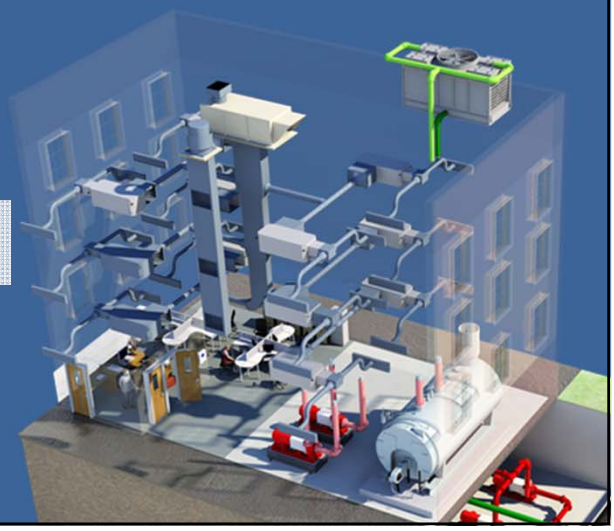
TRANE

TRACE™ 700

ASHRAE Standard 62.1



ASHRAE 62.1: Section 6.2

Ventilation Rate Procedure (VRP)

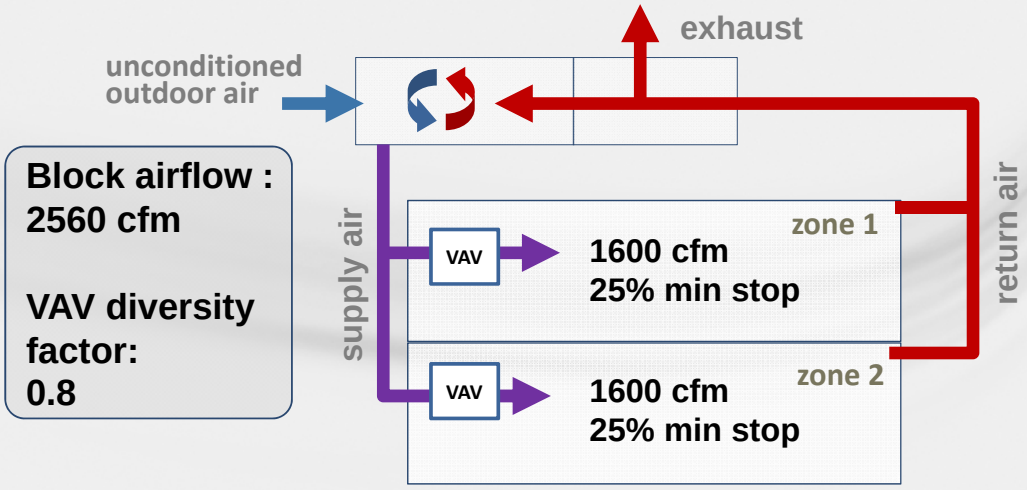
- Prescribes quantity of outdoor air delivered to each zone based
- How to calculate outdoor air flow needed at the system intake

Learning objectives

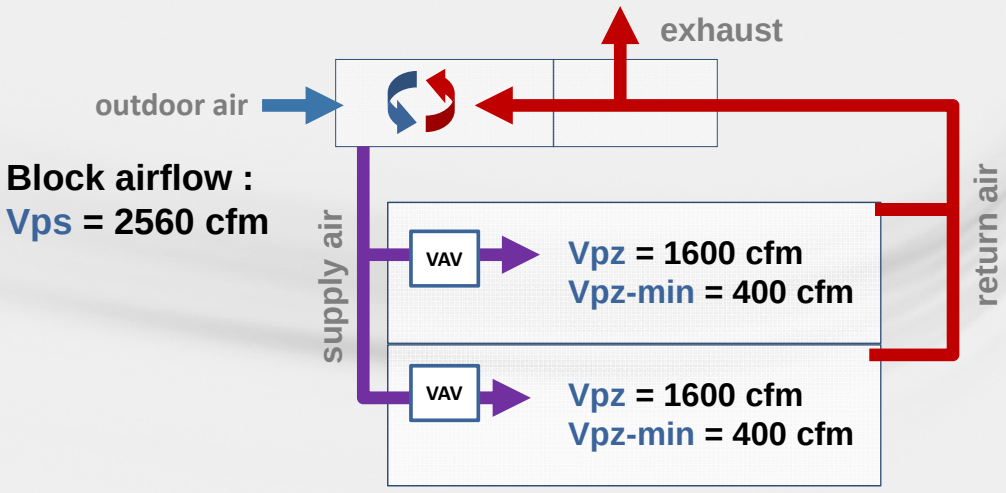
- Describe the multi-zone calculation process
- Show how TRACE™ determines system level
- Common questions

