

Lighting Layout and Sound Index calculation.

Task A

Room index (RI)

$$RI = \frac{60 \times 24}{7(60+24)} = \frac{1440}{7 \times 84} = \frac{1440}{588} = 2.44897959$$

RI= 2.45 (2.5 on utilisation factor table)

RI=2.5

Utilisation Factor (Uf)

RI= 2.5

Ceiling reflectancy = 0.5

Wall reflectancy = 0.3

The utilisation factor table shows that the Uf = 0.45

Number of Lamps Required (N)

$$N = \frac{E \times A}{F \times U_f \times LLF} = N = \frac{200 \times 1440}{18000 \times 0.45 \times 0.75} = N = \frac{288000}{6075} = N=47.407$$

N= 48 Lamps (as it is impossible to have 0.407 of a lamp)

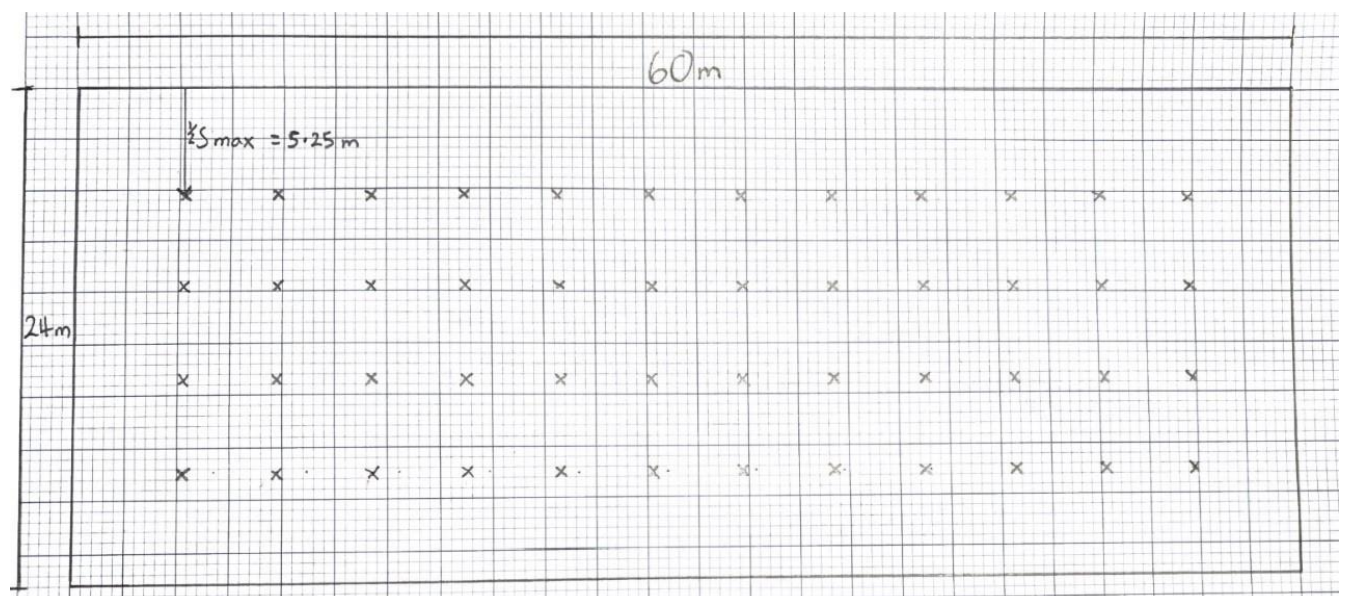
A Suitable Layout for The Lamp Fittings (S)

In a room that is 60m x 24 m (1440m₂)

S_{max}=10.5

I would recommend 4 rows of 12, 1.2m long fluorescent lamps.

Fluorescent Lamp Layout.



Task B: SRI Calculation

1) A brick wall of area 20m^2 contains a window of area 4m^2 .
The values of sound reduction indexes are:
50dB for the brickwork and 10dB for the window.
Calculate the overall sound reduction index for the entire wall.

Window (T1) (A=4)

$$\begin{aligned} \text{SRI} &= 10 \times (\log_{10}(1/T_1)) \\ 10 &= 10 \times (\log_{10}(1/T_1)) \\ 1 &= (\log_{10}(1/T_1)) \\ 1/T_1 &= 10 \text{ to the power of } 1 \\ T_1 &= 10 \text{ to the power of } -1 \\ T_1 &= 0.1 \end{aligned}$$

Wall (T2) (A=20-4)

$$\begin{aligned} \text{SRI} &= 10 \times (\log_{10}(1/T_2)) \\ 50 &= 10 \times (\log_{10}(1/T_2)) \\ 5 &= (\log_{10}(1/T_2)) \\ 1/T_2 &= 10^5 \\ T_2 &= 10^{-5} \\ T_2 &= 0.00001 \end{aligned}$$

Overall SRI Calculation

$$\begin{aligned} \text{SRI} &= \frac{(T_1 \times A_1) + (T_2 \times A_2)}{A_1 + A_2} \\ \text{SRI} &= \frac{(0.1 \times 4) + (0.00001 \times 20-4)}{4+16} = \frac{0.4 + 0.0016}{20} = \frac{0.40016}{20} = 0.020008 \\ \text{SRI} &= 10 \times (\log_{10}(1/0.020008)) \\ \text{SRI} &= 10 \times (\log_{10}(49.980008)) \\ \text{SRI} &= 10 \times 1.698796321277554 \\ \text{SRI} &= 16.98796321277554 \\ \text{OVERALL SRI} &= 16.99 \end{aligned}$$

Task B

2) Discuss the implications of frequency and wavelength in internal sound management, partition wall construction technique and insulation choice.

Sound can transmit through a partition, for example a wall, it does this by converting from sound waves to vibration in the material of the partition. The sound transfer can be classified as impact or airborne sound. Frequencies and wavelengths are what sound is. While the sound travels through materials such as a partition wall the wavelength changes. Although the wave slows down, its frequency remains the same, due to the fact that its wavelength is shorter. As the waves transfer from

one' medium' to another the frequency will never change. As waves travel into the denser medium, the velocity of the waves decrease and wavelength decreases.

Other factors come into effect such as reflectancy. Some sound will transfer through the material but not all of the sound will, some of the sound will reflect off the partition the same as a ball does bouncing back towards you. In an empty room this can cause an echo which may make it hard to understand sounds within the room, for example someone talking to you. Materials have different reflectancy. You can measure this by the time between the initial and secondary sound. To the human ear if the secondary sound is under 0.1 seconds after the initial sound, it won't be heard as an echo. But if the second sound is greater than 0.1 second the human ear will process them as two separate sounds, which will result in an echo. You can have paint which can dampen sound, but mostly absorption measures within the room are key to reducing echo. As absorption is a key method of reducing echo, having sound absorbing objects in the building can greatly decrease echo. These objects are usually carpets, chairs, plants, cushions or even curtains. All these absorption methods decrease the echo effect by absorbing sound before it reflects off the walls and absorbing the secondary reflected sound before the human ear can hear it.

It is always important to consider sound absorption during the construction phase as some construction projects may not want many objects in the building after construction. Methods can be taken such as insulation and sound absorbing boards. Insulation such as sound absorbing mineral wool insulation, or sound absorbing slabs that are build into the partition walls the same as most insulating methods. For example, between timber in stud partitions or replaced for sound absorbing boards on exterior walls. There are many different boards that can be used such as sound absorbing plaster board or even polystyrene lightweight boards that can be a part of a plasterboard or two separate boards.