

Past and Future of Ventilating Dwellings

The Past and Future of Ventilating Dwellings

ASHRAE 62.2-2013

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Rick Karg, presenter

- Member of ASHRAE 62.2 committee.
- Energy consultant/trainer since 1980.
- *Home Energy* magazine editorial advisor.
- Maine Home Performance program manager.
- Advisor to DOE and BPI for ventilation issues.
- Software developer since 1994.
 - ZipTest Pro (Texas Instruments calculators)
 - ResVent 62.2 (iPhone/iPad)
 - Residential Energy Dynamics (web-based via browser)

Webinar Outline

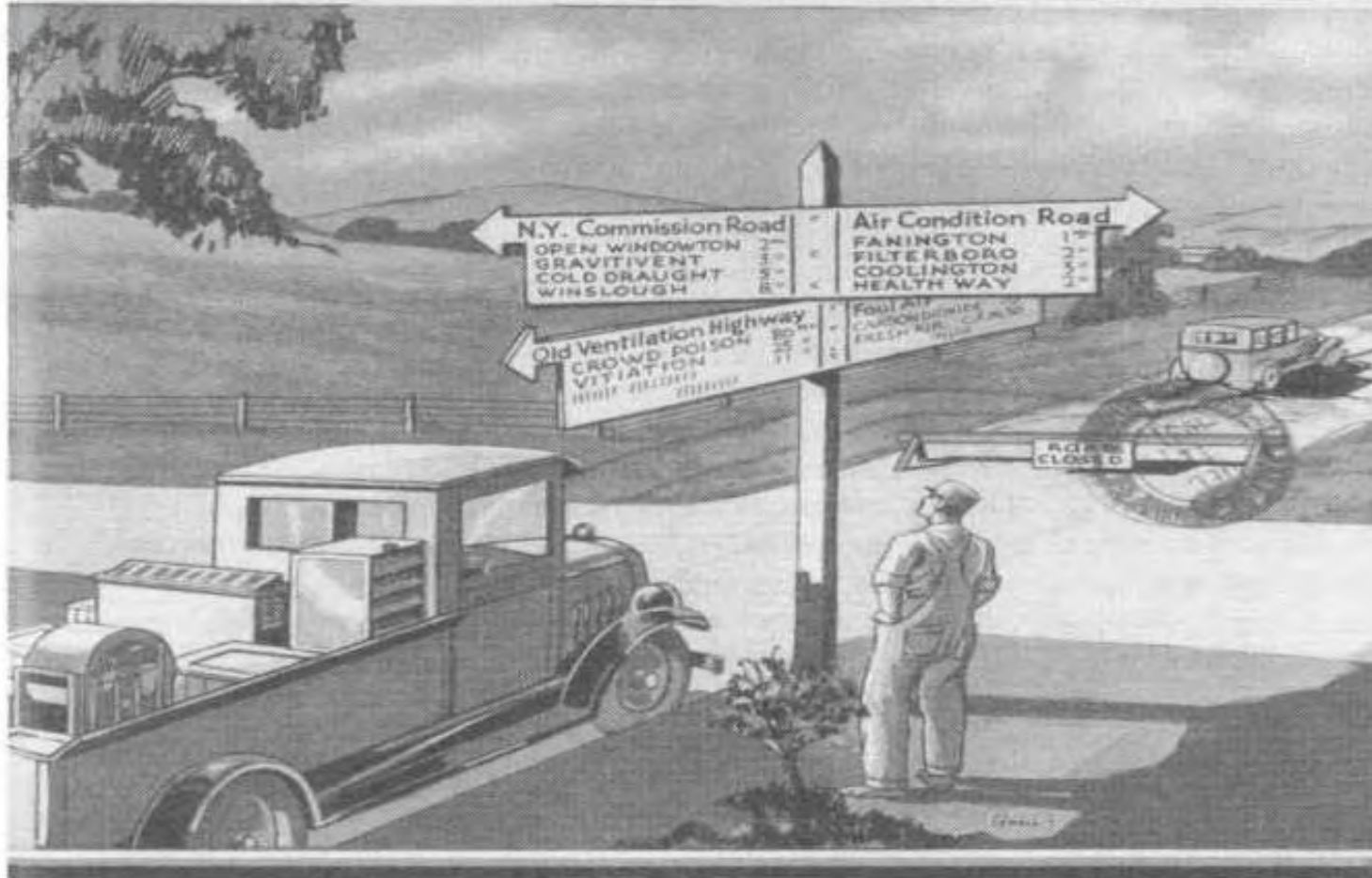
- History and future of ventilation.
- Programs requiring ASHRAE 62.2.
- ASHRAE 62.2-2013 design details.
 - Local ventilation
 - Whole-building ventilation
 - Alternative Compliance
 - Infiltration Credit
- Additional selected requirements.
- Example calculations with RED Calc Free.

