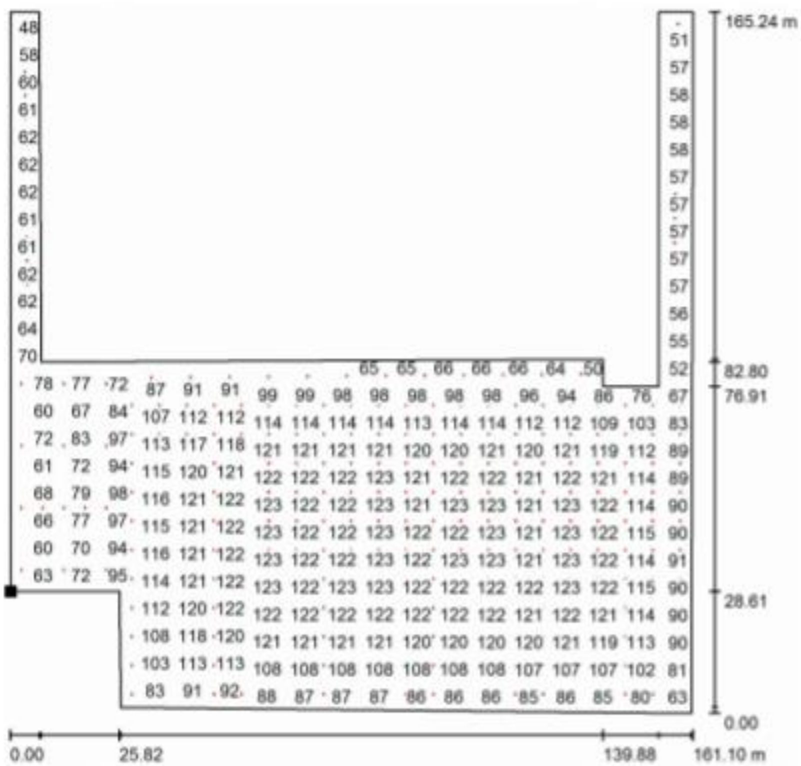
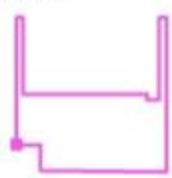
PARKING / Workplane / Value Chart (E)



Values in Lux, Scale 1 : 1293

Not all calculated values could be displayed.

Position of surface in room:
Marked point:
(28.977 m, 55.970 m, 0.000 m)



Grid: 128 x 128 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
100	30	126	0.305	0.242

4>BHEL BADMINTON COURT DESIGN(Malleshwaram, opposite to IISC CAMPUS,BANGALORE)

Design Requirements by the Client:

To achieve 300Lux illuminance throughout the Badminton court with Linear lights and flood lights such that the mounting height is 15m and the dimensions of the court is 15m X 15m.

Since it is just for the officials playing so this design falls under CATEGOREY-3 ie;

There will be no CCTV or Live TV covererage so illuminance is proposed as 250-300 lux

Achieved uniformity>50%

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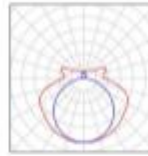
BHEL / Luminaire parts list

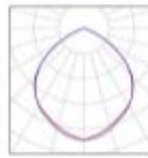
37 Pieces Crompton Greaves Ltd. 01 IGP132LT8-16
Article No.: 01
Luminous flux (Luminaire): 3492 lm
Luminous flux (Lamps): 3494 lm
Luminaire Wattage: 33.2 W
Luminaire classification according to CIE: 80
CIE flux code: 37 66 88 80 100
Fitting: 1 x IGP132LT8-16 (Correction Factor 1.000).

See our luminaire catalog for an image of the luminaire.



8 Pieces Crompton Greaves Ltd. 01 LFLE-50-CDL
Article No.: 01
Luminous flux (Luminaire): 4098 lm
Luminous flux (Lamps): 4105 lm
Luminaire Wattage: 48.8 W
Luminaire classification according to CIE: 100
CIE flux code: 57 91 99 100 100
Fitting: 1 x LFLE-50-CDL (Correction Factor 1.000).

