Life Is Tough Enough As It Is...
Life Is Tough Enough As It Is…
It’s Harder When You Are Stupid…
Life Is Tough Enough As It Is…
It’s Harder When You Are Stupid…
Don’t Do Stupid Things…
What is a Building?
A Building is an Environmental Separator
• Control heat flow
• Control airflow
• Control water vapor flow
• Control rain
• Control ground water
• Control light and solar radiation
• Control noise and vibrations
• Control contaminants, environmental hazards and odors
• Control insects, rodents and vermin
• Control fire
• Provide strength and rigidity
• Be durable
• Be aesthetically pleasing
• Be economical
Arrhenius Equation
For Every 10 Degree K Rise
Reaction Rate Doubles

\[ k = A e^{-E_a/(RT)} \]
Damage Functions
Water
Heat
Ultra-violet Radiation
2\textsuperscript{nd} Law of Thermodynamics
Heat Flow Is From Warm To Cold
Moisture Flow Is From Warm To Cold
Moisture Flow Is From More To Less
Air Flow Is From A Higher Pressure to a Lower Pressure
Gravity Acts Down
Thermodynamic Potential
Water Control Layer
Air Control Layer
Vapor Control Layer
Thermal Control Layer
Cladding
Control layers
Structure
Ballast
Filter fabric
Control layers
Roof structure
Slab
Control layers
Stones
Earth
Attic

Roof

Wall

Slab
Configurations of the Perfect Wall
Brick veneer/stone veneer

Drained cavity

Exterior rigid insulation — extruded polystyrene, expanded polystyrene, isocyanurate, rock wool, fiberglass

Membrane or trowel-on or spray applied drainage plane, air barrier and vapor retarder

Concrete block

Metal channel or wood furring

Gypsum board

Latex paint or vapor semi-permeable textured wall finish

Vapor Profile
Brick veneer/stone veneer

Drained cavity

Exterior rigid insulation — extruded polystyrene, expanded polystyrene, isocyanurate, rock wool, fiberglass

Membrane or trowel-on or spray applied drainage plane, air barrier and vapor retarder

Non paper-faced exterior gypsum sheathing, plywood or oriented strand board (OSB)

Uninsulated steel stud cavity

Gypsum board

Latex paint or vapor semi-permeable textured wall finish

Vapor Profile
Brick veneer/stone veneer
Drained cavity
Exterior rigid insulation — extruded polystyrene, expanded polystyrene, isocyanurate, rock wool, fiberglass
Membrane or trowel-on or spray applied drainage plane, air barrier and vapor retarder
Non paper-faced exterior gypsum sheathing, plywood or oriented strand board (OSB)
Insulated wood stud cavity
Gypsum board
Latex paint or vapor semi-permeable textured wall finish

Vapor Profile
Building Science Corporation

Joseph Lstiburek

Figure 2a

Vapor Profile
Figure 2b

Vapor Profile

Brick veneer/stone veneer
Drained and vented cavity
Thermal control layer - exterior rigid insulation - rock wool or fiberglass
Membrane or trowel-on or spray applied or liquid applied water control layer and air control layer
Non paper-faced exterior gypsum sheathing, plywood or oriented strand board (OSB)
Uninsulated steel stud cavity
Gypsum board
Latex paint or vapor semi-permeable textured wall finish
Figure 2c

Vapor Profile

- Brick veneer/stone veneer
- Drained and vented cavity
- Thermal control layer - exterior rigid insulation - rock wool or fiberglass
- Membrane or trowel-on or spray applied or liquid applied water control layer and air control layer
- Non paper-faced exterior gypsum sheathing, plywood or oriented strand board (OSB)
- Insulated wood stud cavity
- Gypsum board
- Latex paint or vapor semi-permeable textured wall finish
Commercial Enclosure: Simple Layers

- Structure
- Rain/Air/Vapor
- Insulation
- Finish
Building Science Corporation

Joseph Lstiburek – Rain Control 92

Diagram showing a piece of flashing with labels:
- Upturned leg
- Base sloped to exterior
- Drip edge

The diagram includes arrows indicating the direction of water flow, labeled "DOWN" and "OUT".
<table>
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<th>Pascals</th>
<th>mph</th>
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<tbody>
<tr>
<td>50 Pa</td>
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<tr>
<td>500 Pa</td>
<td>65 mph</td>
</tr>
<tr>
<td>1,000 Pa</td>
<td>90 mph</td>
</tr>
</tbody>
</table>
Plywood/OSB sheathing

Water control layer

$\frac{3}{8}''$ spacer strip
Rain Screen
Beer Screen?
Rain enters cup due to momentum ("kinetic energy")

Cup drains water to exterior
Rain enters cup due to momentum ("kinetic energy")

Wind enters cup—pressurizing cup; no rain entry due to wind driven rain

Cup can still drain water to exterior

Entire wind pressure taken here
Baffle to deflect raindrops hitting face of cup due to momentum ("kinetic energy")

Pressure in cup is same as pressure outside on face of baffle

Momentum driving force converted to gravity—water drains away

Wind enters cup—pressurizing cup; no rain entry due to wind driven rain

Cup can still drain water to exterior

Entire wind pressure taken here
Insulating glass unit

Seal (gasket)

Setting block (typically two per unit)

Hole providing drainage and pressurization

Frame

Rough opening
Outer seal sees water but not pressure; no pressure difference across this seal, therefore no rain entry.

Pressure in chamber is same as pressure outside on face of assembly.

Air enters and pressurizes chamber.

Key seal is interior seal as it takes maximum wind load but it does not see water.

Entire wind pressure taken here.

Pressure chamber.
Intent of sealant is to limit this lateral flow of water between sheathing and building wrap.