Example: Two zone office

Calculate required outdoor air intake VAV reheat system



ASHRAE Standard 62.1 Variables



Zone Airflow Rates

1

Define Zone Level Parameters

a. Define zone airflow rates and distribution effectiveness
   a. R_a = Outdoor airflow rate per unit area (Table 6-1)
   b. R_p = Outdoor airflow rate per person (Table 6-1)
   c. E_z = Define zone air distribution effectiveness (Table 6-2)

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2. **Calculate Breathing Zone Outdoor Airflow (V_{bz})**
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   a. Vbz= (Rp x Pz) + (Ra x Az),
      where Pz is the number of people and Az is the zone area
3. **Calculate Zone Outdoor Airflow (V_{oz})**
   a. Voz = Vbz/Ez

Zone Airflow Rates

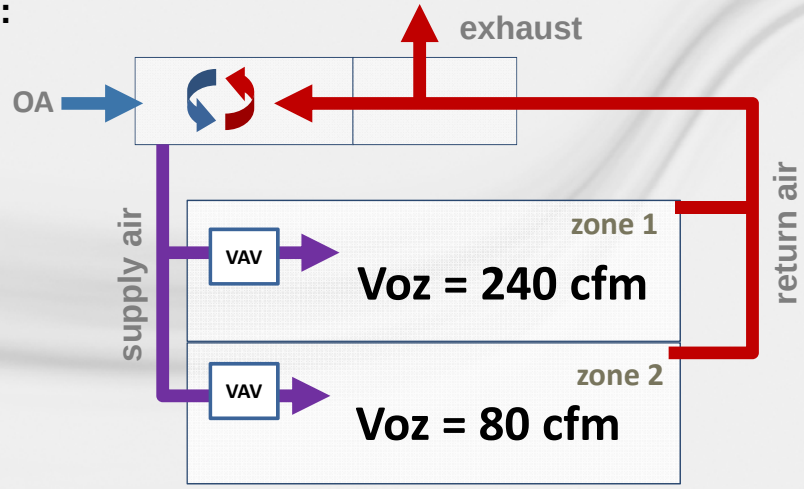
Calculate V_{bz} and V_{oz}:

Zone 1:

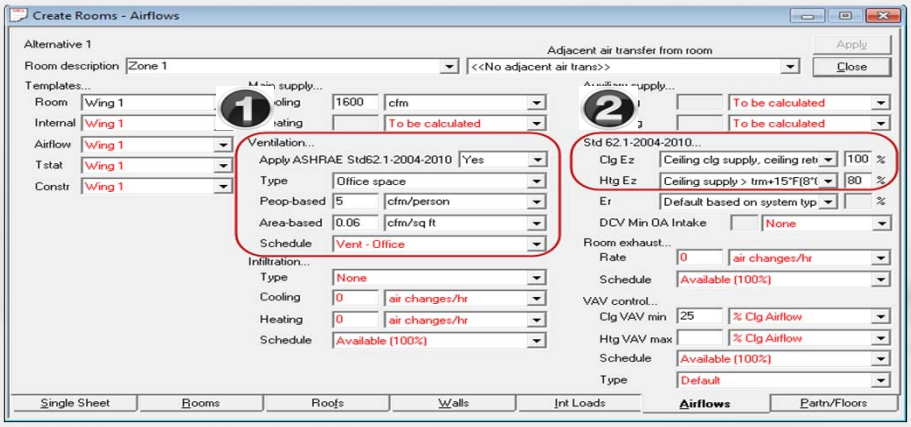
- Rp = 5 cfm/p
- Ra = 0.06 cfm/ft^2
- Pz = 30 people
- Az = 1500 ft^2
- Ez = 1.0 (cooling)