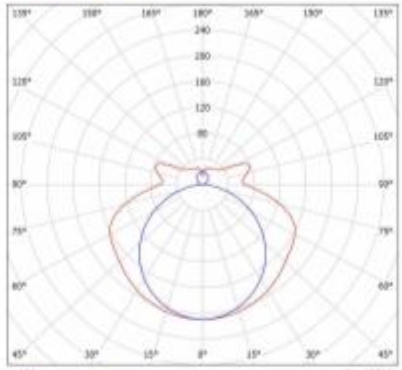
See our luminaire catalog for an image of the luminaire.



Crompton Greaves Ltd. 01 IGP132LT8-16 / Luminaire Data Sheet

See our luminaire catalog for an image of the luminaire.

Luminous emittance 1:



Luminaire classification according to CIE: 80
CIE flux code: 37 66 88 80 100

Luminous emittance 1:

Glare Evaluation According to UGR

ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room Size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	16.5	17.7	17.1	18.3	18.6	15.4	16.6	15.9	17.1	17.8
	3H	18.8	19.9	19.4	20.5	21.1	16.8	17.9	17.4	18.5	19.2
	4H	19.8	20.8	20.4	21.4	22.1	17.3	18.4	18.0	19.0	19.7
	6H	20.7	21.6	21.3	22.2	23.0	17.7	18.6	18.3	19.3	20.0
	8H	21.0	21.9	21.7	22.6	23.3	17.8	18.7	18.4	19.3	20.1
	12H	21.2	22.1	22.0	22.9	23.6	17.8	18.7	18.4	19.3	20.1
4H	2H	17.1	18.2	17.8	18.9	19.5	16.2	17.3	16.9	17.9	18.6
	3H	19.6	20.5	20.3	21.2	21.9	17.9	18.8	18.6	19.5	20.2
	4H	20.8	21.6	21.5	22.3	23.0	18.6	19.4	19.3	20.1	20.9
	6H	21.8	22.5	22.5	23.2	24.0	19.2	19.8	19.9	20.5	21.4
	8H	22.2	22.9	23.0	23.6	24.4	19.3	19.9	20.0	20.7	21.5
	12H	22.6	23.1	23.3	23.9	24.8	19.4	20.0	20.1	20.7	21.5
8H	4H	21.1	21.8	21.8	22.5	23.3	19.3	20.0	20.0	20.7	21.5
	6H	22.3	22.9	23.1	23.6	24.5	20.1	20.6	20.8	21.4	22.2
	8H	22.9	23.4	23.6	24.1	25.0	20.4	20.9	21.2	21.6	22.5
	12H	23.4	23.8	24.2	24.6	25.5	20.6	21.0	21.4	21.8	22.7
12H	4H	21.1	21.7	21.8	22.4	23.1	19.4	20.0	20.2	20.7	21.6
	6H	22.4	22.9	23.2	23.6	24.5	20.3	20.8	21.1	21.6	22.4
	8H	23.0	23.4	23.8	24.2	25.1	20.7	21.1	21.5	21.9	22.8
Variation of the observer position for the luminaire distances S											
S = 1.0H		+0.1 / -0.1					+0.1 / -0.1				
S = 1.5H		+0.1 / -0.2					+0.2 / -0.2				
S = 2.0H		+0.2 / -0.3					+0.3 / -0.5				
Standard table		BK09					BK04				
Correction Summand		7.3					4.4				
Corrected Glare Indices referring to [illegible] Total Luminous Flux											

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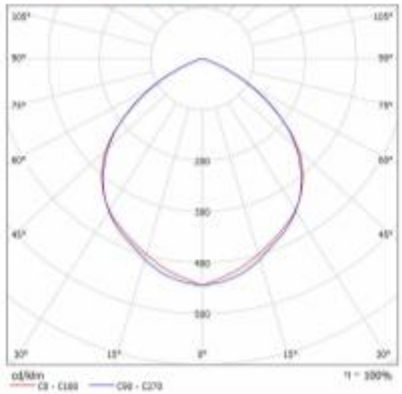
Crompton Greaves Ltd. 01 LFLE-50-CDL / Luminaire Data Sheet

See our luminaire catalog for an image of the luminaire.