Short History/Future of Ventilation

The AEROLOGIST

The Magazine of Air Conditioning

December, 1931



Ventilation controversy. Here one sees the confusion created by changing physiologic theory in ventilation practice. Fresh-air advocates used the report of the New York Commission on Ventilation to bolster their position that mechanical ventilation should be abandoned in favor of open windows. Air-conditioning advocates were headed in the opposite direction, toward man-made weather. (Aerologist [December 1931]: cover)

Ventilation Standards History

- ASHRAE 62-1973
 - 5 CFM per person
 - 15 - 20 CFM per person recommended
- ASHRAE 62-1981
 - 5 CFM per person
- ASHRAE 62-1989
 - 15 CFM per person, and
 - 0.35 ACH
 - BPI Building Airflow Standard (BAS) based on this version of standard

Ventilation Standards History

- ASHRAE 62.2-2003
 - First standard specifically for residential buildings (62.2 committee formed in 1997)
 - CFM ventilation = $0.01 \text{Area}_{\text{floor}} + 7.5(\text{Bed} + 1)$
- ASHRAE 62.2-2010
 - CFM ventilation = $0.01 \text{Area}_{\text{floor}} + 7.5(\text{Bed} + 1)$
 - Adopted by Dept. of Energy
- ASHRAE 62.2-2013
 - CFM ventilation = $0.03 \text{Area}_{\text{floor}} + 7.5(\text{Bed} + 1)$
 - BPI and DOE adoption in 2014

Ventilation History

Pa

lings

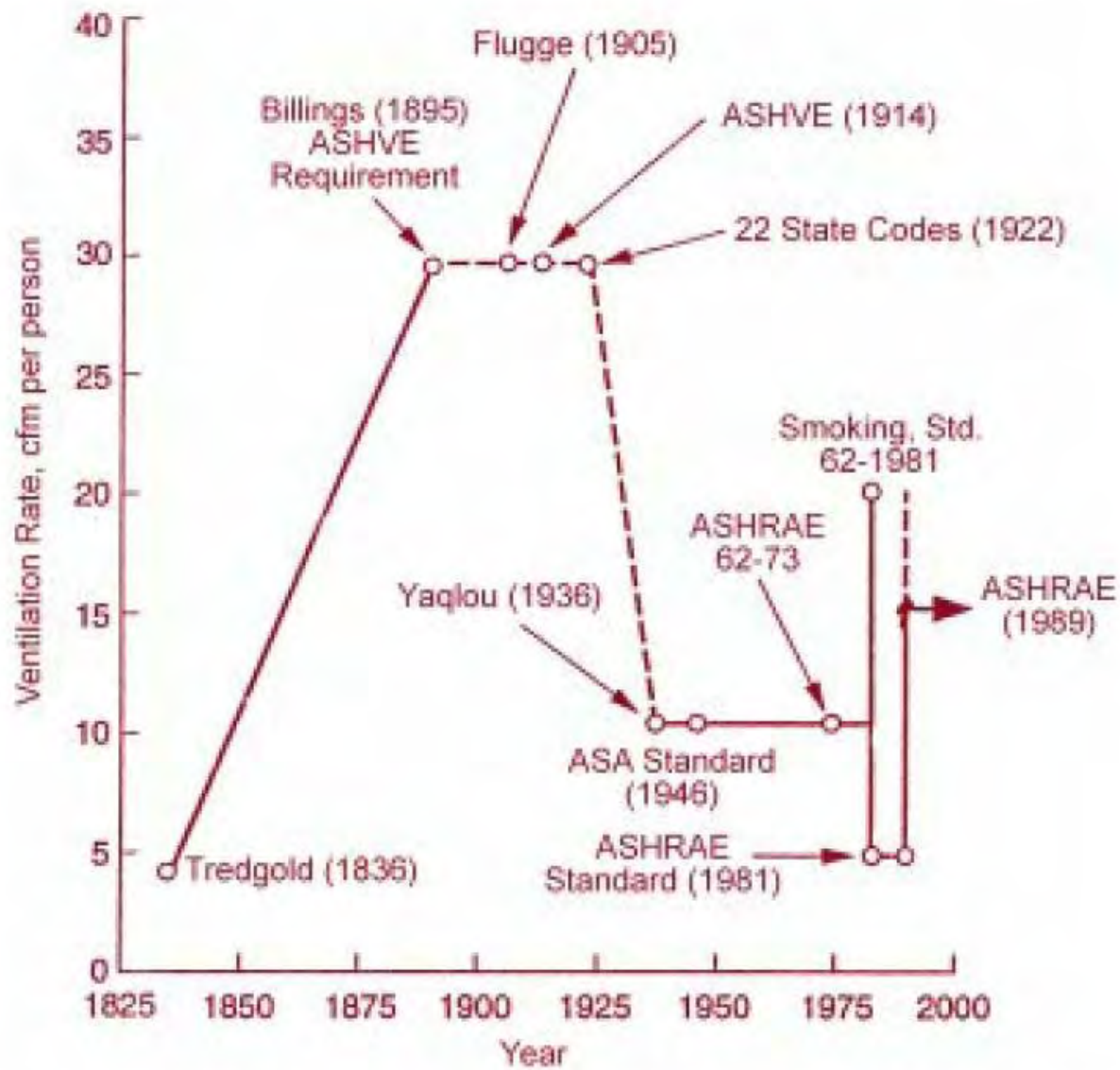


Figure 1: Minimum ventilating rate history.

