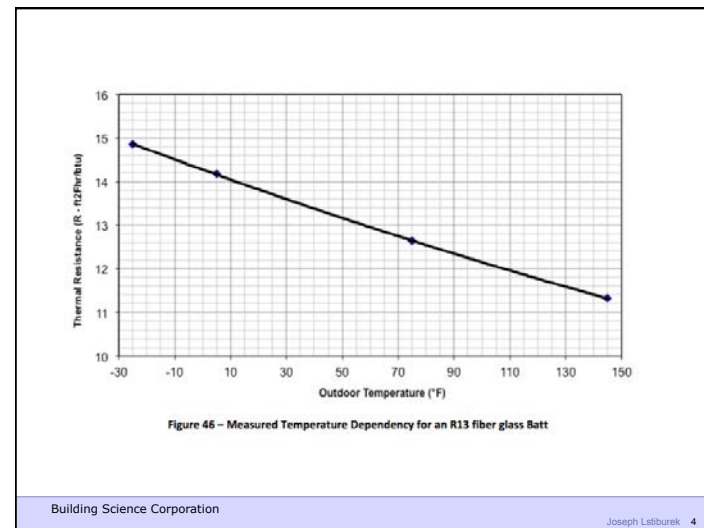


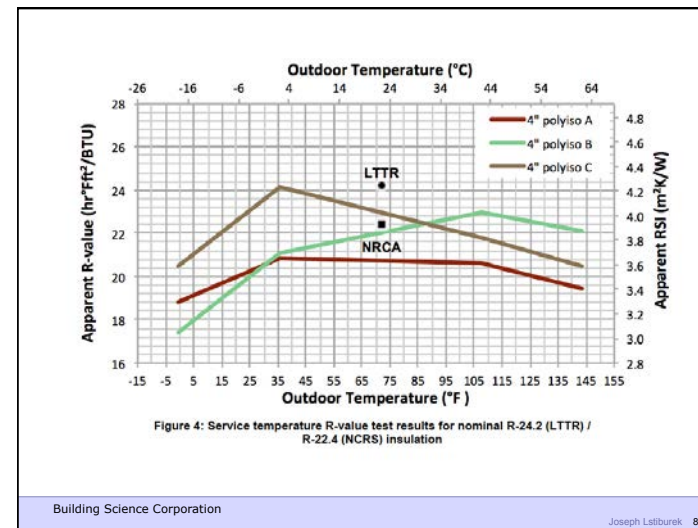
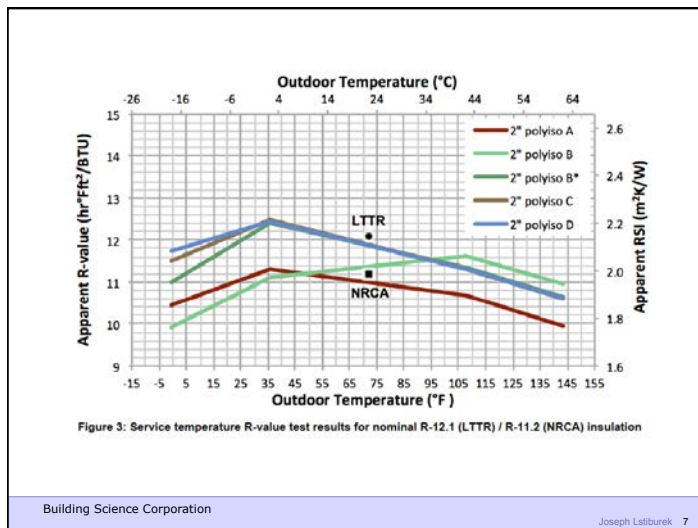
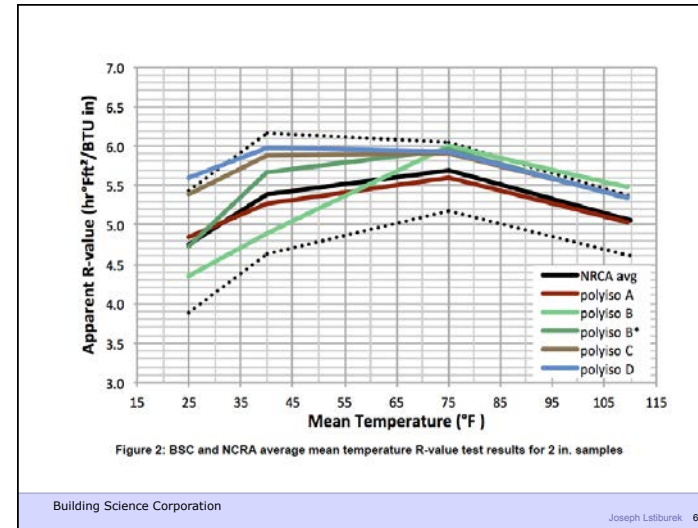
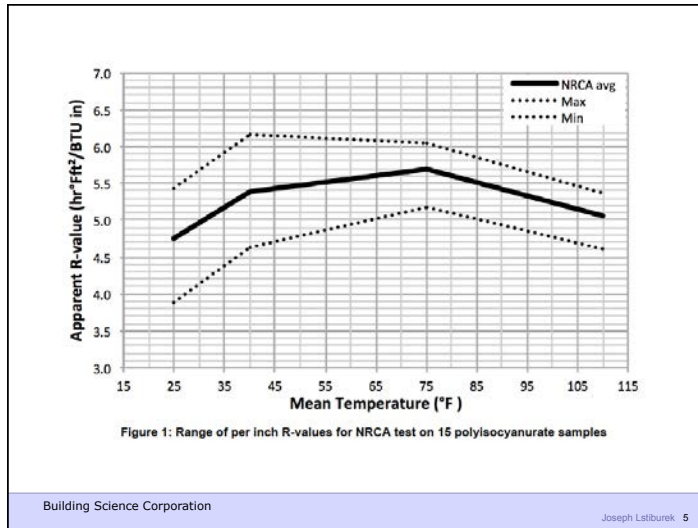
Joseph Lstiburek, Ph.D., P.Eng, ASHRAE Fellow