Luminous emittance 1:



Luminaire classification according to CIE: 100
CIE flux code: 57 91 99 100 100

Luminous emittance 1:

Glare Evaluation According to UGR

ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room Size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	21.4	22.6	21.7	22.8	23.0	21.4	22.6	21.7	22.8	23.0
	3H	21.5	22.6	21.8	22.8	23.1	21.6	22.6	21.9	22.9	23.1
	4H	21.4	22.4	21.8	22.7	23.0	21.5	22.5	21.8	22.8	23.0
	6H	21.4	22.3	21.7	22.6	22.9	21.4	22.3	21.8	22.6	22.9
	8H	21.3	22.3	21.7	22.5	22.8	21.4	22.3	21.8	22.6	22.9
	12H	21.3	22.1	21.7	22.4	22.8	21.4	22.2	21.7	22.5	22.9
4H	2H	21.7	22.7	22.0	22.9	23.2	21.7	22.7	22.0	22.9	23.2
	3H	21.8	22.7	22.2	23.0	23.3	21.8	22.7	22.3	23.0	23.4
	4H	21.8	22.5	22.2	22.8	23.3	21.9	22.6	22.3	22.9	23.3
	6H	21.7	22.3	22.1	22.7	23.1	21.8	22.4	22.3	22.8	23.2
	8H	21.7	22.2	22.1	22.6	23.0	21.8	22.3	22.2	22.7	23.1
	12H	21.7	22.2	22.1	22.6	23.0	21.7	22.2	22.2	22.6	23.1
8H	4H	21.7	22.3	22.1	22.7	23.1	21.8	22.3	22.2	22.7	23.1
	6H	21.6	22.1	22.1	22.5	23.0	21.7	22.2	22.2	22.6	23.0
	8H	21.6	22.0	22.1	22.4	22.9	21.7	22.1	22.2	22.5	23.0
	12H	21.6	21.9	22.1	22.4	22.9	21.6	22.0	22.1	22.4	22.9
12H	4H	21.7	22.2	22.1	22.6	23.0	21.8	22.2	22.2	22.7	23.1
	6H	21.6	22.0	22.1	22.4	22.9	21.7	22.1	22.2	22.5	23.0
	8H	21.6	21.9	22.1	22.4	22.9	21.6	22.0	22.1	22.4	22.9
Variation of the observer position for the luminaire distances S											
S = 1.0H		+0.3 / -0.7					+0.4 / -0.6				
S = 1.5H		+1.2 / -2.6					+1.1 / -2.3				
S = 2.0H		+2.4 / -5.9					+2.2 / -5.3				
Standard table		BK01					BK01				
Correction Summand		3.8					3.0				
Corrected Glare Indices referring to 4200lm Total Luminous Flux											

BHEL / Workplane / Value Chart (E)

