



PH FEELING HIGHER: HIGH-RISE MULTIFAMILY VENTILATION

Steven Winter Associates, Inc.
Improving The Built Environment Since 1972



Passive House Requirements

- Continuous balanced mechanical ventilation
- In cold climates ERV/HRVs $\geq 75\%$ efficient
- Occupants should have the ability to boost the ventilation rate to a minimum of
 - 35 cfm in kitchens
 - 24 cfm in full baths
 - 18 cfm/person ≈ 0.34 ACH
- Occupants should have the ability to reduce the flow rate when away
- Daily average should be ≥ 0.30 ACH.
 - ceiling height of no more than 8.2'
 - # occupants = treated floor area/377 ft² per person
- Flow rates should not be kept much higher to prevent excessively dry interior air and to reduce the heating demand.
- All ventilation runs through the ERV/HRV



Ventilation Options

Individual ERV

Central ERV

- Pros**
- Resident Meter
 - No slab penetrations
 - Continuous, boost flow easily achievable
 - PH certified units available
 - Precedent for unitized ERV

- Reduction in horizontal ducts
- Continuous, boost flow achievable
- Significantly reduced maintenance
 - No wall penetrations

- Cons**
- 2 penetrations/apartment
 - Ceiling height issues
 - Exhaust/intake separation restrictions
 - In-unit maintenance, filter change 3x/yr
 - Loss of floor space if ceiling space unavailable

- Owner Meter
- No PH certified units available
- Floor space reduction
- Large slab penetrations
- Fire rated shafts/dampers needed
- Complexity of controls for variable flow rates
- No precedent for central balanced system w/ HR in US



Cornell

- Central, Constant Volume System
 - Not typical for PH: no occupant control
 - But:
 - Operable windows in every apartment
 - High level of ventilation
 - Ability to reduce flows if needed





COMPLIANCE W/ CODES & STANDARDS

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Take-Always

- PH ventilation requirements differ from current codes and US standards – primarily for small dwellings
- This affects certification programs such as LEED & ENERGY STAR
- Currently addressing these on a case by case basis



Ventilation Rates

	PH	NYC Code	ASHRAE 62.2
Supply	>= 0.3 ACH balanced	0.35 ACH or 15 cfm/person	#(beds + 1) x 7.5 + area x 0.01
Exhaust			
Kitchen	35 cfm boost	35 cfm continuous	5 ACH continuous*
Bath	24 cfm boost	20 cfm continuous	20 cfm continuous

*ENERGY STAR: 25 cfm continuous in kitchen OK for PH projects if:

- balanced ERV/HRV and
- no open combustion appliances.



