Building Science
Airflow In Buildings II

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Lapse Rate
Figure 11.1: Building with no internal separations with opening at the bottom (Adapted from G.O. Handegord, 1998)
Figure 11.2: Building with no internal separations with opening at the top (Adapted from G.O. Handegord, 1998)
Figure 11.3: Building with no internal separations with openings at top and bottom (Adapted from G.O. Handegord, 1998)
Figure 11.4: Basic two storey house with vented attic
(Adapted from G.O. Handegord, 1998)
Figure 11.6: Two storey house with operating chimney
(Adapted from G.O. Handegord, 1998)
Stack effect
Wind
Figure 11.8: Stack effect pressures in high rise office building
(Adapted from G.O. Handegord, 1998)
Figure 11.9: Multi-storey building with floor spaces isolated from vertical shafts.
(Adapted from G.O. Handegord, 1998)
Figure 11.12: Apartment building with tighter apartment entry doors
(Adapted from G.O. Handegord, 1998)
Air Barrier Metrics

Material 0.02 l/(s-m²)@75 Pa
Assembly 0.20 l/(s-m²)@75 Pa
Enclosure 2.00 l/(s-m²)@75 Pa
Seal around rough openings of windows and doors.

Seal along top plates on exterior walls.

Seal drywall to first stud in the wall (see Figure 16.7).

Seal along bottom plate on exterior walls.

Partitions: seal at top plate where adjacent to an unconditioned space (see Figure 16.8).

Seal along inside of bottom of first stud in interior wall (see Figure 16.7) or, hold back first stud to pass drywall behind stud (see Figure 16.8).
ELA \approx C \times \frac{\text{Rate of flow}}{\sqrt{\text{Pressure difference}}}

(Meters)^2 \approx \frac{1}{780} \times \frac{\text{Litres per second}}{\sqrt{\text{Pascals}}}

Building Science
ELA = \frac{1}{780} \times \frac{\text{Flow rate}}{\sqrt{\text{Pressure difference}}}

ELA = 0.278 \text{ m}^2
### Table 1: Normalized Leakage Areas

<table>
<thead>
<tr>
<th>Building Area</th>
<th>Surface Area (sf)</th>
<th>CFM50 (cfm)</th>
<th>Normalized leakage at 75 Pa (liters/second/m^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stairwell</td>
<td>4824</td>
<td>2483</td>
<td>3.4</td>
</tr>
<tr>
<td>Corridor 2</td>
<td>9490</td>
<td>5202</td>
<td>3.6</td>
</tr>
<tr>
<td>Corridor 3</td>
<td>9490</td>
<td>6783</td>
<td>4.7</td>
</tr>
<tr>
<td>Corridor 5</td>
<td>9490</td>
<td>6783</td>
<td>4.7</td>
</tr>
<tr>
<td>Unit 201</td>
<td>3283</td>
<td>1005</td>
<td>2.0</td>
</tr>
<tr>
<td>Unit 205</td>
<td>3118</td>
<td>894</td>
<td>1.9</td>
</tr>
<tr>
<td>Unit 208</td>
<td>4029</td>
<td>1267</td>
<td>2.1</td>
</tr>
<tr>
<td>Unit 309</td>
<td>4250</td>
<td>1263</td>
<td>2.0</td>
</tr>
<tr>
<td>Unit 313</td>
<td>4029</td>
<td>1264</td>
<td>2.1</td>
</tr>
<tr>
<td>Unit 503</td>
<td>4027</td>
<td>1405</td>
<td>2.3</td>
</tr>
<tr>
<td>Unit 506</td>
<td>4027</td>
<td>1340</td>
<td>2.2</td>
</tr>
<tr>
<td>Elevator shaft</td>
<td>2693</td>
<td>5671*</td>
<td>13.9</td>
</tr>
</tbody>
</table>

*This value was extrapolated from 2 Pa to 50 Pa using an assumed value of n=0.65. This extreme of extrapolation is subject to significant error.
SECOND THROUGH SIXTH FLOOR PLAN
ASHRAE Standard 62.2 calls for 7.5 cfm per person plus 0.01 cfm per square foot of conditioned area

Occupancy is deemed to be the number of bedrooms plus one

Occupant Rate + Building Rate
Return air → Supply air

Kitchen → Bath

Outside air → Exhaust air

Dryer air
Distributed Ventilation

- Individual unit exhaust ventilation fan exhausts (during occupancy) from each bedroom, bathroom, and kitchen
- Operation of system is time of occupancy sensitive — on only when occupied
Grille located high in wall on bedroom side to avoid blockage by furniture.

Cavity is sealed tight, drywall glued to studs and plates on both sides.

Grille located low in wall on hallway side.
Motorized damper — typically closed (connected to fire control system)

Smoke and hot gas vent
($3^{1/2}$% of shaft or 3 ft$^2$
per elevator car)

Constant airflow regulator

Exhaust from elevator shaft
Double Facade
aka “Facadists”
Note the difference - “viva la difference”

Single façade with exterior shade - good
Double façade - bad
UFA…aka “Underfloor Air Plenums” - or other dumb things I did before I became an adult....