Zone 2:

- Rp = 5 cfm/p
- Ra = 0.06 cfm/ft^2
- Pz = 10 people
- Az = 500 ft^2
- Ez = 1.0 (cooling)



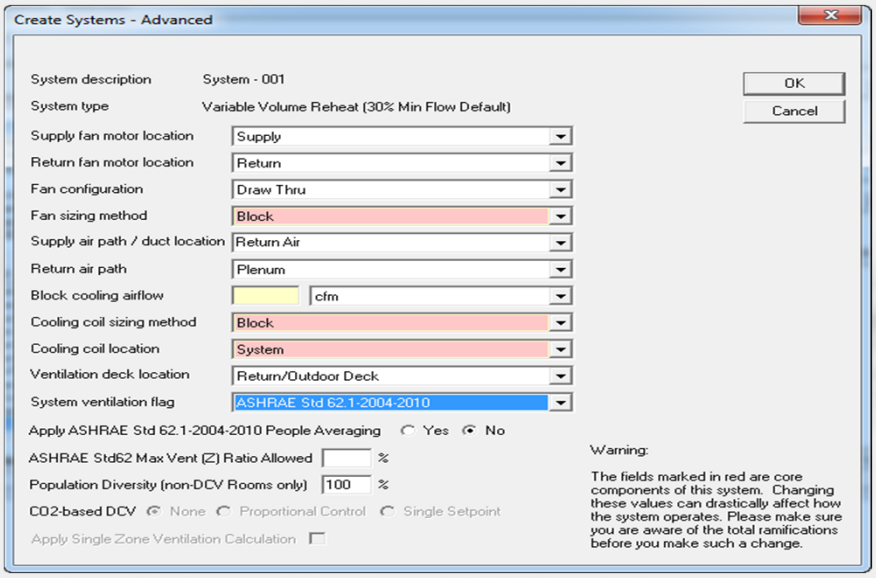
ASHRAE Standard 62.1/TRACE demonstration



1. **Area and occupancy ventilation rates:** OA required to remove contaminants from people and building materials

2. **Zone level efficiency:** Effectiveness of zone level outdoor airflow to dilute indoor contaminants

ASHRAE Standard 62.1/TRACE demonstration



3. Area and occupancy ventilation rates: Select an appropriate standard 62.1 calculation

TRACE™ ASHRAE Standard 62.1 report

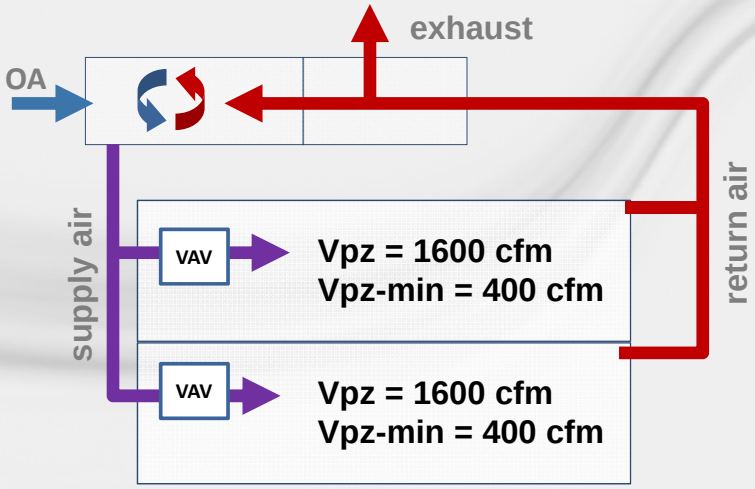
Ventilation Parameters

System Zone Room	Occupancy Category	Rp cfm / p	Pz People	Ra cfm/ft²	Az ft²	Vbz cfm	Cooling Ez	Cooling Voz cfm
Alternative 1								
Zone 2	Officespace	5.00	10.00	0.06	500	80	1.00	80
Zone 1	Officespace	5.00	30.00	0.06	1,500	240	1.00	240
VAV reheat		5.00	40.00	0.06	2,000	320		320