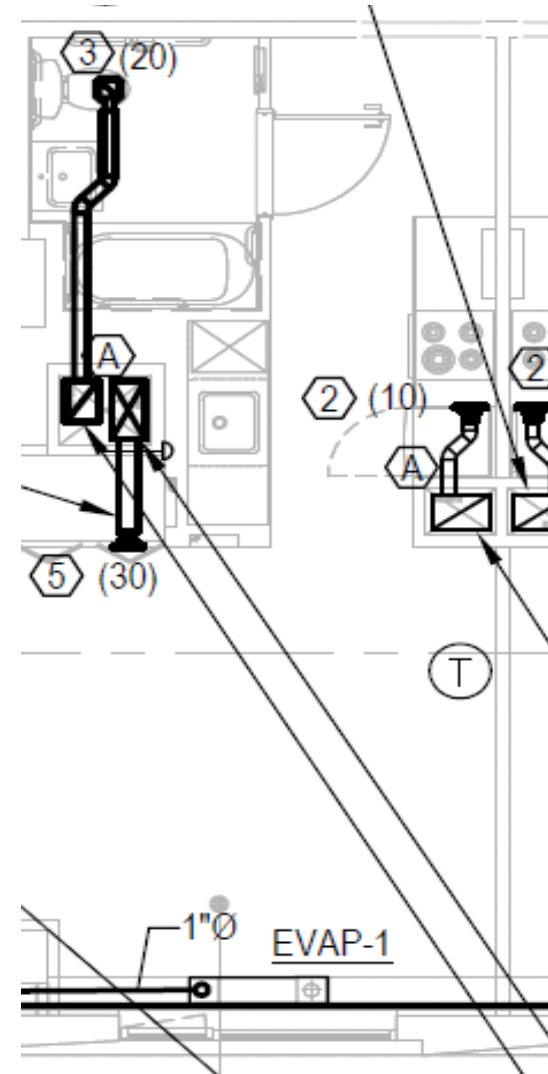
Ventilation Conflicts

			NYC	ASHRAE 62.2
	Beds	Baths	Exhaust/Supply [ACH]	
400	studio	1	1.0/0.3	0.8/0.2
600	1	1	0.7/0.4	0.6/0.3
800	2	2	0.7/0.4	0.6/0.3
1000	3	2	0.6/0.5	0.5/0.3
1200	3	2	0.5/0.4	0.4/0.3
1400	4	2	0.4/0.4	0.4/0.3



Cornell Design: STUDIO

- Constant volume
- Complies with code, 62.2 and been given PH approval – long process
- Adjustable dampers at each termination
- Smallest units at 0.6 ACH – air will turn over 14 times a day as opposed to 8 if 0.3 ACH
- 0.3 ACH = 15 cfm





Comfort in Small Units

- 30 cfm is high for one small room
- Temperature of air very important - 80% efficient ERV will supply 56 F air to space if 0 F outside, 62 F if 30 F outside
- Preheat should be included for v. cold weather
- Pay attention to direction of throw from vent
- Need efficient preheat -90% or better



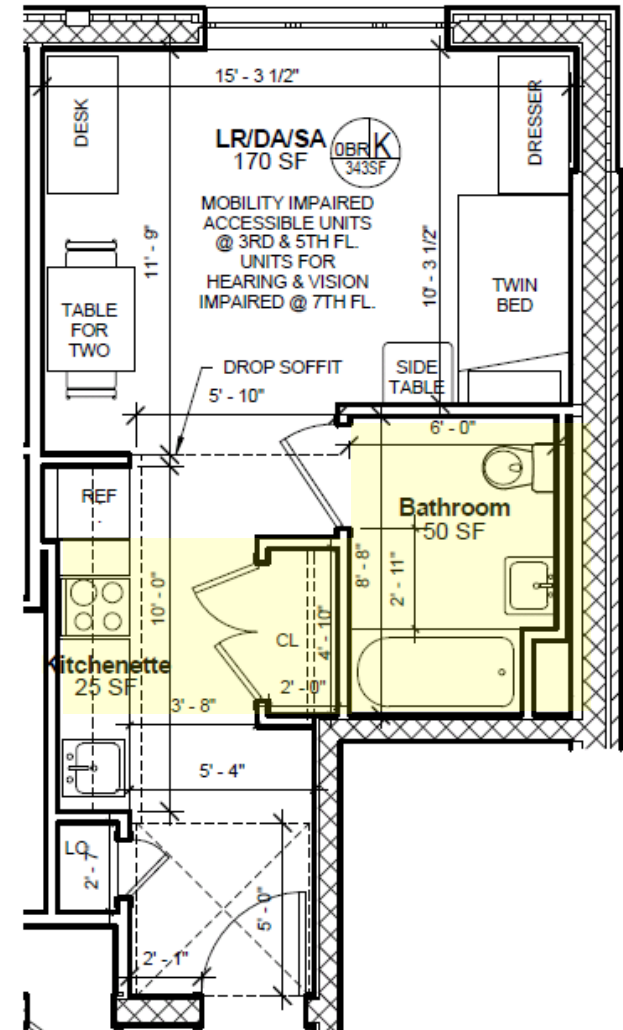
Other Considerations

- Increasing ventilation rate from 0.3 ACH to 0.45 ACH increases heat demand 17%
- ERV efficiency change from 0.85 to 0.75 increases heat demand by 23%
- Measurement is an issue under 10 cfm
- Duct tightness crucial to deliver proper flows



Solutions?

- Allow PH design on certified projects?
- Minimum ACH instead of minimum flow?
- Requirement for commissioning?
- Minimum cfm/person?





LBNL research

- <http://eetd.lbl.gov/publications/deep-energy-retrofits-eleven-california-case-studies>
- http://www.passivehousecal.org/sites/default/files/PHCA_IAQinPHhomes_10252014-45minute.pdf



Questions?

Thank You.

Lois B. Arena, PE, CPHD