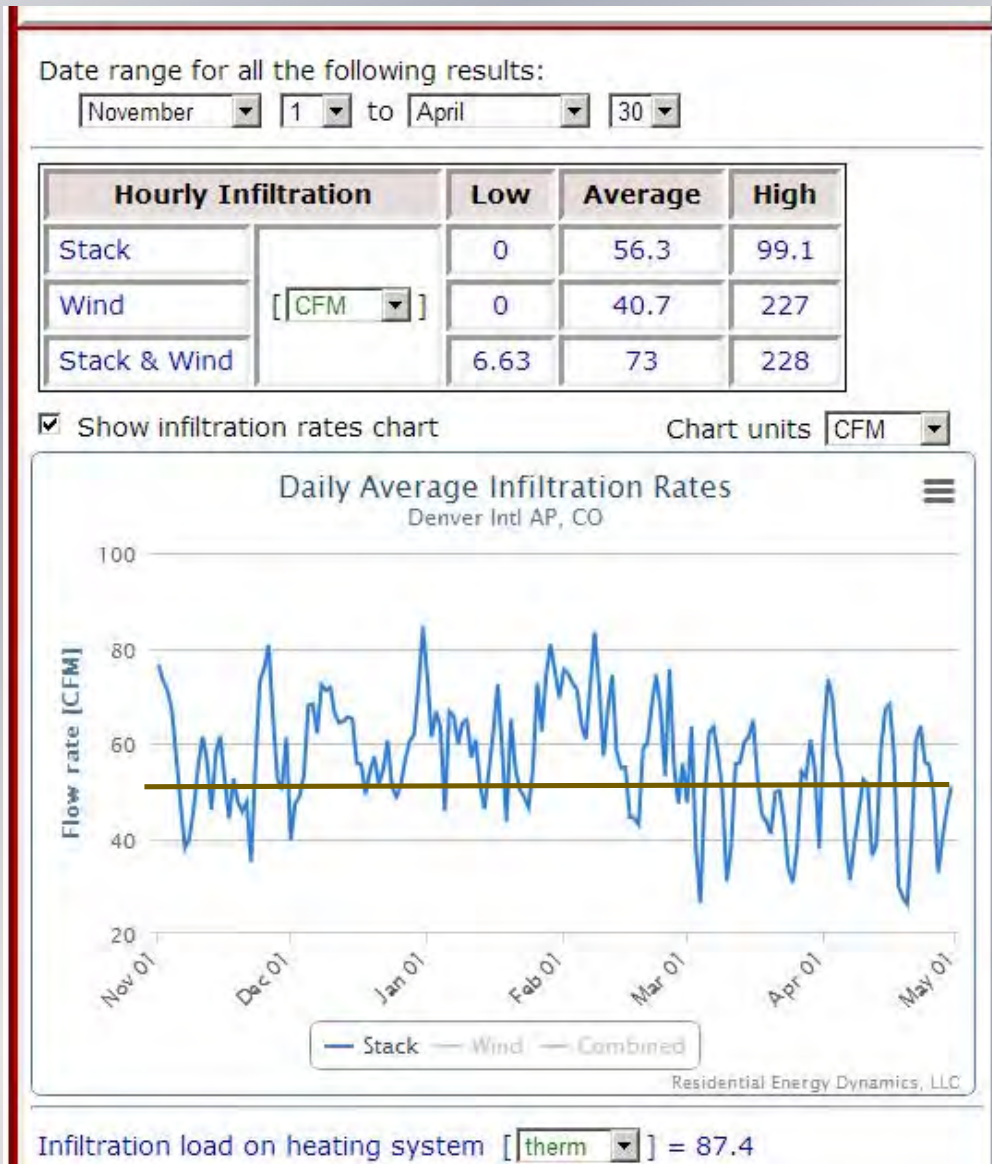
Source: "The History of Ventilation and Temperature Control", John E. Janssen, ASHRAE Journal, September 1999.

Comparison of Standards

- 2000ft², two-story dwelling in Cleveland, 4 bedrooms, 1300/1000 CFM₅₀.
- ASHRAE whole-building ventilation required:
 - 62-1989 - 16/56 CFM (L_{BLn} = 14.8)
 - 62.2-2010 - 38/47 CFM
 - 62.2-2013 - 45/57 CFM
- Notice how much more the 1989 version changes with tightening. Also, for tighter house, all three in same ballpark.

Past and Future of Ventilating Dwellings

Natural Ventilation is Variable



- Denver, CO
- 1400 CFM₅₀
- 2-story
- Thermostat at 68F
- Nov 1 - April 30

RED Calc Free Advanced Infiltration (AIM-2) tool using TMY3 data

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The Future of Ventilation

- More research/science applied as it becomes available.
- IAQ equivalence
 - Determine contaminants of concern
 - Determine health impact of doses
 - Compare to baseline
 - DALY*s and acceptability
 - Ventilate accordingly
- Likely that ventilation will remain controversial.