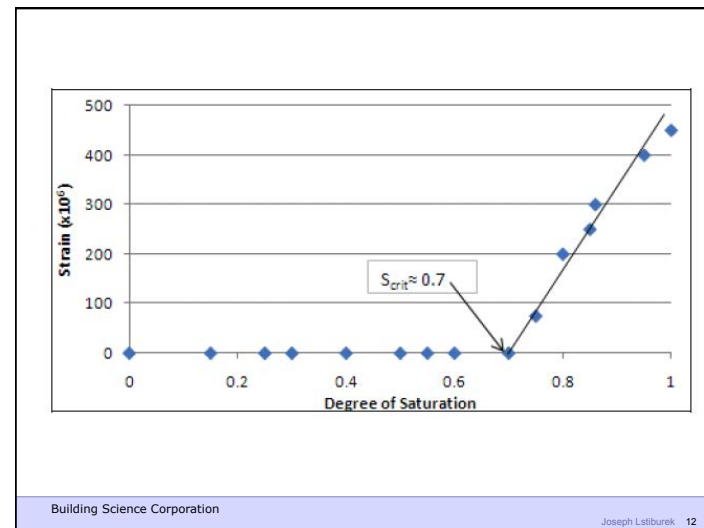
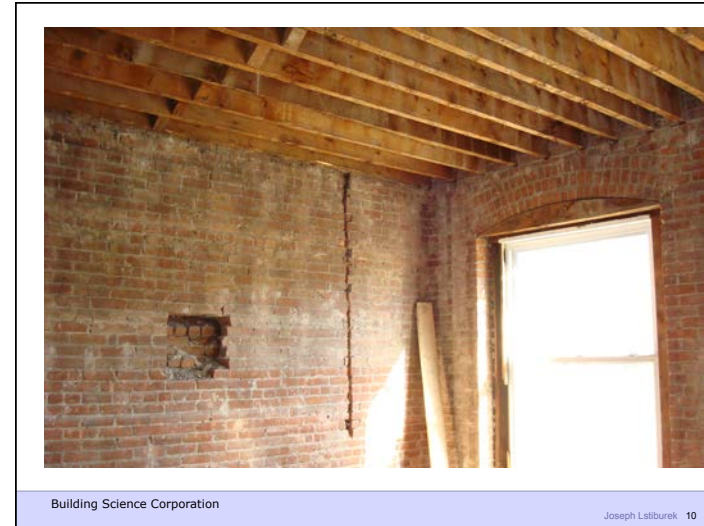
# Building Science

