**Heat Loss: Building materials**

- solid surfaces,
- wall sections of wall assemblies,
- Joints and cold bridges,
- moisture and construction

**Human Comfort - ‘Material comfort’**

- Durability
- Maintenance
- Leaks to humidity / air can lead to Mould / Rotting
- Concept / ‘Look’ / Aesthetic

-> Thermal resistance - vapor resistance
->>>> Umbrella versus Rain Coat!
Construction techniques and thermal properties

Monolithic versus multi layered
Plaster finished masonry versus Visible masonry
BUT TODAY MOST
Construction techniques involve multi layered construction

Wall assembly, dew point, wind protection

Basic Wall construction with
R-factor 21.5
outside air film 00.17
4” brick 00.80
1/2” plywood 00.62
51/2” batt insulation 19.00
1/2” studwood
1/2” drywall 00.32
Inside air film 00.68

A fairly well insulated wall considering energy efficiency starts with 25 / 30 and can go far higher. (LEED etc)

DRAW thermal gradient to demonstrate Dew Point in insulation and introduce vapor barrier and also wind paper
Moisture!
How can a structure be water tight breathable and?

- Position of the insulation
- Protection of construction
- ->Structural temperature should NOT fall below Dew Point - no condensation or

- Vapor Barrier

- Ventilated Façade and roofs
Improve the construction

Basic Wall construction with
R-factor 21.5

<table>
<thead>
<tr>
<th>Component</th>
<th>R-value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside air film</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>4” brick</td>
<td>0.80</td>
<td>outside ‘aesthetic / rain</td>
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<tr>
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<td>structural</td>
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<tr>
<td>Vapor retarder</td>
<td>irrelevant</td>
<td></td>
</tr>
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CHANGE INSULATION : CONSEQUENCES for the Construction

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Question in Class

- Develop an equivalent heavyweight construction with concrete, masonry or alternative construction

- Source: Stein book: tables E.
In class example: Roof

• Wood Shingles, plain and plastic film faced
• 3/4” Building board. Plywood sheathing (Douglas Fir)
• 11 1/4” Mineral fiber (batt insulation)
  – 2.0lbs/cuft/R=38
• 6mi polyethylene vapor barrier (no R value)
• 5/8” Gypsum plaster light weight aggregate

Class room example

• Give R-values and building geometry

• Give a roof composition

• Compare solid and composite construction
Minimum standards relative to climate data in the U.S.
Principles for building envelopes moisture control
Vent or heat or dehumidify
Inbetween Spaces