190	208	219	224	235	240	240	246	249	253	248	250	242	238	242	235	223	212
198	215	225	229	239	244	244	251	255	258	253	254	246	243	246	240	229	217
226	242	251	254	264	269	270	280	287	290	284	283	275	269	272	266	253	243
243	257	267	269	276	281	281	291	299	300	297	294	286	282	285	280	266	256
256	270	278	280	287	292	292	301	310	311	307	304	296	292	295	290	276	266
270	282	289	290	297	302	302	312	321	321	318	315	306	301	304	301	287	277
288	301	308	308	314	318	317	325	334	336	332	331	323	317	321	316	303	291
292	307	313	313	318	321	320	327	336	338	334	333	326	321	325	321	307	294
300	313	319	319	322	324	323	329	337	339	337	337	330	326	330	326	313	299
302	315	321	321	324	325	323	329	337	339	336	336	332	327	331	328	314	301
305	319	324	324	324	323	321	324	332	334	333	334	330	330	334	331	318	304
306	322	326	323	323	322	320	324	331	333	331	334	330	330	334	333	320	305
307	322	325	323	323	322	319	323	330	332	330	333	330	330	334	334	320	306
308	323	327	325	325	324	320	324	331	335	332	334	331	329	335	334	323	305
304	320	325	324	326	324	322	325	331	335	333	334	330	329	334	331	318	302
303	318	324	324	325	326	323	326	333	337	335	336	331	328	333	329	317	300
301	316	322	322	326	326	324	327	335	339	336	335	330	326	331	327	315	299
299	314	319	321	324	326	324	329	337	340	337	335	329	325	329	324	313	297
292	300	312	311	317	320	320	327	330	336	334	332	323	317	321	318	300	290
284	297	303	303	309	313	313	322	332	333	329	324	315	309	312	309	296	282
278	291	296	297	303	308	308	318	327	329	325	319	310	304	306	302	288	276
266	280	287	288	295	299	300	309	318	320	316	311	302	295	296	292	278	265
247	261	267	269	279	283	284	292	300	301	298	291	284	274	276	271	258	246
236	249	256	258	268	272	273	280	287	289	286	280	272	263	264	260	247	236
218	232	240	244	255	259	259	268	275	277	273	268	260	250	251	246	232	220

15.00 m

0.00

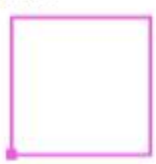
0.00

15.00 m

Values in Lux, Scale 1 : 118

Not all calculated values could be displayed.

Position of surface in room:
Marked point:
(0.000 m, 0.000 m, 0.000 m)



Grid: 128 x 128 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
298	183	340	0.614	0.539

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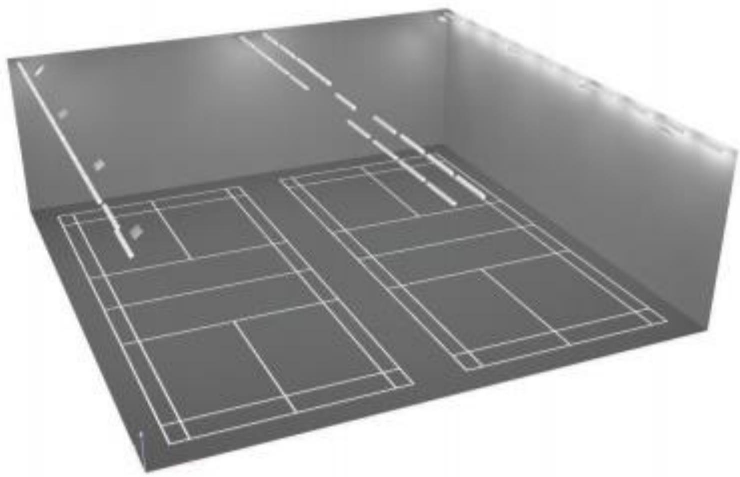
BHEL / 3D Rendering



5>HOTEL JW MARRIOT DESIGN:

It is an international Hotel in Bangalore.