Programs Requiring ASHRE 62.2

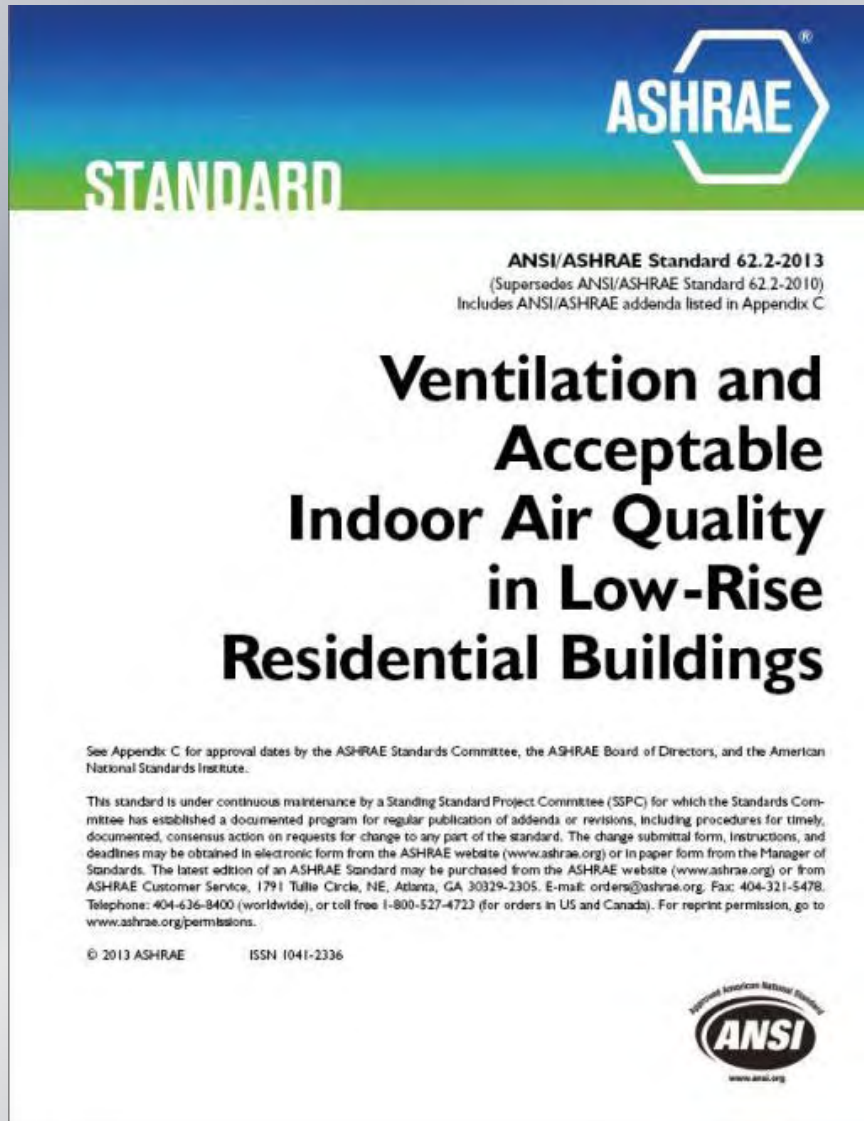
Require ASHRAE 62.2

- *Standard Work Specifications for Home Energy Upgrades*, DOE/NREL, 2013. <https://sws.nrel.gov/>
- *Healthy Indoor Environment Protocols for Home Energy Upgrades*, EPA, 2010.
- *Weatherization Health and Safety Guidance (Weatherization Program Notice 11-6)*.
 - Calls for use of ASHRAE 62.2-2010.
 - DOE allows 2013 version now, required by PY 2014.
- *Building Performance Institute, 2014*
 - *Standard BPI-1200, Standard Practice for the Basic Analysis of Buildings, Section 8*, out for public comment 10/4/2013.
 - Official release expected January 1, 2014.

ASHRAE 62.2- 2013

Past and Future of Ventilating Dwellings

ASHRAE 62.2-2013



www.ashrae.org

*A minimum standard,
not a necessarily a
best-practices
standard*

Scope of ASHRAE 62.2-2013

- Single-family, multifamily up to three stories, manufactured, and modular buildings.
- Considers chemical, physical, and biological contaminants, but does not consider thermal comfort.
- Acceptable IAQ will not necessarily be achieved, even if all requirements are met.

ASHRAE 62.2 is a Continuous Maintenance Standard

- About 20 ASHRAE Standards in this category.
- Change proposals may be submitted at any time by the public.
 - Committee must respond in writing:
 - Accepted for public review without modification.
 - Accepted for public review with modification.
 - Accepted for future study.
 - Rejected.

62.2-2013 Design Details*

- **Local ventilation**
 - Bathrooms and kitchen
- **Whole-Building ventilation**
 - **Basic equation**
 - Add Alternative Compliance supplement
 - Subtract Infiltration Credit

*Based on existing dwellings

Local Ventilation (bathrooms and kitchen)

Local Ventilation

- Exhaust the worst air in the dwelling as quickly as possible.
 - Bathrooms.
 - Kitchens.



