Building Science

Adventures In Building Science
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
Activation Energy Doubles

\[ k = Ae^{-E_a/(RT)} \]
Damage Functions
Water
Heat
Ultra-violet Radiation
2nd Law of Thermodynamics
In an isolated system, a process can occur only if it increases the total entropy of the system

Rudolf Clausius
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
The Three Biggest Problems In Buildings Are Water, Water and Water…
Cladding
Control layers
Structure
Ballast
Filter fabric
Control layers
Roof structure
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)
Insulated wood stud cavity
Gypsum board
Latex paint or vapor semi-permeable textured wall finish

Vapor Profile
Commercial Enclosure: Simple Layers

- Structure
- Rain/Air/Vapor
- Insulation
- Finish
HARVARD SCHOOL OF PUBLIC HEALTH
Stucco

Bond Break
Drainage Matt

Slab
Sealant
Vapor

Liquid
Pascals  mph
50  Pa = 20  mph
100  Pa = 30  mph
150  Pa = 35  mph
250  Pa = 45  mph
500  Pa = 65  mph
1,000  Pa = 90  mph
All We Have To Figure Out Is How Much Hits The Wall
Rain Screen
Beer Screen?