Design Requirements=300lux on an average and Uniformity greater than 40%

Luminaires recommended=LCTLRN-36-FO-CDL(CROMPTON GREAVES SQUARE TYPE 2FTX2FT Luminaire)

JW MARRIOT

REFLECTANCES=50:30:20 for CELING:WALL:FLOOR

MAINTENANCE FACTOR=0.8

Partner for Contact: PRAMOD PADMANAB
PHONE: 9986016000
:
:

Date: 27.03.2019
Operator: ANIRBAN CHATTERJEE

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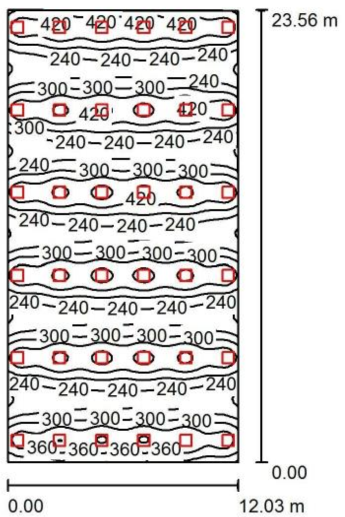
MAIN FUNCTION HALL / Summary



Height of Room: 2.800 m, Mounting Height: 2.800 m, Light loss factor: 0.80					Values in Lux, Scale 1:303
Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	308	172	447	0.558
Floor	20	287	199	353	0.693
Ceiling	50	54	32	118	0.585
Walls (4)	30	196	47	1146	/

Workplane:
Height: 0.760 m
Grid: 128 x 64 Points
Boundary Zone: 0.000 m
Illuminance Quotient (according to LG7): Walls / Working Plane: 0.684, Ceiling / Working Plane: 0.176.

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	36	Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL (1.000)	3525	3529	34.2
			Total: 126892	Total: 127058	1230.5

Specific connected load: 4.35 W/m² = 1.41 W/m²/100 lx (Ground area: 283.05 m²)

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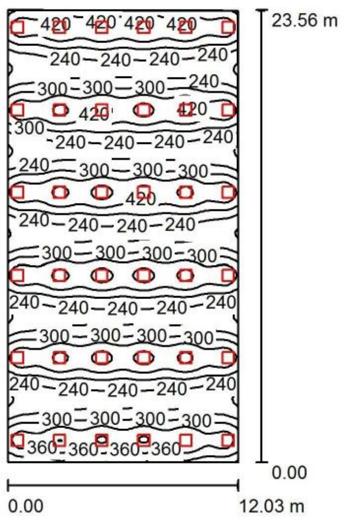
MAIN FUNCTION HALL / Summary



Height of Room: 2.800 m, Mounting Height: 2.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:303

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	308	172	447	0.558
Floor	20	287	199	353	0.693
Ceiling	50	54	32	118	0.585
Walls (4)	30	196	47	1146	/

Workplane:
Height: 0.760 m
Grid: 128 x 64 Points
Boundary Zone: 0.000 m
Illuminance Quotient (according to LG7): Walls / Working Plane: 0.684, Ceiling / Working Plane: 0.176.

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	36	Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL (1.000)	3525	3529	34.2
			Total: 126892	Total: 127058	1230.5

Specific connected load: 4.35 W/m² = 1.41 W/m²/100 lx (Ground area: 283.05 m²)

Operator ANIRBAN CHATTERJEE
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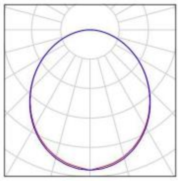
MAIN FUNCTION HALL / Luminaire parts list

36 Pieces

Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL
Article No.: 01
Luminous flux (Luminaire): 3525 lm
Luminous flux (Lamps): 3529 lm
Luminaire Wattage: 34.2 W
Luminaire classification according to CIE: 100
CIE flux code: 49 80 95 100 100
Fitting: 1 x LCTLRN-36-FO-CDL (Correction Factor 1.000).

See our luminaire catalog for an image of the luminaire.



