

Lighting System Level In The Dewan Sri Mas, Polytechnic Sultan Abdul Halim Mu'adzam Shah (POLIMAS), 06000 Jitra, Kedah, Malaysia

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Abstract: This study is carried out to analyze the level of the lighting system in the Dewan Sri Mas which is a multi-purpose hall at the Polytechnic Sultan Abdul Halim Mu'adzam Shah (POLIMAS), Jitra, Kedah. The study involves the collection of data employing the use of a luxmeter (an instrument to measure lighting levels) to determine the level of lighting in afore-mentioned multi-purpose hall. From the required number of the luxmeter readings, a series of calculations is carried out to determine the amount of lighting in the space in the hall. The result from the calculations will determine whether the level of lighting for the hall in the Dewan Sri Mas, POLIMAS, has been achieved to the required standard for a multi-purpose hall or otherwise. The overall results have shown that the level of lighting in the Dewan Sri Mas, POLIMAS has met with the required specifications set out by the Jabatan Standard Malaysia (2014a). The specifications therein for a multi-purpose hall is in the range of 300 - 500 lux. The lighting level achieved for the front area of the hall is 352.40 lux. The lighting level achieved on the stage is 281.0 lux and has also satisfied the minimum requirements set by the Jabatan Standard Malaysia at a level of 100 lux.

Key words: *Hall; Artificial lighting; Illumination*

INTRODUCTION

The process of designing a lighting system for a building must achieve the objectives of both meeting the requirements of the relevant building regulations of the local authorities as well as satisfying the installation standards which apply. This is to ensure a lighting system that is effective, efficient and which also gives cost savings in the long term.

The lighting system is a requirement and a necessary and important part of the facilities in a building to provide a satisfactory comfort level to its occupants. The lighting level in the building must be adequate for carrying out the many and various activities in the building. As such it is paramount that the lighting level for each designated space must meet the requirements that are pre-determined as set out in the *Jabatan Standard Malaysia*. The standards therein are the basis upon which the lighting system design is carried out in order to meet the required standards of both the

functional and the aesthetical aspects of the building [1].

Background Problem

The lighting level is amount of light arriving on a subject or on a unit area of a working surface. This is measured in a unit lux [2]. There are a number of suggested levels of lighting requirements for a hall where activities are mainly carried out by students. As an example, the Jabatan Standard Malaysia (2014a) under the code MS 1525:2014 suggests an average lighting level of 300 to 500 lux is required for teaching and learning activities. This code is developed by the Technical Committee on Energy Efficiency in Buildings (Passive) under the auspices of the Industrial Standard Committee (ISC) for Buildings, Construction and Civil Engineering [3].

On the other hand, the level recommended by the Public Works Department, Malaysia, is in the range of 200 - 300 lux, (Panduan Teknik Reka Bentuk Jabatan

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Kerja Raya Malaysia 2011). This standard may be interpreted and applied for building services design, construction and environmental management to meet requirements for the majority of users [4].

Problem Statement

Research on the quality of lighting for application in a hall is rather limited. In fact, it has been reported that there is very little interest among researchers in this area of study these days (Zakaria & Ismail 2012) [5].

One such study was carried out in a classroom at the Sekolah Pendidikan Khas, Setapak, Kuala Lumpur in 2018. The findings of the study found that the lighting level for the classroom was below the standard set by the Malaysian Standard MS 1184:2014 for individuals with special needs (Wan Nur Amirah Ibrahim, 2018) [6]. In this case, the lighting for the classroom may be ameliorated by utilizing other additional forms of artificial lighting.

It is therefore necessary to determine that the real lighting level achieved for the space in the Dewan Sri Mas, Polytechnic Sultan Abdul Halim Mu'adzam Shah, Jitra, Kedah (POLIMAS) is in tandem with the standards set out by the Jabatan Standard Malaysia. In this study, only the lighting provided by means of artificial light sources is considered because the hall has no windows for day-lighting for consideration.

OBJECTIVE AND RESEARCH METHODOLOGY

Objective

This study is carried out to analyze the adequacy of the optimum lighting level achieved in the Dewan Sri Mas, Polytechnic Sultan Abdul Halim Mu'adzam Shah, Jitra, Kedah. The study involves the collection of data using the luxmeter to determine the lighting level in the hall.