Local Ventilation Requirements

- Local exhaust fans must be installed in bathrooms and kitchen.
 - Bathrooms (not half bathrooms)
 - 50 CFM demand-controlled, or
 - 20 CFM continuous.
 - Kitchen
 - 100 CFM demand-controlled*

* Vented range hood required if flow rate is less than 5 kitchen ACH, new buildings.

Local Kitchen Ventilation



This does not enhance the installer's credibility!

For Existing Dwellings...

- May use the Alternative Compliance path if...
 - No local ventilation, or
 - If local ventilation is less than
 - 50 CFM in bathroom
 - 100 CFM in kitchen

Must increase whole-building ventilation to make up for local ventilation deficit.



This does not enhance the installer's credibility either!

Whole-Building Ventilation

Whole-Building Ventilation

- Intended to dilute the pollutants in a dwelling. General ventilation as compared to local ventilation for bathrooms and kitchens.



Whole-Building Ventilation Calculation 2013

Total Required Ventilation Rate, Q_{tot}
+ Alternative Compliance Supplement*
- Infiltration Credit, Q_{inf}^{**}
Required Mechanical Ventilation Rate, Q_{fan}

New Building Restrictions:

* May not be used for new buildings.

** May not be more than $2/3 \times Q_{tot}$ for new buildings.

ASHRAE 62.2-2013

Floor Area (ft ²)	Bedrooms				
	1	2	3	4	5
<500	30	38	45	53	60
501 - 1000	45	53	60	68	75
1001 - 1500	60	68	75	83	90
1501 - 2000	75	83	90	98	105
2001 - 2500	90	98	105	113	120
2501 - 3000	105	113	120	128	135
3001 - 3500	120	128	135	143	150
3501 - 4000	135	143	150	158	165
4001 - 4500	150	158	165	173	180
4501 - 5000	165	173	180	188	195

$$Q_{\text{tot}} = 0.03 \text{ AREA}_{\text{floor}} + 7.5(\text{Bed} + 1)$$

ASHRAE 62.2 Requirements

- The whole building ventilation requirements of the Standard may be satisfied by **intermittent** operation.
- Example:
 - HRV rated at 150 CFM capacity.
 - Whole house requirement is 50 CFM.
 - Operate HRV on a timer for 20 minutes out of every hour to get 50 CFM average.

Alternative Compliance Supplement (Path) for Existing Dwellings

Appendix A

Alternative Compliance Path

- For existing dwellings only.
- Alternative method of meeting local exhaust requirements in kitchens and bathrooms that do not have the existing LOCAL fan flow required by ASHRAE 62.2-2013.

Alternative Compliance Path

- In each room where local ventilation should be, determine deficit relative to required demand-controlled rate:
 - How much less than 50 CFM in bathrooms.
 - How much less than 100 CFM in kitchens.
- For each room with a deficit, reduce deficit by 20 CFM if that room has an openable window(s).*

*Deficit may not be below zero for any bathroom or kitchen.

Alternative Compliance Path

- Add up deficits and divide by 4.
- Add this result to the whole-building ventilation requirement.
 - This becomes the new whole-building ventilation requirement.