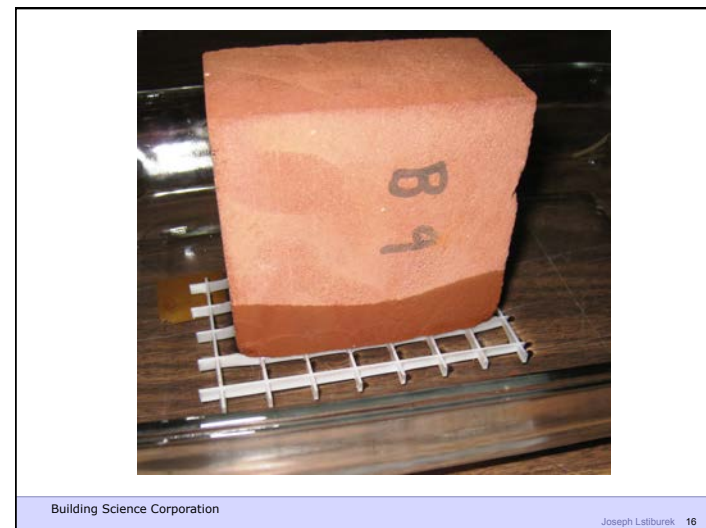
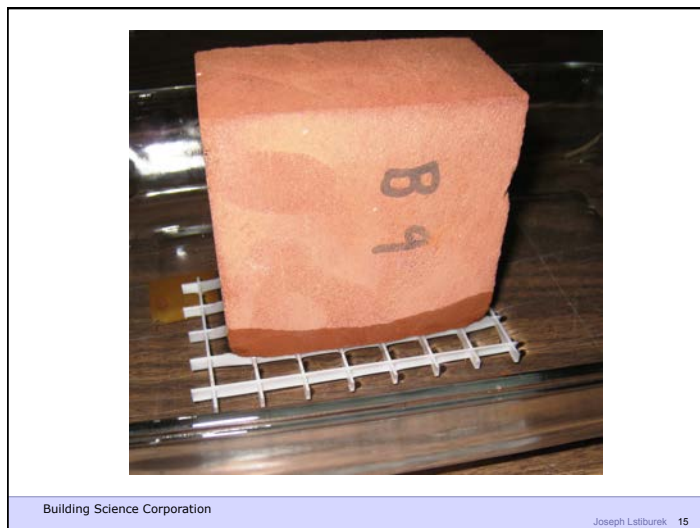
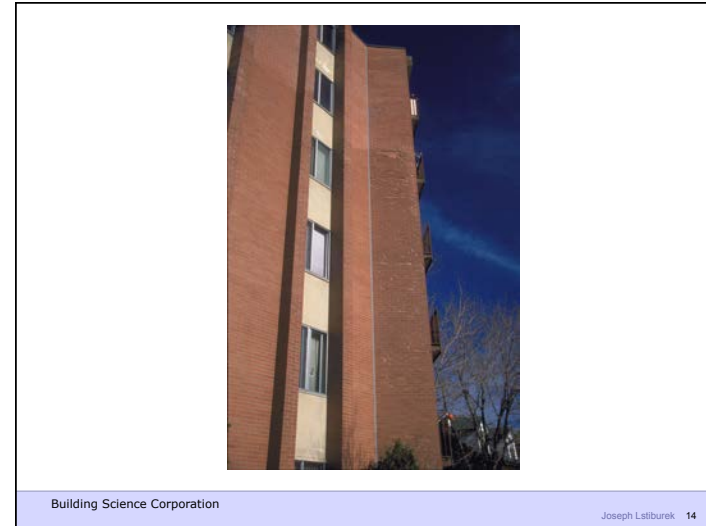
## R-Values of Materials Mass Assemblies

presented by [www.buildingscience.com](http://www.buildingscience.com)