Based on the readings obtained using the luxmeter, a calculation is made to ascertain the amount of lighting in the hall. The result from the calculation will show whether the lighting level in the Dewan Sri Mas, POLIMAS meets with the required standard set by the Jabatan Standard Malaysia (2014a) or otherwise.

Research Scope

The scope of this research is the Dewan Sri Mas, Polytechnic Sultan Abdul Halim Mu'adzam Shah (POLIMAS), Jitra, Kedah. This hall was completed in 1987 and has undergone an upgarde in June 2016. Air-conditioning was introduced into the hall to accommodate and facilitate the teaching and learning processes carried out in it. It is used as an examination hall and for the hosting of seminars and conferences. It is also used for sports activities among others. It serves

as the venue for the POLIMAS annual convocation ceremony.





Photo 1, 2, 3 and 4: Dewan Sri Mas, Polytechnic Sultan Abdul Halim Mu'adzam Shah (POLIMAS), Jitra, Kedah, Malaysia.

Study Equipment

The equipment used is as shown below:



Photo 5: Luxmeter (for the measurement of lighting) (Lx-1010B Digital Light Luxmeter)



Photo 6: Laser measuring tool (equipment for measuring distances) (Bosh GLM 35 Measure, 120-Feet)

Photo 5 & 6 : Study Equipment

PROCEDURE FOR FIELD DATA COLLECTION

Using the Luxmeter

The lighting in the Dewan Sri Mas is measured using a digital luxmeter (Lx-1010B Digital Light Luxmeter). For this purpose, the instrument is placed on a student study table at a height of 76 cm above floor level for measurements to be taken. This table is moved from point to point according to the points shown below in Fig. 1. The hall space is divided into 2 areas namely, the front and the area on the stage. A total of 150 points were prepared for the front and 15 points for the stage (Refer to Figure 1).

Analysis of Results

From the readings obtained using the luxmeter, a calculation is made to determine the lighting level obtained in the hall. All the results are then compared with the specification table from the Jabatan Standard Malaysia (2014a). The final analysis will show whether the lighting level obtained in the hall in the Dewan Sri Mas, POLIMAS has met with the requirements or otherwise.

RESULTS AND DISCUSSION

Observations from the resultant readings taken at each point with the luxmeter has revealed that they are very close to one another having received similar amount of lighting in the area (Figure. 1) under study.

Lighting System

From the results of the study in the Dewan Sri Mas, POLIMAS it was ascertained that the lighting system employed in the main hall space utilised the 30 units of the Venus Pyramid Light Low Bay 250w, 600mm x 600mm whereas 12 units of 2 x 5w/8w PLCE Upper & Down Wall Light type of luminaires were used at the front of the hall. The stage in the hall was lit up using 2 units of Pyramid Light Low Bay 250w, 600mm x 600mm coupled with 2 units of 2 x 36w (F), Recessed Luminaire C/W Mirror Reflector type. A suitable arrangement of these luminaires is planned to achieve the desired lighting level as a whole.

The arrangement of the luminaires should ideally provide sufficient amount of lighting for any visual tasks carried out in the hall spaces at any location in the hall. In the arrangement, it is suggested that the luminaires be arranged and installed parallel to the main axis of the hall. A diagonal pattern would not be suitable and may prove unsatisfactory and uncomfortable for carrying out visual tasks in the hall [7].

Calculation of Lighting Level

For the purpose of calculating the lighting level for the hall, the Dewan Sri Mas is divided into a few sections. The front area of the hall is divided into 10 rows and 15 columns and 5 rows and 3 columns for the stage area (see Figure 1) to fix the points for readings to be taken with the luxmeter. Each point centred in an area of measuring 2m x 2m have readings taken in succession and recorded. The following are the results obtained from the luxmeter readings following the points fixed in the Dewan Sri Mas, POLIMAS (Refer to Appendix A).