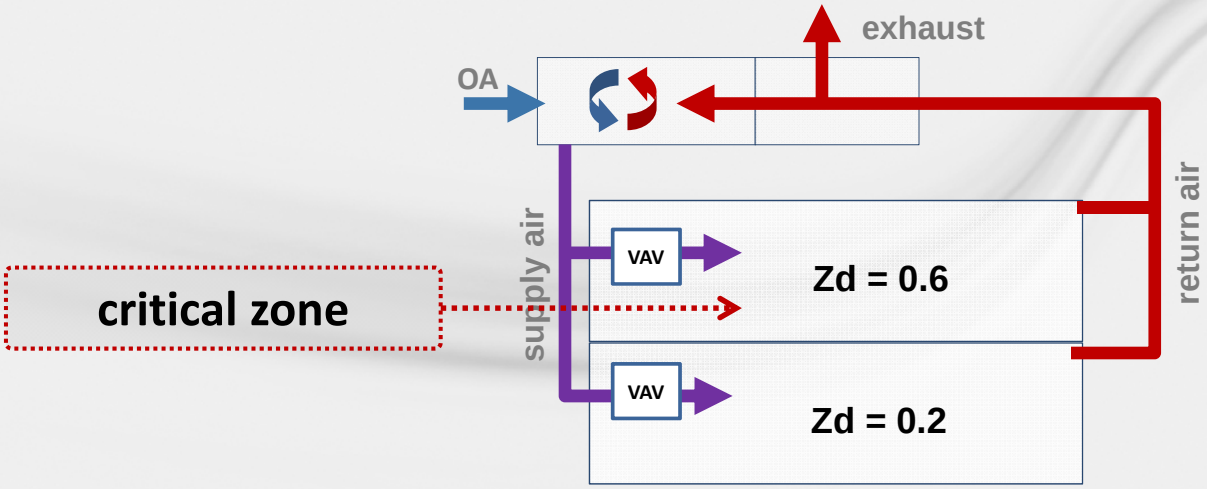
4 Determine Zone Primary OA Fraction (Z_p) for each zone

Zp = Voz/Vpz-min

Where
Voz = zone outdoor airflow
Vpz-min = minimum expected zone primary airflow at the design condition analyzed



5 Determine critical zone (zone with maximum Zd)



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Ventilation Calculation for Cooling Design

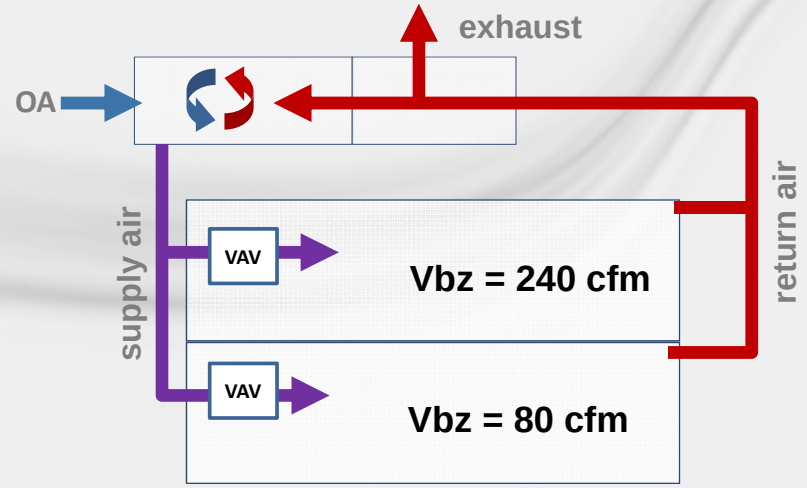
System Zone Room	Box Type	Vpz cfm	Vfan cfm	Vdz cfm	Vpz-min cfm	Voz-clg cfm	Zd	
Alternative 1								
Zone 2	VAV Reheat	1,600	1,600	1,600	400	80	0.200	
Zone 1	VAV Reheat	1,600	1,600	1,600	400	240	0.600	*
VAV reheat		3,200	2,560	3,200	800	320		