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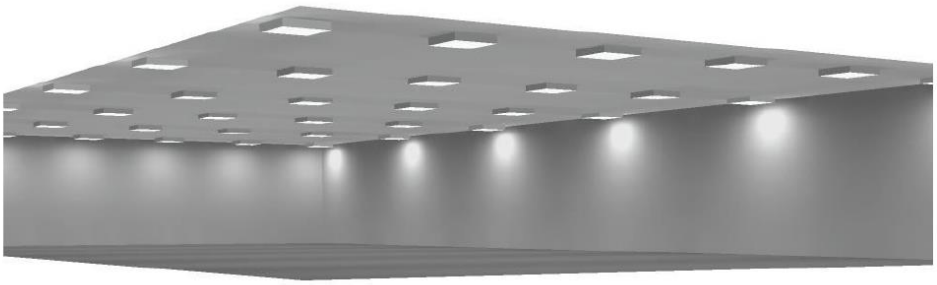
MAIN FUNCTION HALL / 3D Rendering



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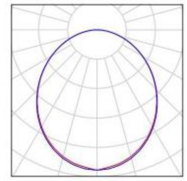
BRIDAL DRESS CHANGING ROOM / Luminaire parts list

2 Pieces

Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL
Article No.: 01
Luminous flux (Luminaire): 3525 lm
Luminous flux (Lamps): 3529 lm
Luminaire Wattage: 34.2 W
Luminaire classification according to CIE: 100
CIE flux code: 49 80 95 100 100
Fitting: 1 x LCTLRN-36-FO-CDL (Correction Factor 1.000).

See our luminaire catalog for an image of the luminaire.



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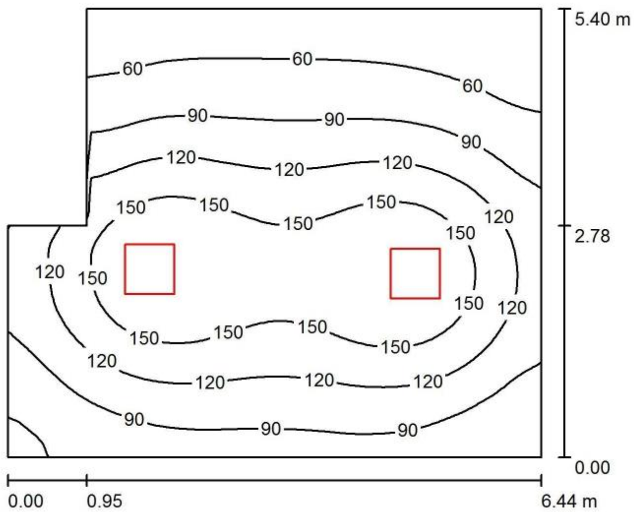
BRIDAL DRESS CHANGING ROOM / Summary



Height of Room: 2.800 m, Mounting Height: 2.800 m, Light loss factor: 0.80 Values in Lux, Scale 1:70

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	109	36	181	0.326
Floor	20	109	36	181	0.324
Ceiling	50	17	9.92	27	0.568
Walls (6)	30	53	11	271	/

Workplane:
Height: 0.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m
Illuminance Quotient (according to LG7): Walls / Working Plane: 0.486, Ceiling / Working Plane: 0.159.

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	2	Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL (1.000)	3525	3529	34.2
			Total: 7050	Total: 7059	68.4

Specific connected load: 2.12 W/m² = 1.93 W/m²/100 lx (Ground area: 32.27 m²)

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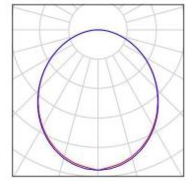
BALL ROOM 1 / Luminaire parts list

72 Pieces

Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL
Article No.: 01
Luminous flux (Luminaire): 3525 lm
Luminous flux (Lamps): 3529 lm
Luminaire Wattage: 34.2 W
Luminaire classification according to CIE: 100
CIE flux code: 49 80 95 100 100
Fitting: 1 x LCTLRN-36-FO-CDL (Correction Factor 1.000).

See our luminaire catalog for an image of the luminaire.