Overall average of area at the front of the Dewan Sri Mas = Overall total/ No. of lux points
 = 3,524.4/ 10
 = 352.4 lux

Overall average of area on top of the stage of the Dewan Sri Mas = Overall total/ No. of lux points
 = 843/ 3
 = 281.0 lux

Results

Jabatan Standard Malaysia (2014a) under the code MS 1525:2014 has set values for the minimum level of lighting required for various types of spaces. The following are the specifications set for a multi-purpose hall according to the Jabatan Standard Malaysia (2014a) with a comparison made with the results obtained from the study with the average lux readings:

i) Front of stage :

Function of Space	Results	Jabatan Standard Malaysia (2014a)	Place of Measurement
Multi-purpose Hall	352.40 lux	300 – 500 lux	Table Height (H)

Note : (H) shows *meters* in a horizontal position

From the results obtains in the Dewan Sri Mas, POLIMAS, it is found that the lighting level achieved in the hall spaces are adequate and found also to have satisfied the requirements of specifications set by the Jabatan Standard Malaysia (2014a)

ii) On the Stage :

The desired lighting level on top of the stage is different from the level in the main hall. An example for the use of the stage is shown below :

Function of Space	Results	Jabatan Standard Malaysia (2014a)	Place of Measurement
Concert Hall/Theater	281.0 lux	≥ 100 lux	Table Height (H)

Note : (H) shows *meters* in a horizontal position

From the results obtained in the study the lighting level achieved on top of the stage has also been achieved to the required specifications set by the Jabatan Standard Malaysia (2014a).

DISCUSSION ON THE RESULTS OBTAINED

The results from the lux calculations in the Dewan Sri Mas has shown that the artificial lighting obtained from the luminaires installed is adequate and have met with the specifications set by the Jabatan Standard Malaysia (2014a) with the results actually exceeding the minimum level specified.

Should the existing lighting levels were to be found lacking during the study, various scenarios could exist. Factors such as the glare index and shadowing may cause discomfort when visual tasks are carried out in the hall. From the results achieved from the study, it is clear that due consideration must be placed on the various design aspects for a good lighting system to meet the specifications mention afore. This is to ensure that the lighting received on the visual working plane is neither too little or too much [8].

This study is to ensure a lighting system for the Dewan Sri Mas, POLIMAS, is adequate and will satisfy the needs for any kind of visual tasks to carried out in it. The hall is used mainly for official ceremonies, semester end examinations and the annual convocation ceremony, to mention a few. Lighting plays a part in determining moods in a space. For example a bad lighting system may affect the mood and performance of students sitting for their examinations in the hall.

A good lighting system design is not just a decorative exercise but it is an important aspect in the building services package for the building space. Not only does it enhances the important features of the space but it certainly can influence the moods in a favorable and comfortable environment for activities to be carried out. It is also of importance to be able to identify the types of luminaires suitable for each visual task. The capacity of the space and its population are other factors to be considered as well to achieve a good lighting system overall.

CONCLUSIONS

From the results of the study carried out, a number of conclusions may be made of the site under study:

- i) The lighting in front of the hall stage in the Dewan Sri Mas has met with the requirements set by the Jabatan Standard Malaysia (2014a) which is within the range of 300 - 500 lux. This is borne out of the result obtained, which is 352.40 lux.
- ii) The lighting level achieved for the top of the hall stage is adequate by the standards set by the Jabatan Standard Malaysia (2014a) i.e. 100 lux and this is also borne out from the result obtained which was 281.0 lux.

Among the suggestions proposed are as follow:

- i) The Maintenance Unit of POLIMAS should implement a maintenance schedule for the lighting system in the hall.
- ii) The luminaires and their lamps should always be checked to maintain their good functioning condition. The lifespan of lamps is a factor to consider and changed when its lifespan is up. An adhoc approach to the maintenance will bring about undesirable circumstances when these lamps burn out and spares are not readily available for their replacement. Such a situation may not be pleasant if some important ceremony happens to be ongoing in the hall.

