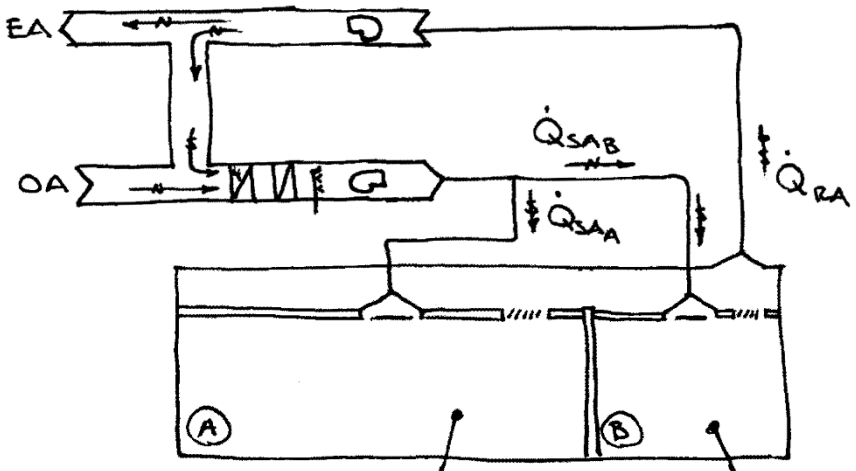
EXAMPLE - MULTIPLE ZONE DESIGN.



$300\,m^2$ / 3 m CEILING
LECTURE HALL ∴ $150P/100m^2$
∴ 450 PEOPLE.
ACH = 4 TO 10 ∴ 8 ACH

$$Q_{SA_A} = \frac{(300 \times 3)(8)}{3.6} = 2000\ L/s$$

$$Q_{OA_A} = (3.8 \times 450) + (0.3 \times 300) = 1800\ L/s$$

$$\%OA_A = 1800/2000 = 90\ \%$$

$100\,m^2$ / 3 m CEILING
CLASSROOM $35P/100\,m^2$
∴ 35 P
ACH = 4 TO 10 ∴ 8 ACH.

$$Q_{SA_B} = \frac{(100 \times 3)(8)}{3.6} = 667\ L/s$$

$$Q_{OA_B} = (5 \times 35) + (0.6 \times 100) = 235\ L/s$$

$$\%OA_B = 235/667 = 35\ \%$$

THIS WILL NOT WORK AS $\%OA_A \neq \%OA_B$
WHAT TO DO?

SOLUTION 1: INCREASE Q_{SA} OF ZONE (A)

TO MAKE $\%OA_A = \%OA_B = 35\%$ ... $Q_{SA_A} = \frac{1800}{0.35} = 5143\ L/s$.

OR $ACH_A = 20.6$! WOW. BIG!

SOLUTION 2: INCREASE Q_{OA} OF ZONE (B)

TO MAKE $\%OA_A = \%OA_B = 90\%$ ... $Q_{OA_B} = 667 \times 0.9 = 600.3\ L/s$

THAT RAISES TO TOTAL OA FROM $1800 + 235 = 2035\ L/s$
TO ... $1800 + 600 = 2400\ L/s$.

THAT'S A 18% INCREASE IN OA $(2400/2035 = 1.18)$

SOLUTION 3: DO BOTH BUT IN MODERATION.

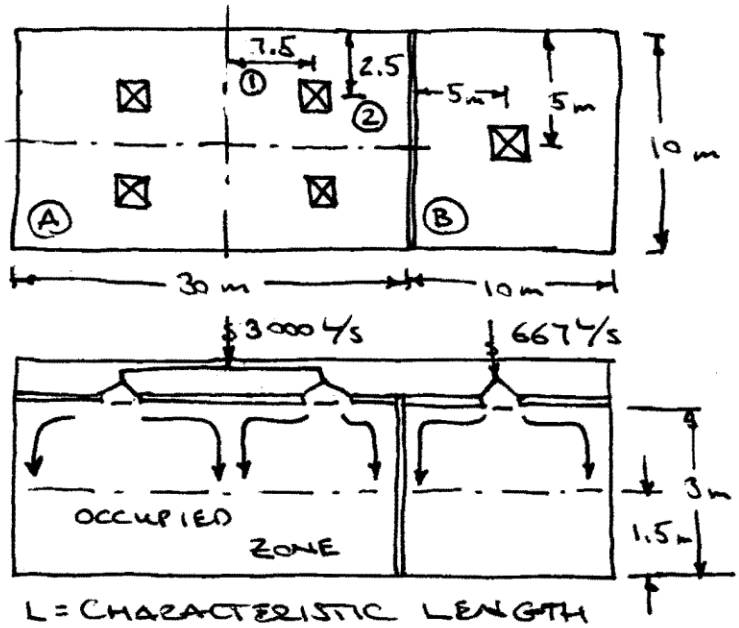
(A): ACH = 12 → $Q_{SA_A} = 3000\ L/s$ → $\%OA = 1800/3000 = 60\%$