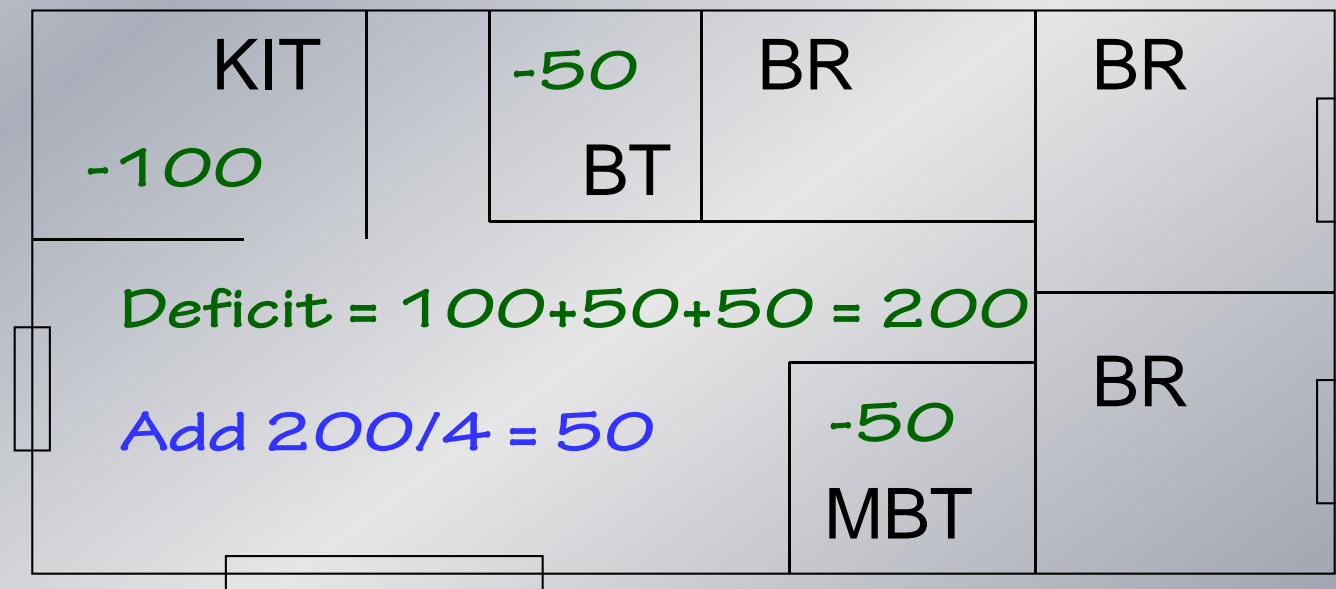
Calculated before infiltration credit

Alternative Compliance Path

- For existing fans, sound requirements of 62.2 are not applicable.
- Must measure flow if ratings don't exist or duct sizing can't be verified.
 - If only have rating at 0.10 in. IWC but not 0.25 in. IWC, can reduce rating at 0.10 in. IWC by 25%.
- Alternative compliance supplement must be applied before infiltration credit.