6 Determine uncorrected OA intake (Vou)

$$V_{ou} = D \, \Sigma_{all\ zones} R_p P_z + \Sigma_{all\ zones} R_a A_z,$$

where D represents the occupancy diversity within the system

Assume D =1
Vou = 320 cfm



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System Ventilation Requirements

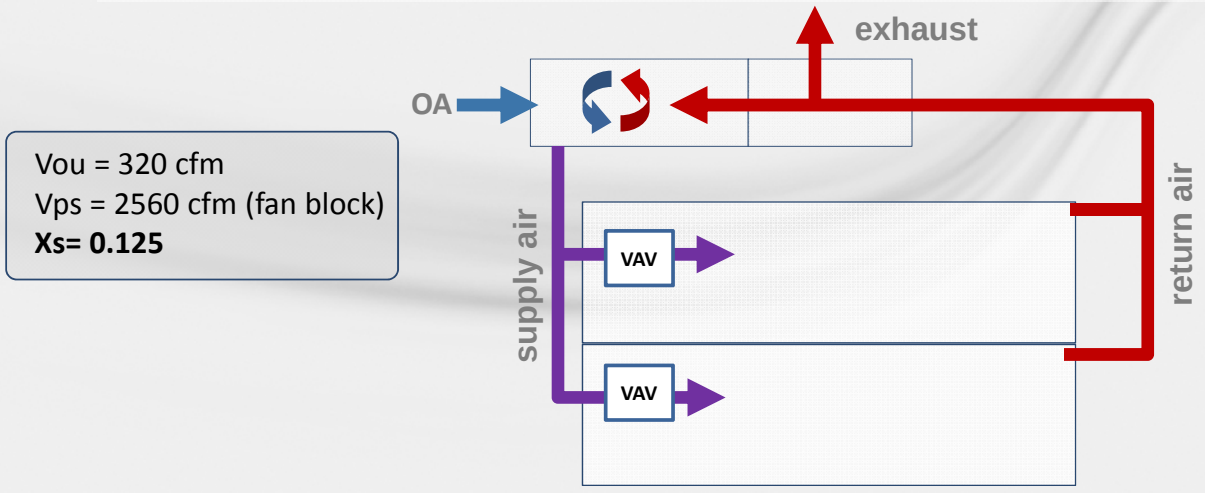
AHU Location	Description		∑ Vpz cfm	Ps People	∑ Pz People	D Ps / ∑ Pz	Vou cfm
Alternative 1							
System	VAV reheat	Cooling	3,200	40	40	1.00	320
		Heating	800	40	40	1.00	320

7 Determine Average Outdoor Air Fraction (Xs)

Xs = Vou/Vps

where Vps is system primary airflow (VAV block airflow)

Vou = 320 cfm
Vps = 2560 cfm (fan block)
Xs= 0.125



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System Ventilation Requirements

AHU Location	Description		Vou cfm	Vps cfm	Xs
Alternative 1					
System	VAV reheat	Cooling	320	2,560	0.125
		Heating	320	800	0.400