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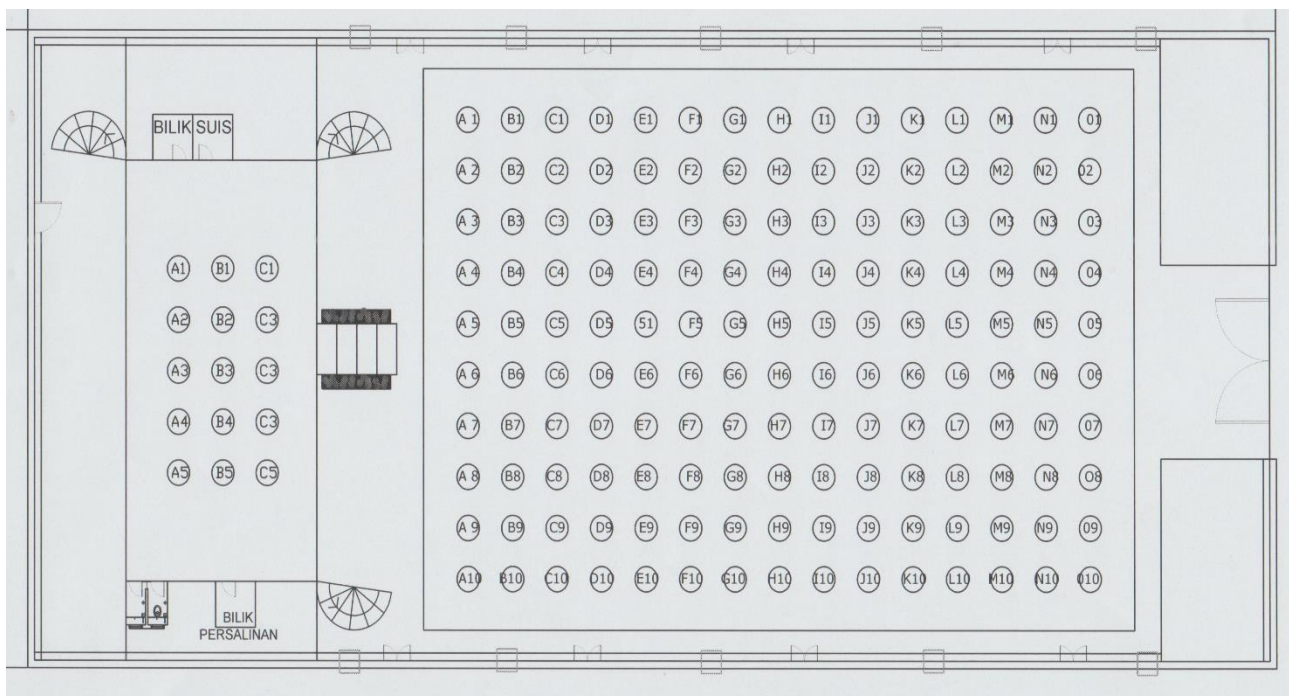


Figure 1: Measurement points determined for readings of the Luxmeter

Point Row	A1	B2	C3	D4	E5	F6	G7	H8	I9	J10	K11	L12	M13	N14	O15	Tot. Lux	Ave.
	Readings lux (In Front of Hall Stage)																
1	350	351	352	352	352	352	352	352	352	352	352	352	352	351	350	5,274	351.6
2	350	352	351	353	353	353	354	354	354	352	352	352	352	351	351	5,284	352.3
3	351	352	352	352	353	353	355	355	354	353	353	353	352	352	352	5,292	352.8
4	350	352	352	353	353	353	355	355	354	354	353	353	352	352	352	5,293	352.9
5	351	353	352	353	353	353	355	355	355	354	354	354	353	353	352	5,300	353.3
6	351	352	352	353	353	353	355	355	355	354	354	354	354	353	352	5,300	353.3
7	351	352	352	353	353	353	355	355	355	354	353	353	353	353	352	5,297	353.1
8	350	353	353	352	352	352	354	354	354	353	353	353	353	352	351	5,289	352.6
9	350	351	352	353	352	352	353	353	353	352	352	352	352	352	351	5,280	352.0
10	350	350	350	352	350	350	351	351	350	350	351	352	350	350	350	5,257	350.5
																Total	3524.4
	Readings lux (On The Stage)																
Point Row																	
1	280	281	282	281	280											1,404	280.8
2	280	281	283	282	280											1,406	281.2
3	280	282	282	281	280											1,405	281.0
																Total	843.0

Note : The luxmeter is placed horizontally on top of the student work table.

Appendix A: Readings obtained from the luxmeter at points and rows in the Dewan Sri Mas, POLIMAS