Alternative Compliance Path

- Example #1: 3 BR, 1500 sq. ft. house



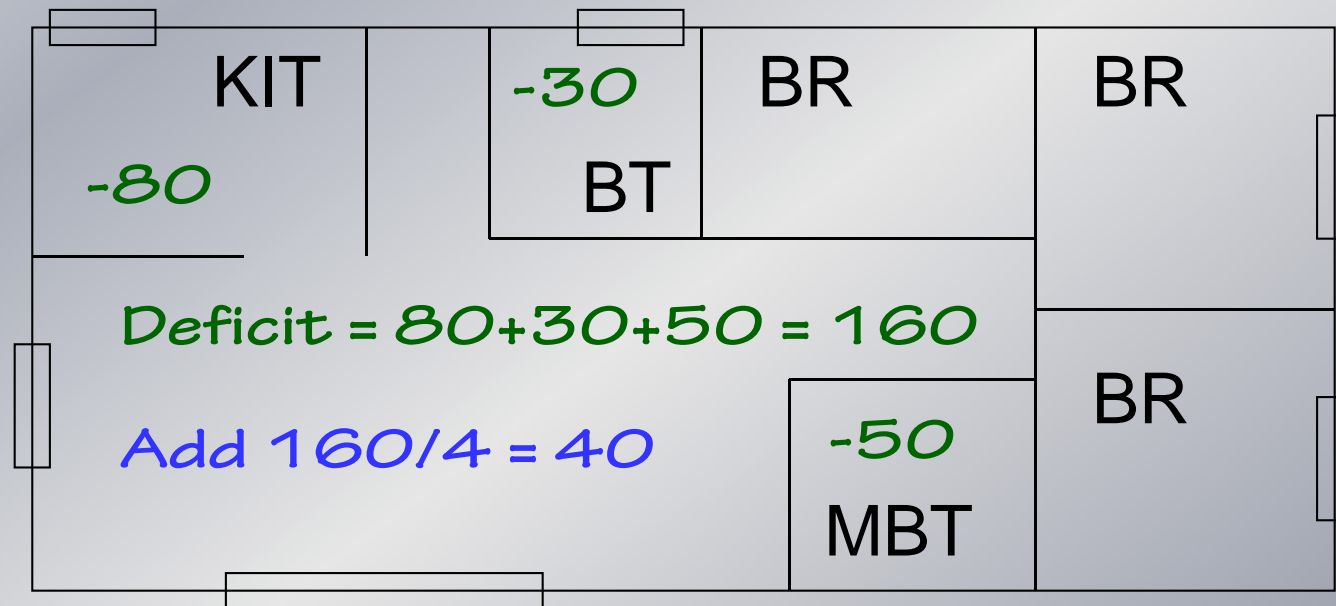
No Windows in KITCHEN or BATHS

Whole-building requirement = $45 + 50 = 95$ CFM

Source: P. Francisco

Alternative Compliance Path

- Example #2: 3 BR, 1500 sq. ft. house

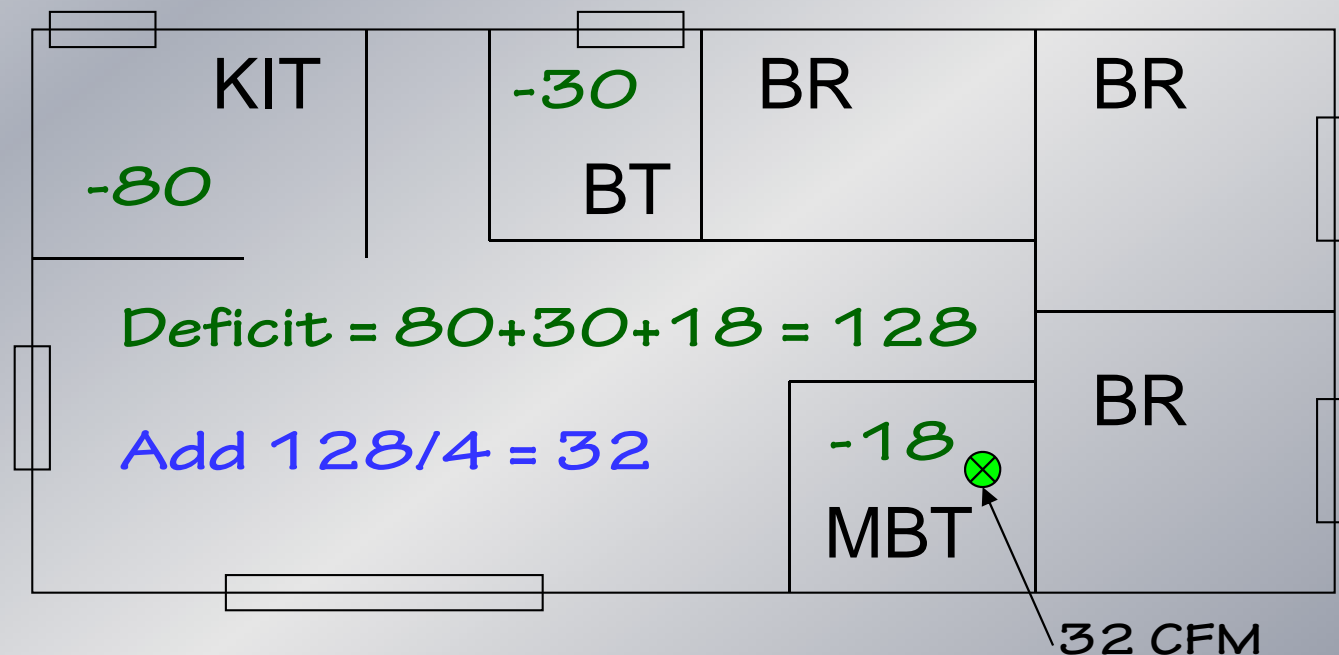


Whole-building requirement = $45 + 40 = 85$ CFM

Source: P. Francisco

Alternative Compliance Path

- Example #3: 3 BR, 1500 sq. ft. house

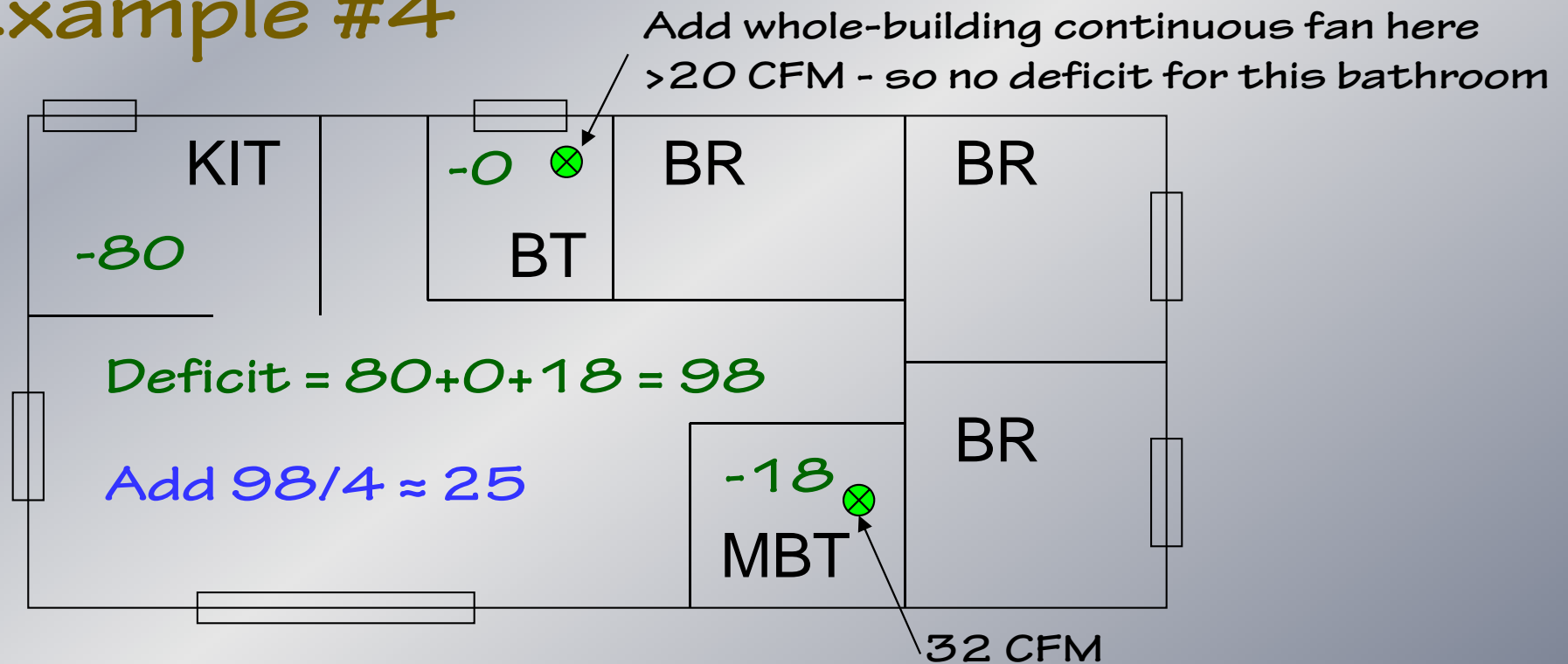


Whole-building requirement = $45 + 32 = 77$ CFM

Source: P. Francisco

Alternative Compliance Path

■ Example #4



Whole-building requirement = $45 + 25 = 70$ CFM

Source: P. Francisco

Infiltration Credit for Existing and New Dwellings

Infiltration Credit

- Infiltration credit calculation requires weather information.
 - 2013 version includes over 1000 weather locations for North America (TMY3 data).
 - 2010 version uses TMY2 weather data.