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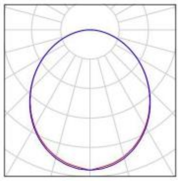
BALL ROOM 1 / Luminaire parts list

72 Pieces

Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL
Article No.: 01
Luminous flux (Luminaire): 3525 lm
Luminous flux (Lamps): 3529 lm
Luminaire Wattage: 34.2 W
Luminaire classification according to CIE: 100
CIE flux code: 49 80 95 100 100
Fitting: 1 x LCTLRN-36-FO-CDL (Correction Factor 1.000).

See our luminaire catalog for an image of the luminaire.



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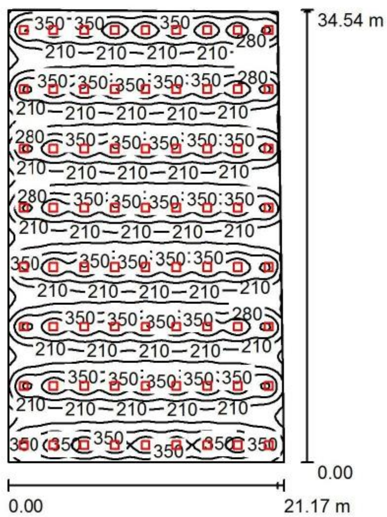
BALL ROOM 1 / Summary



Height of Room: 2.800 m, Mounting Height: 2.800 m, Light loss factor: 0.80					Values in Lux, Scale 1:444
Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	273	115	422	0.422
Floor	20	261	138	332	0.530
Ceiling	50	48	27	69	0.568
Walls (4)	30	148	40	602	/

Workplane:
Height: 0.760 m
Grid: 128 x 128 Points
Boundary Zone: 0.000 m
Illuminance Quotient (according to LG7): Walls / Working Plane: 0.544, Ceiling / Working Plane: 0.175.

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	72	Crompton Greaves Ltd. 01 LCTLRN-36-FO-CDL (1.000)	3525	3529	34.2
			Total: 253783	Total: 254117	2461.0

Specific connected load: 3.41 W/m² = 1.25 W/m²/100 lx (Ground area: 720.75 m²)

6>Energy Savings in Indoor Lightings.

Generally, by thumb rule Energy consumption by using LED is half or less than the Energy consumption by conventional light sources.

Survey of COCA-COLA PLANT,BIDAR –RETROFIT PROJECT.

AREA	EXISTING FIXTURE	QUANTITY
TG-3	1X400W HIGHBAY	9
BOILER	1X400W HIGHBAY	6
	WELLGLASS 70W	40
TG-3_GROUND FLOOR	WELLGLASS 70W	6
VFD	2X36W FTL	6
	2X36W CFL(2X2)	12
BAGGAG	250W STREET LIGHT	6
SWITCH YARD	400W FLOODLIGHT	4
OLD POWERHOUSE GROUND FLOOR	2X36W FTL	8
	WELLGLASS 70W	2
OLD POWER HOUSE TURBINE FLOOR	400W MH HIGHBAY	6
	2X36WFTL	10
MILL SECTION	1X4MH 400W HIGHBAY	12
	2X36W FTL	10
MILL DCS ROOM	2X40W FTL	10
MILL GRPF	2X40W FTL	2
MILL IRC	2X36W FTL	6
WORKSHOP	1X400W HIGHBAY	4
CANE UNLOADING AREA	400W FLOODLIGHT	10
BOILNG HOUSE+SUGAR HOUSE	1X400W HIGHBAY	12
	70W WELLGLASS	9
	150W FLOODLIGHT	24
RVF AREA GROUND FLOOR/TOP	NO LIGHT	0
INJECTION MOTORS	2X40W FTL	6
STORE	250W HIGHBAY	5
DM PLANT&WATER TREATMENT PLANT	1X80W MH DE	12
	1X400W MH	4
OUTSIDE AREA	1X250W STREETLIGHT	They will tell
TG3-4M FLOOR	1X70W WELLGLASS	7
PCC ROOM	2X36W FTL	18