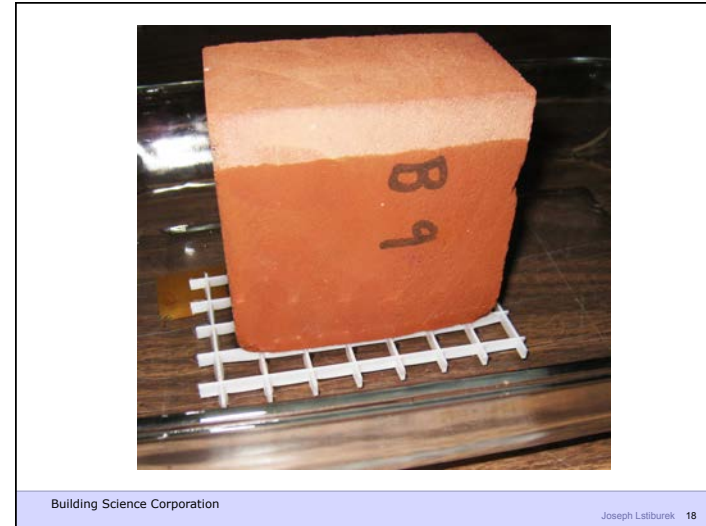
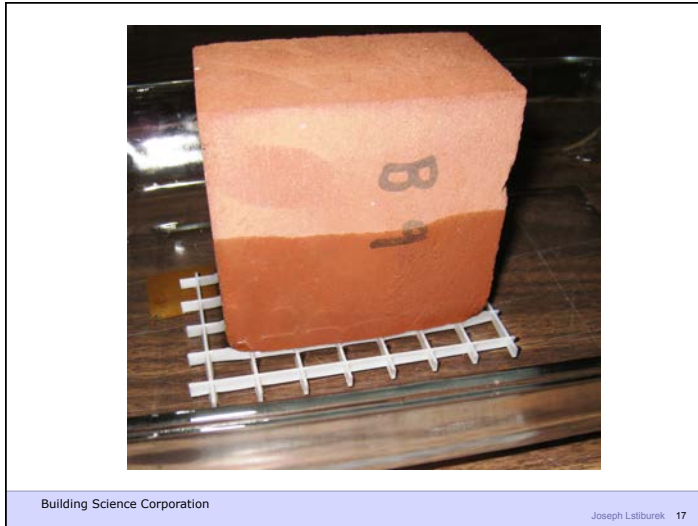


