

Materials and services



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1. Room Index

Factory area measures 60m x 24m x 8m height

Calculations

$$\text{Room index} = \frac{L \times W}{Hm(L + W)}$$

8m - 1m = 7m = Top of working plane

$$\text{RI} = \frac{60 \times 24}{7(60 + 24)} = 2.45$$

2. Utilisation factors

Ceiling reflectance is 0.5

area reflectance is 0.3

UF = 0.45

I looked at this utilisation factor table and identified the light fitting type which was the recessed louvre at 50% and then selected the correct ceiling reflectance which was 0.5 and then looked for the wall reflectance which is 0.3. I then looked for the room index which was 2.45. I then looked back at the previously identified column where the two meet and found the utilisation factor which in this case is 0.4.

3. The Number of Light Fittings Required

$$N = \frac{E \times A}{F \times UF \times LLF}$$

N = Number of light fittings

E = Illuminance level required (lux)

A = Area (m^2)

F = initial luminous flux output of each lamp (lumens)

UF = Utilisation factor (from table)

LLF = Light loss factor

Light loss factor = 0.75

illumination required = 200 lux

initial illuminance flux output = 18000 lumens

calculations

$$N = \frac{200 \times (60 \times 24)}{18000 \times 0.45 \times 0.75} = 47.47 \text{ recurring}$$

47.47 lamps required which would be impossible so therefore there would be 48 lamps.

4. Suitable layout for the lamp fitting

For fluorescent tubes in diffusing luminations

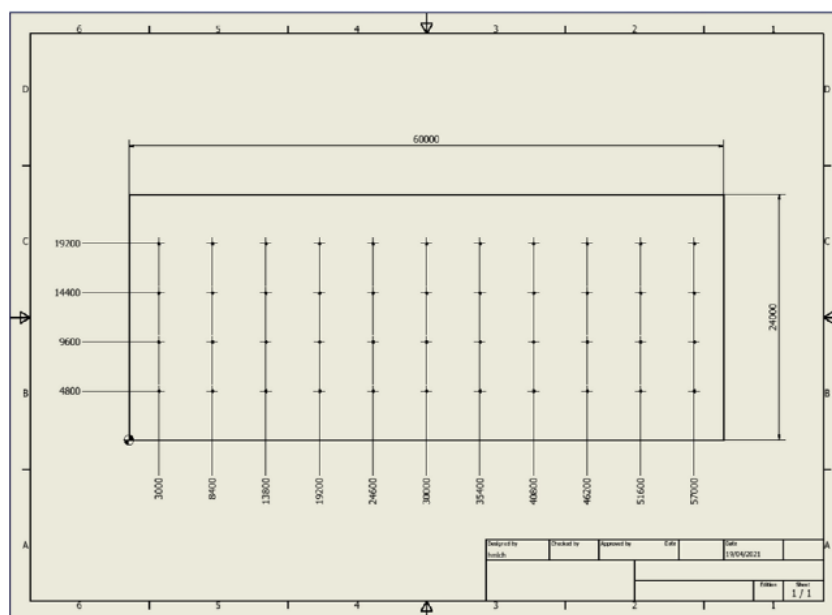
$$S_{\max} = 1.5 \times H_m$$

7m = working plane height (H_m)

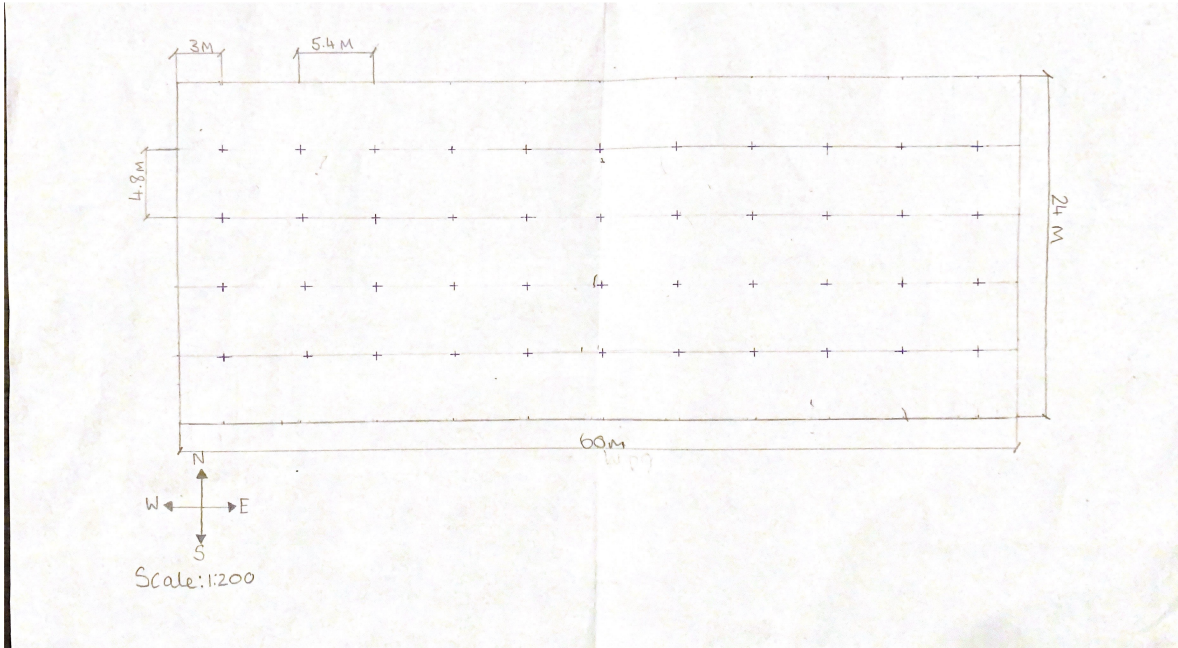
$1.5 \times 7 = 10.5\text{m}$ = maximum spacing between fittings.