STAIRES LHS STAIRES RHS	1X70W WELLGLASS 1x70W WELL GLASS	4 4

As we see all the conventional fixtures existing which are to be replaced by LEDs of suitable wattage such that the LUMEN output increases with minimum energy consumption. For instance:

1>**400W Conventional highbay** is replaced by **CROMPTON'S LHB-200-CDL/60**(ie; a LED highbay of wattage 200W and beam angle 60 dgree)

2>**Well Glass of 70W** is replaced by **CROMPTON'S** WELLGLASS **LWV12-35-CDL.(**a LED of 35W**)**

3>2X36W FTL is **replaced by CROMPTON'S LCTLRN-36-FO-CDL(**a LED 2x2 luminaire of 36W).

Thus we can see that energy consumption is reduced to 50% of the existing CONVENTIONAL LUMINAIRES.

Though initial investment cost of LED is little higher but usage of LED's reduce both the losses and the energy consumption.

CONCLUSION

.Conclusion: Indoor lighting defines beauty of the interior places, economic efficiency, safety and security. The conventional luminaires consume more power and gives out more lumen output compared to LEDs. So the lighting design should be designed in such a way that the energy consumption of interior lights for particular area has to be optimized and light pollution problems has to be minimized. Studies have been simulated on DIALux software of different types of interior places Hotels,industries in Bangalore, Gulbarga, in state of KARNATAKA and with conventional light sources as well as LED light sources. Compared to HPSV luminaires, LED luminaires has almost equal luminous efficacy as per major research showed in the last decade. However, unlike most HPSV that do not have full-cutoff optics, LEDs are designed to focus light and do not emit light in all directions. This result reduced light pollution and glare. Since the human eye is more sensitive to the blue end of the spectrum under dim lighting conditions, LED light with high blue content can be detected more easily by the human eye compared to HPSV luminaire at night vision. Moreover, LEDs have considerably higher CRI and variable CCT than HPSV lamps. Compared to LED Indoor Commercial lights with FTLS,CFLS,HPSV LEDs have a higher installation cost than HPSV luminaire. Assuming an annual usage of 4,380 hours, the estimated average lifetime of LEDs is over 11.44 years, whereas HPSV luminaires promise an average service-free period of around 3.42 years only. LED light sources can be instantly turned on/off, but it takes a long time for metal halide lamps to reach an ideal operating temperature. LEDs can also provide more uniform distribution of illuminance that can eliminate hot spots on the pavement encountered with use of HPSV streetlights.

Though LED is now at the peak among the light sources and it can easily replace the conventional lighting. In case of outdoor lighting especially street lighting LED is the only solution on the basis of energy and vision. Worldwide energy crisis is going up day by day and different countries are switching to the renewable energy option and energy efficient technology. In this scenario LED can take a leading role. A major part of the work is done on LED street light luminaire mainly Chip on Board technology. In future further work can be done on this kind of COB chip and luminaire. In street lighting massive changes will come in the recent years.

Future Scope of Work:

Lighting, along with architecture, Hotels,hospitals,office,industries etc. are improving the world regularly in terms of Visualization. Lighting designers are trying their best to offer a beautiful world to the present & future generation, keeping in mind about energy efficient with smart handling lighting solution.

DALI is a great innovation of new era. By means of DALI complete lighting control can be done such as daylight harvesting, scheduled illumination, occupancy controlled illumination, etc.

Now a days using Internet Illumination level control, lighting On/off system control, has been discovered so, The effects of the new "IOT(INTERNET OF THINGS)" system for Road lighting performance can be investigated in Future.

Light ON/OFF can be controlled based on the occupants of room.Light level can be controlled based on the occupants entry in and exit from the room , as well as it in corridors can be made to turn ON/OFF by using SENSOR TECHNOLOGY which saves a lot of POWER. Besides that SMOKE DETECTION by the LED sensors can be implemented in places where there are chances of FIRE HAZARDS like oil storage ware house,meeting rooms etc.

Those features can be investigated in Future for better INTERIOR lighting purpose.

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