A Building is an Environmental Separator

What is a Building?

- 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
Zeroth Law – A=B and B=C therefore A=C  
First Law - Conservation of Energy  
Second Law - Entropy  
Third Law – Absolute Zero

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
Moisture Flow Is From Warm To Cold
Moisture Flow Is From More To Less

Thermal Gradient – Thermal Diffusion
Concentration Gradient – Molecular Diffusion

Vapor Diffusion

Thermodynamic Potential
Damage Functions

Water
Heat
Ultra Violet Radiation

Oxidization (Ozone)
Fatigue (Creep)
The Three Biggest Problems In Buildings Are Water, Water and Water…

80 Percent of all Construction Problems are Related to Water

Heat
Air
Moisture

HAM
Hygrothermal Analysis

Water Control Layer
Air Control Layer
Vapor Control Layer
Thermal Control Layer
Commercial Enclosure: Simple Layers

- Structure
- Rain/Air/Vapor
- Insulation
- Finish
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

Entire wind pressure taken here

Cup can still drain water to exterior
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

Rough opening

Frame

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

Pressure moderated chamber

Interior air seal

Adhesive-backed sill flashing

Housewrap

Sheathing

Beveled wood siding
Rain Screen

Beer Screen?
Rockwool

1x3 furring @ 24" o.c.
#10 screws @ 16" o.c. vertically
Result: 20 psf cladding weight
with < 2/100" deflection