8 Determine system ventilation efficiency (Ev):

Equation A-1

$$Ev = 1+Xs-Zd\text{-}max = 1+0.125-0.6 = 0.525$$

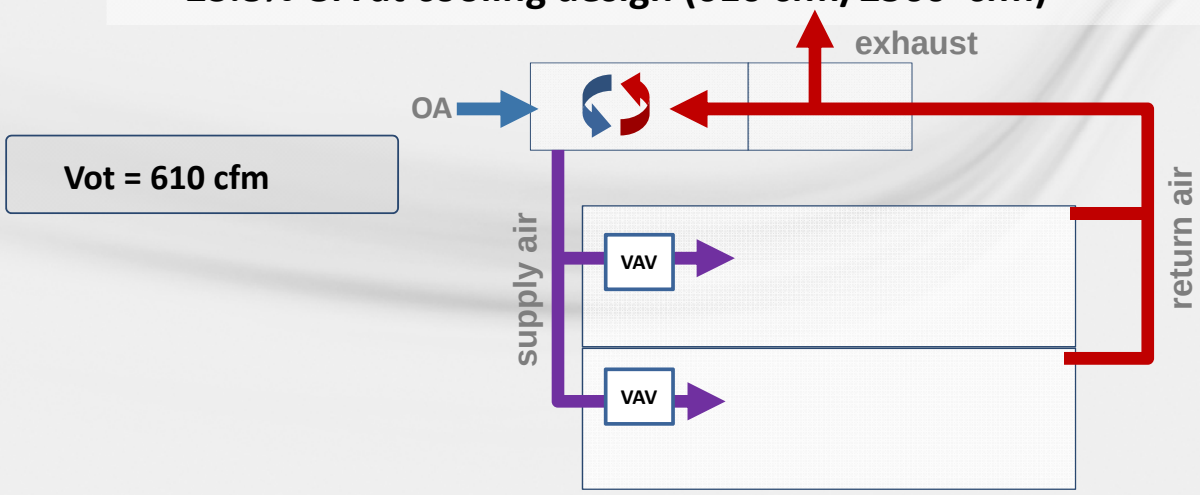
Table 6.3 System Ventilation Efficiency

Max (Zp)	Ev
≤ 0.15	1.0
≤ 0.25	0.9
≤ 0.35	0.8
≤ 0.45	0.7
≤ 0.55	0.6
> 0.55	Use Appendix A

9 Find outdoor intake flow (Vot):

Vot = Vou/Ev = 320/0.525 = 610 cfm

23.8% OA at cooling design (610 cfm/2560 cfm)



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System Ventilation Requirements

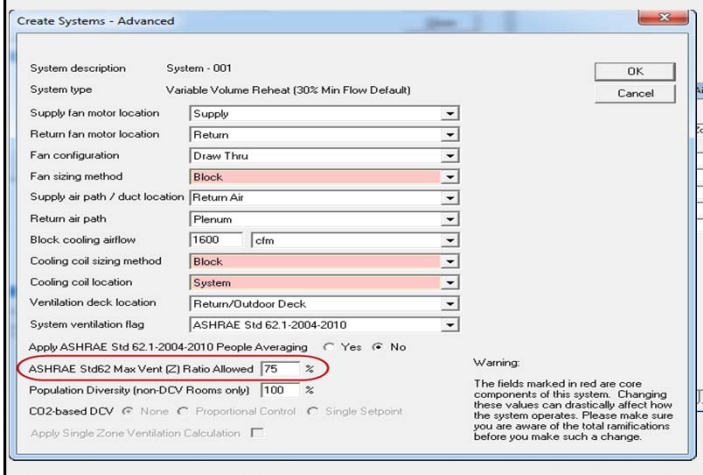
AHU Location	Description		Xs	Ev	Vot cfm	%OA Vot / Vps
Alternative 1						
System	VAV reheat	Cooling	0.125	0.525	610	23.8
		Heating	0.400	0.800	400	50.0

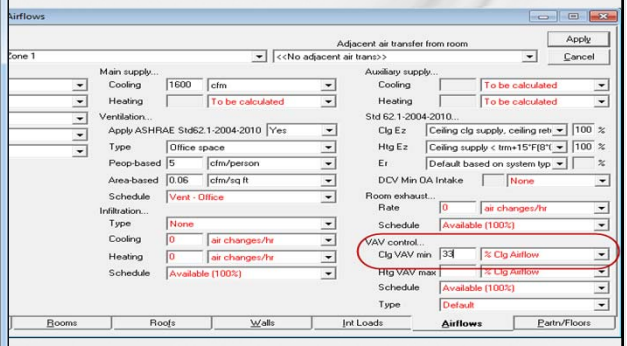
TRACE and ASHRAE Standard 62.1
Common Questions

- **Why is my system 100% OA?**
- Why does my ASHRAE multi-zone spreadsheet does not match the TRACE 700 output?
- Why does TRACE calculate Zd using Vpz-min?