Do NOT use weather data from another version of standard!

Infiltration Credit

- Blower door test for 2013 standard infiltration credit must be multi-point, not single-point, unless the authority having jurisdiction allows single-point.

In practice, single-point testing is likely to be used. This is up to the program (authority having jurisdiction)

Whole-Building Ventilation Calculation 2013

Total Required Ventilation Rate, Q_{tot}
+ Alternative Compliance Supplement*
- Infiltration Credit, Q_{inf}^{**}
Required Mechanical Ventilation Rate, Q_{fan}

New Building Restrictions:

* May not be used for new buildings.

** May not be more than $2/3 \times Q_{tot}$ for new buildings.

Additional Selected Requirements of Standard 62.2

Carbon Monoxide Alarms

- “6.9 A Carbon Monoxide Alarms. A carbon monoxide alarm shall be installed in each dwelling unit in accordance with NFPA 720, *Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment*, and shall be consistent with requirements of applicable laws, codes, and standard.

Adjacent Spaces

- Must prevent migration of contaminants to the adjoining occupiable space.
 - All joints, seams, penetrations, and openings must be sealed or gasketed.
- Any ducts in the garage must leak less than 6% of total heating/cooling system air flow.
 - Example: 90 CFM of leakage for a 1500 CFM system.

Instructions and Labeling

- Provide to owner or occupant of dwelling unit:
 - Information on ventilation systems installed;
 - Instructions on proper operation; and
 - Instructions on proper maintenance.
- Controls shall be labeled as to their function.

Clothes Dryer Venting

- *Must be exhausted to the outdoors.*

Sound Ratings for Fans

- The sound ratings of installed ventilation equipment shall meet the requirements of the Standard.
 - 1 sone maximum for whole-building fans, continuous and intermittent.
 - 3 sone maximum occupant-controlled fans.
 - Existing fans in existing homes and remote fans (air handlers, in-line) are exempt.

62.2-2013
Calculations
with
RED Calc Free

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Residential Energy Dynamics

- Diagnostic tools for energy pros
 - Makes work easier, faster, more credible
- Used by
 - Energy auditors, designers, HVAC folks, private contractors, low-income program staff
- RED Calc Free requires internet connection; RED Calc Pro will not

ASHRAE 62.2-2010 Ventilation
Reset Print

New or existing construction

Use infiltration credit

Closest weather station

Weather factor [1/hr] = 0.87

Living area [] 2000
 Number of occupants
 Building height [] 16
 Measured leakage @ 50Pa [] 1800

Use Advanced Blower Door Inputs

Use Local Ventilation Alternative Compliance

Kitchen included # Baths included

	Existing Flow [<input type="text" value="CFM"/>]	Openable Window	Deficit [<input type="text" value="CFM"/>]
Kitchen	<input type="text" value="60"/>	<input checked="" type="checkbox"/>	20
Bath #1	<input type="text" value="27"/>	<input type="checkbox"/>	23

Total deficit [] = 43

Whole-Bldg Ventilation Results

N-factor₂₀₁₀ = 18.4
 Natural airflow [] = 98
 Total required ventilation rate [] = 50
 Alternative compliance supplement [] = 10.75
 Infiltration credit [] = 29
 Required mechanical ventilation rate [] = 32

Whole-Bldg Ventilation Run-Time Tool

Fan capacity []
 Fan run-time per hour [] = 24

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ASHRAE 62.2-2013 Ventilation
Reset Print

New or existing construction

Use infiltration credit

Closest weather station

Weather and shielding factor [1/hr] = 0.59

Living area [] 2000
 Number of occupants
 Building height [] 16
 Measured leakage @ 50Pa [] 1800

Use Advanced Blower Door Inputs

Use Local Ventilation Alternative Compliance

Kitchen included # Baths included

	Existing Flow [<input type="text" value="CFM"/>]	Openable Window	Deficit [<input type="text" value="CFM"/>]
Kitchen	<input type="text" value="60"/>	<input checked="" type="checkbox"/>	20
Bath #1	<input type="text" value="27"/>	<input type="checkbox"/>	23

Total deficit [] = 43

Whole-Bldg Ventilation Results

N-factor₂₀₁₃ = 24.8
 Effective annual avg infiltration rate [] = 73
 Total required ventilation rate [] = 90
 Alternative compliance supplement [] = 10.75
 Infiltration credit [] = 73
 Required mechanical ventilation rate [] = 28

Whole-Bldg Ventilation Run-Time Tool

Fan capacity []
 Fan run-time per hour [] = 21

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