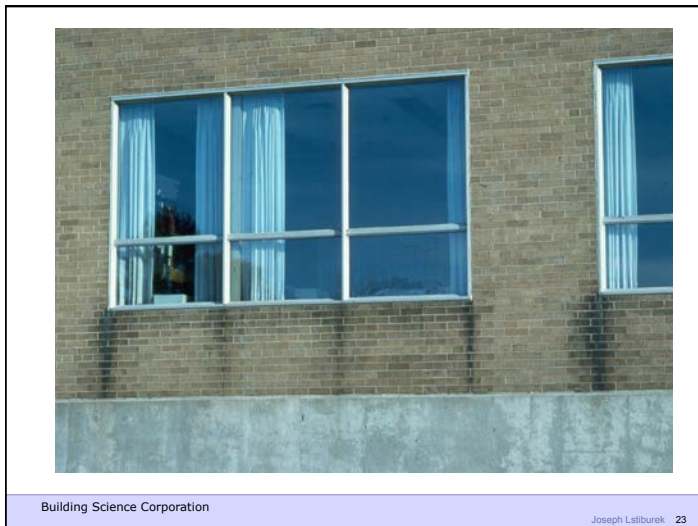
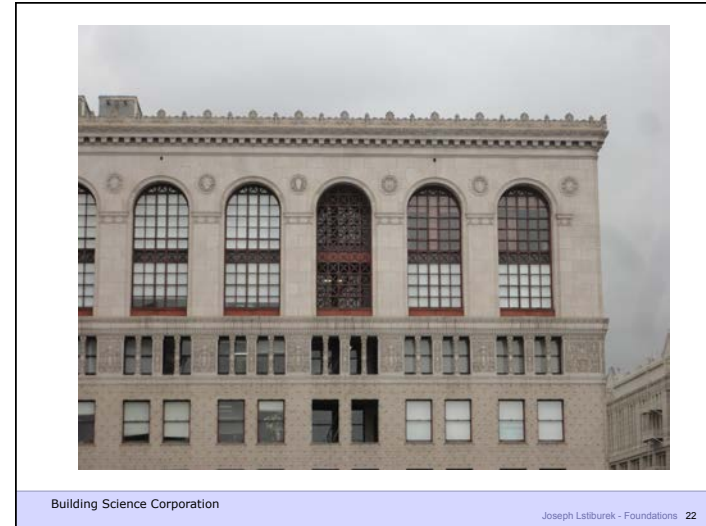
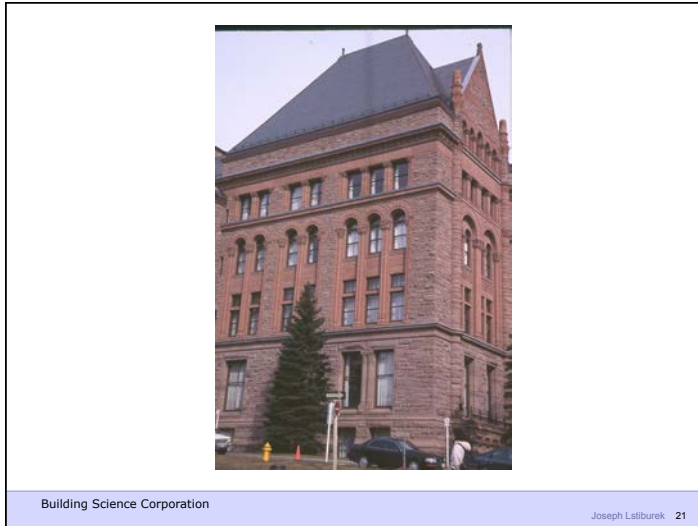