Resolving 100% OA

- Set Max Vent Allowed (Max Zd) in Create Systems>Advanced
- Increase VAV min in critical zone in Create Rooms>Airflows





ASHRAE Standard 62.1

Lesson 2: Program Methodology

100% OA

System Ventilation Requirements

AHU Location	Description		Vou cfm	Vps cfm	Xs	Ev	Vot cfm	%OA Vot / Vps
Alternative 2								
System	System - 001	Cooling	480	2,560	0.188	0.188	2,560	100.0
		Heating	480	800	0.600	0.600	800	100.0

Max Zd = 75%

System Ventilation Requirements

AHU Location	Description		Vou cfm	Vps cfm	Xs	Ev	Vot cfm	%OA Vot / Vps
Alternative 3								
System	System - 001	Cooling	480	2,560	0.188	0.438	1,097	42.9
		Heating	480	933	0.514	0.764	628	67.3

Max Zd

Pros

Reduce OA cfm

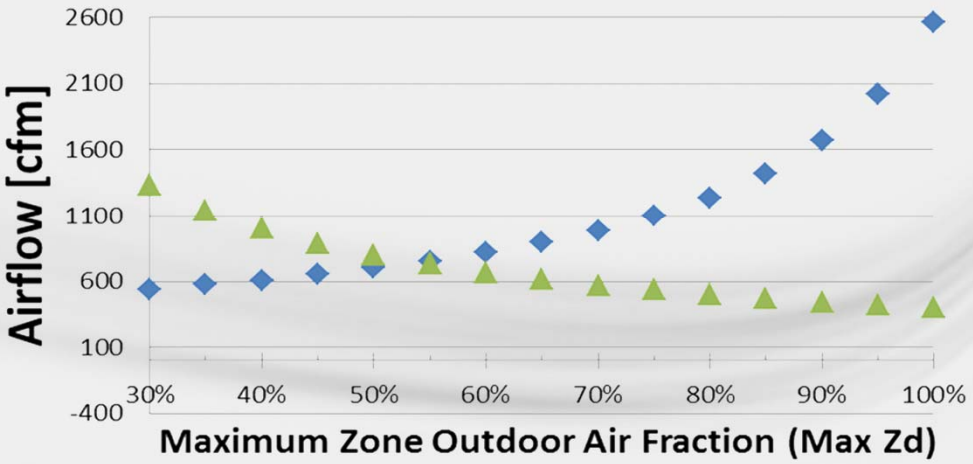
- Reduced outdoor air cfm
- Reduced ventilation load

Cons

Increased airflows

- Increased minimum stop
- Increased fan power
- Increased reheat loads

Impact of $Z_{d\text{-}max}$ on V_{ot} and $V_{pz\text{-}min}$



Note: These values are for the 2 zone example

TRACE and ASHRAE Standard 62.1

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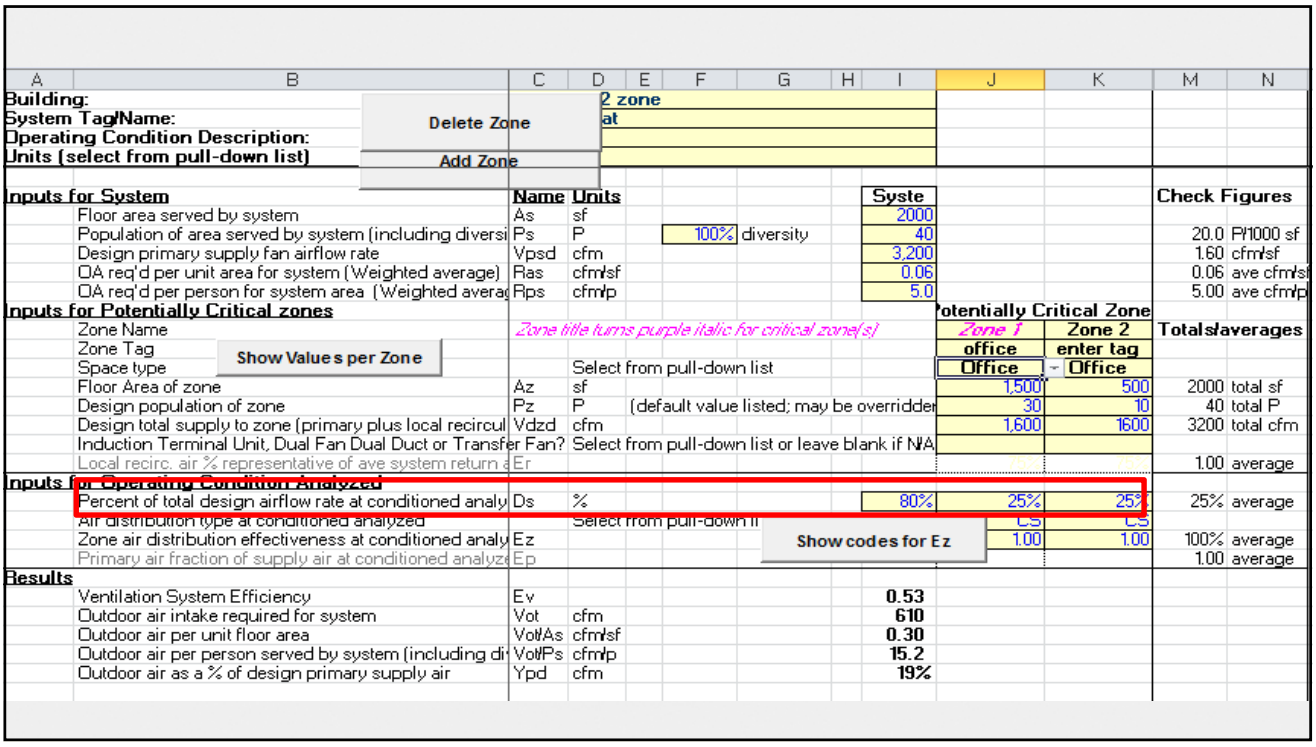