(B): $Q_{OA_B} = 667 \times 0.6 = 400.2\ L/s$

THAT RAISES THE SA BY ... $(3000 + 667)/(2000 + 667) = 37\%$

ALSO RAISES THE OA BY ... $(1800 + 400.2)/(1800 + 235) = 8\%$ ①

EXAMPLE - CHECKING YOUR DIFFUSER LAYOUT



L = CHARACTERISTIC LENGTH

$L_{A_1} = 7.5 + 1.5 = 9 \text{ m} = 29.5 \text{ FEET}$

$L_{A_2} = 2.5 + 1.5 = 4 \text{ m} = 13.1 \text{ FEET}$

$L_B = 5 + 1.5\text{m} = 6.5\text{ m} = 21.3 \text{ FT}$

FOR CIRCULAR CEILING DIFFUSERS $\left[T_{0.25}/L\right] = 0.8$ (EH PRICE, ADPI TABLE 5)

GOAL THROW

$T_{0.25_{A1}} = 9 \times 0.8 = 7.2\text{m} = 23.6 \text{ FT}$

$T_{0.25_{A2}} = 4 \times 0.8 = 3.2\text{m} = 10.5 \text{ FT}$

$T_{0.5_B} = 6.5 \times 0.8 = 5.2\text{m} = 17.1 \text{ FT}$

$Q_{DIFFUSER_A} = 3000 \text{ l/s} \div 4 = 750 \text{ l/s} = 1590 \text{ CFM}$

$Q_{DIFFUSER_B} = 667 \text{ l/s} = 1414 \text{ CFM}$

DIFFUSER SELECTION

E.H. PRICE, SPD, 24x24, SIZE 15

ACTUAL (LISTED) THROW: $T_{0.25_A} \simeq 21 \text{ FT}$, $T_{0.25_B} \simeq 19.5 \text{ FT}$

WILL THIS DIFFUSER WORK?

ACCEPTABLE RANGE OF $T_{0.25}/L = 0.7$ TO 1.2 (EH PRICE, ADPI TABLE 5, ROOM LOAD = 190 W/m²)

OUR OPERATING $T_{0.25}/L$'S ARE:

A1: ACTUAL $T_{0.25}/L = 21/29.5 = 0.71$ OK

A2: ACTUAL $T_{0.25}/L = 21/13.1 = 1.6$ NOT OK

B: ACTUAL $T_{0.25}/L = 17.1/24.6 = 0.7$ OK (CLOSE BUT OK.) (2)

Table 5: Air diffusion performance index (ADPI) selection guide

Terminal Device	Room Load W/m2	T0.25/L for Max. ADPI	Max. ADPI	ADPI Greater Than	Range of T0.25/L
High Sidewall Grilles	250	1.8	68	-	-
	190	1.8	72	70	1.5 to 2.2
	125	1.6	78	70	1.2 to 2.3
	65	1.5	85	80	1.0 to 1.9
	< 30	1.4	90	80	0.7 to 2.1
Circular Ceiling Diffusers*	250	0.8	76	70	0.7 to 1.3
	190	0.8	83	80	0.7 to 1.2
	125	0.8	88	80	0.5 to 1.5
	65	0.8	93	80	0.4 to 1.7
	< 30	0.8	99	80	0.4 to 1.7
Sill Grille Straight Vanes	250	1.7	61	60	1.5 to 1.7
	190	1.7	72	70	1.4 to 1.7
	125	1.3	86	80	1.2 to 1.8
	65	0.9	95	90	0.8 to 1.3
Sill Grille Spread Vanes	250	0.7	94	90	0.6 to 1.5
	190	0.7	94	80	0.6 to 1.7
	125	0.7	94	-	-
	65	0.7	94	-	-
Ceiling Slot Diffusers (for T_{100}/L)	250	0.3	85	80	0.3 to 0.7
	190	0.3	88	80	0.3 to 0.8
	125	0.3	91	80	0.3 to 1.1
	65	0.3	92	80	0.3 to 1.5
Light Troffer Diffusers	190	2.5	86	80	< 3.8
	125	1.0	92	90	< 3.0
	65	1.0	95	90	< 4.5
Perforated & Louvered Ceiling Diffusers	35 to 160	2.0	96	90	1.4 to 2.7
	35 to 160	2.0	96	80	1.0 to 3.4

*Includes square cone diffusers and square plaque diffusers