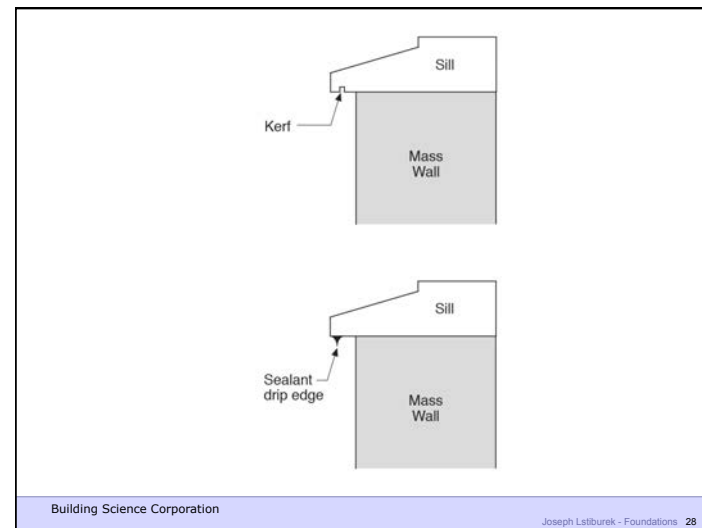


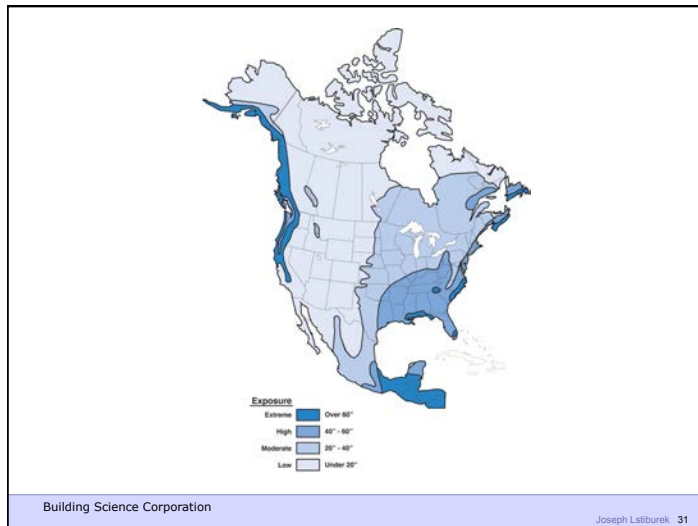
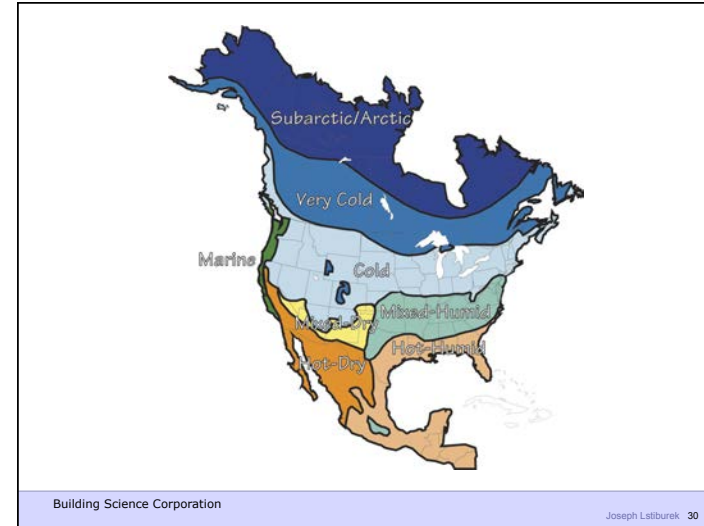












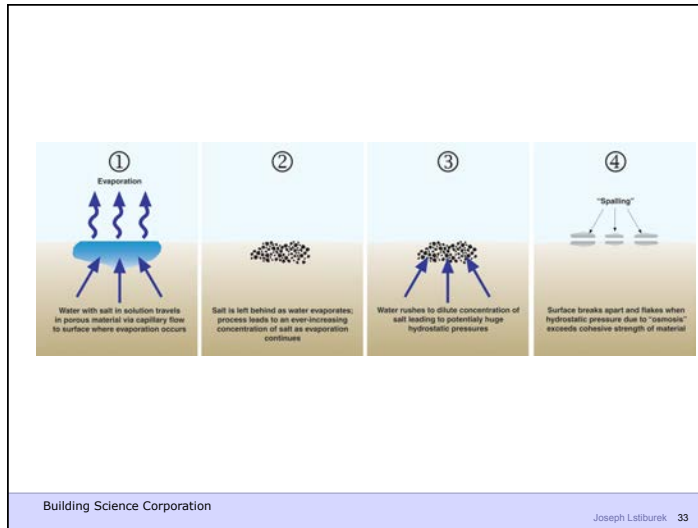
### Capillarity + Salt = Osmosis

- Mineral salts carried in solution by capillary water
- When water evaporates from a surface the salts left behind form crystals in process called efflorescence
- When water evaporated beneath a surface the salts crystallize within the pore structure of the material in called sub-efflorescence
- The salt crystallization causes expansive forces that can exceed the cohesive strength of the material leading to spalling

Building Science Corporation

Joseph Lstiburek 32





### Diffusion + Capillarity + Osmosis = Problem

- Diffusion Vapor Pressure 3 to 5 psi
- Capillary Pressure 300 to 500 psi
- Osmosis Pressure 3,000 to 5,000 psi

Building Science Corporation Joseph Lstiburek 34