Building:				2 zone									
System Tag/Name:	Delete Zone			at									
Operating Condition Description:													
Units (select from pull-down list)	Add Zone												
Inputs for System		**Name**	**Units**					**Syste**				**Check Figures**	
Floor area served by system		As	sf					2000					
Population of area served by system (including diversi		Ps	P		100%	diversity		40				20.0	P/1000 sf
Design primary supply fan airflow rate		Vpsd	cfm					3,200				1.60	cfm/sf
OA req'd per unit area for system (Weighted average)		Ras	cfm/sf					0.06				0.06	ave cfm/s
OA req'd per person for system area (Weighted averag		Rps	cfm/p					5.0				5.00	ave cfm/p
Inputs for Potentially Critical zones										**otentially Critical Zone**			
Zone Name		*Zone title turns purple italic for critical zone(s)*								*Zone 1*	Zone 2	**Totals/averages**	
Zone Tag										office	enter tag		
Space type	Show Values per Zone		Select from pull-down list							Office	Office		
Floor Area of zone		Az	sf							1,500	500	2000	total sf
Design population of zone		Pz	P		(default value listed; may be overridde					30	10	40	total P
Design total supply to zone (primary plus local recircul		Vdzd	cfm							1,600	1600	3200	total cfm
Induction Terminal Unit, Dual Fan Dual Duct or Transfer Fan?			Select from pull-down list or leave blank if N/A										
Local recirc. air % representative of ave system return a		Er								n/a	n/a	1.00	average
Inputs for Operating Condition Analyzed													
Percent of total design airflow rate at conditioned analy		Ds	%					80%		25%	25%	25%	average
Air distribution type at conditioned analyzed			Select from pull-down li							CS	CS		
Zone air distribution effectiveness at conditioned analy	Show codes for Ez	Ez								1.00	1.00	100%	average
Primary air fraction of supply air at conditioned analyze		Ep										1.00	average
Results													
Ventilation System Efficiency		Ev						**0.53**					
Outdoor air intake required for system		Vot	cfm					**610**					
Outdoor air per unit floor area		Vot/As	cfm/sf					**0.30**					
Outdoor air per person served by system (including di		Vot/Ps	cfm/p					**15.2**					
Outdoor air as a % of design primary supply air		Ypd	cfm					**19%**					

TRACE and ASHRAE Standard 62.1

Common Questions

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- **Why does TRACE calculate Zd using Vpz-min?**

Additional resources

- *TRACE™ 700 User's Manual*
- TRACE online (F1) help
- Trane.com/EN
- Trane.com/ContinuingEducation

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