5. Plan layout

CAD layout



Hand drawing



Scale: 1:200

Lights @ 5.4 centres from W → E
4.8 centres from N → S

Task B

1. calculate the SRI of the wall.

$$\text{Transmission coefficient} = T = \frac{\text{Transmitted sound energy}}{\text{Incident sound energy}}$$

T1 Component of the wall

A1 Component of the area of the wall

T2 Transmission coefficient of the window

A2 Area of the window

T0 = Overall transmission coefficient

For brickwork T1 = ? A1 = $20m^2 - 4m^2$ SRI = 50 DB

For Window T1 = ? A2 = $4m^2$ SRI = 10DB

Calculations

Step 1

SRI formula

$$\text{SRI} = 10 \times (\log_{10} \times (1/T))$$

Brick

$$50 = 10 \times (\log (1/T))$$

$$5 = \log_{10} \times (1/T)$$

$$1/T1 = 10^5$$

$$T1 = 10^{-5}$$

$$= 0.0000010$$

$$T1 = 0.000010$$

Window

$$10 = 10 \times (\log_{10}(1/T2))$$

$$1 = \log_{10} \times (1/T2)$$

$$1/T2 = 10^1$$

$$T2 = 10^{-1}$$

$$= 0.10$$

$$T2 = 0.10$$

$$1/T1 = 10^5$$

$$1/10^5 = T1$$

Step 2

$$T_1 = 10^{-5}$$

$$1/T_2 = 10^1$$

$$1/10^1 = T_2$$

$$T_2 = 10^{-1}$$

$$T_0 = \frac{(0.000010 \times 16^2 = (0.10 \times 4) = 0.020008}{16 + 4}$$

$$\begin{aligned} \text{SRI} &= 10 \times (\log_{10}(1/0.020008)) \\ &= 16.987 \\ &= 17 \text{ DB} \end{aligned}$$

2. Implications of frequency and wavelength.

Wavelength is the distance between 2 successive crests of a wave.

Frequency is the number of occurrences of a repeating event per unit of time.

Internal sound management

Sound can play a big factor in the design and management of buildings as it can be very costly if there is a need to retrofit after the project is completed, therefore it is important to consider all sound related issues at the design stage as this is the most cost effective area. All sound should be considered early on such as reflective sound, absorbed sound and transmitted sound. At the design stage you need to consider all rooms within a building and what type of sound resistance they need to suit the needs of the client. Planning where rooms are going to be is important for the levels of volume that are desired, for example if a room is needed to have low levels of noise it should be located furthest away from the loudest areas which is key within the design stage and also choosing the correct materials whether it be reflective materials such as hard materials or soft materials which are good at absorbing noise levels. If there are older appliances within an existing building and noise levels are too high it may be worth considering buying new appliances or repairing or servicing them, there are also other ways of dampening the noise levels which are placing the old appliances on a vibration isolator like a resilient base. It should also be noted that outside noise can effect the internal building, even though it can not be controlled by building its sound transmission loss into our buildings.

Partition wall construction technique

Before you decide on the type of partition wall construction technique firstly you have to understand the transmission of sound and how it is measured. The best way to do this is in laboratory conditions where you can measure the transfer of sound through the different type of partitions you could use within your building, so if you construct a wall of a desired material between two specially isolated rooms you can measure the sound

transfer via the partition to help with your decision making. Most sound is transmitted through a partition as either airborne or impact noise.

In general, as sounds of the same volume pass through a wall, the low bass frequencies will penetrate the wall more easily than the high frequencies. This is for two reasons; their longer wavelength, and the fact that low frequency sounds create resonance/vibration in walls and this helps propagate the passage of sound. What this means is that dependant on the use of the building and the areas surrounding it and the type of noise generated will dictate what is the best internal sound management to use. The three general principles to help with sound insulation are weight, completeness and isolation. In other words a heavier wall is more difficult for sound to penetrate, airtight structures are more sound efficient and air gaps can provide higher insulation. So when choosing a partition these three things should be taken into consideration.

(soundstop.co.uk n.d.)

Insulation material choice

Correct material choice could be vital depending on the type of sound control you want within a room as the acceptable amount of background noises for some areas are 10-20 for concert and recital halls, 35-45 DB for living and family rooms and kitchens and laboratories are 40-45. Hard materials will reflect sound and causes reverberation, which is the collection of sounds that have been reflected off different surfaces and how close those surfaces are in an enclosed area. Reverberation is dependant on the absorption qualities of different materials for example hard materials reflect sound which aid in reverberation and soft materials absorb sound which helps lower the possibility of reverberation. The wall thickness is also a key factor as it can lower the possibility of sound passing through therefore material choice again plays an important factor. An example is if the wall is a heavy wall then it will be difficult to vibrate as sound waves are vibrations, therefore choosing the right material for your wall is vital e.g insulation . Material choice for the buildings exterior is also key as keeping external sound out is important, therefore using harder materials is better externally as they reflect sound, you can also get sound absorbing materials on surfaces which will reflect unwanted noise. Services and plant also need dampening and this can be done by suspending them from ceilings so they are not bolted to building and causing vibration.

References

www.soundstop.co.uk. (n.d.). *The Science of Soundproofing* | Soundstop.co.uk. [online]
Available at: <https://www.soundstop.co.uk/science-of-soundproofing>.