

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

Building Science

Adventures In Building Science

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What is a Building?

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Joseph Lstiburek 2

A Building is an Environmental Separator

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Joseph Lstiburek 3

2nd Law of Thermodynamics

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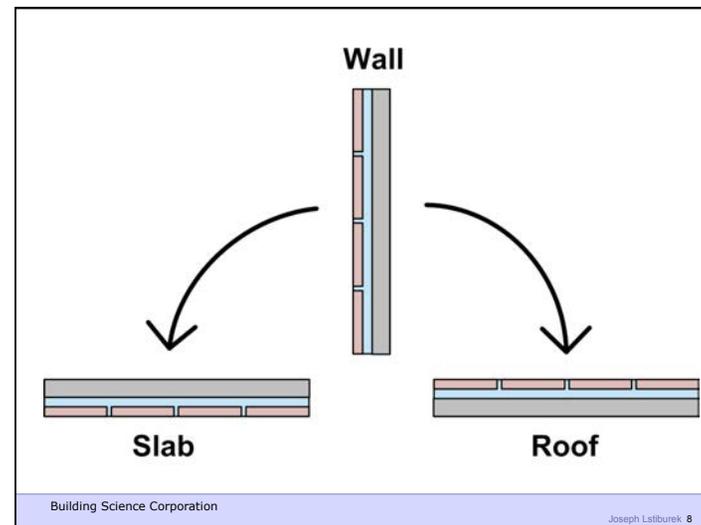
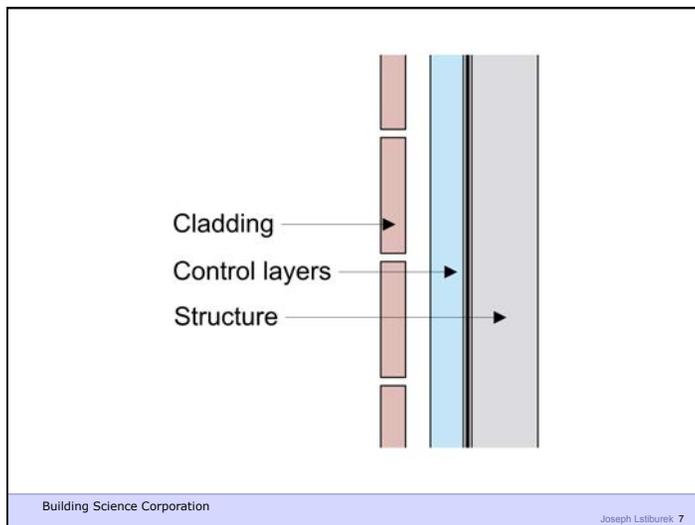
Joseph Lstiburek 4

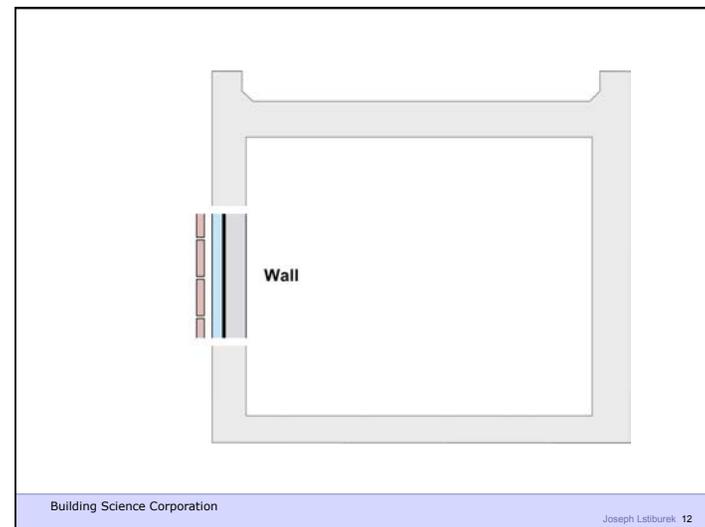
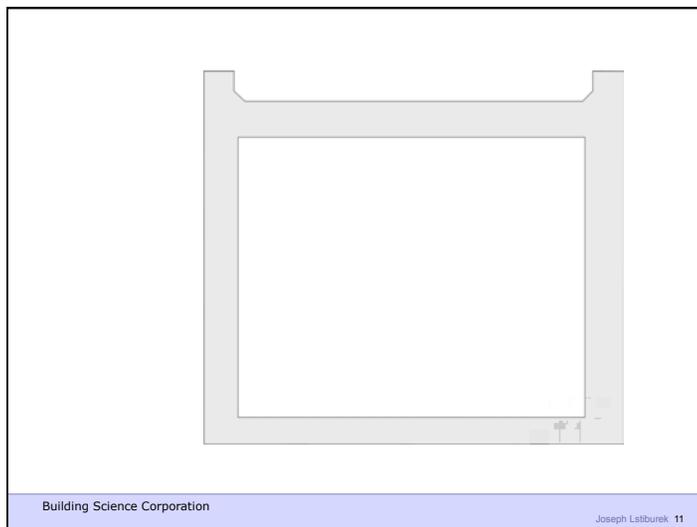
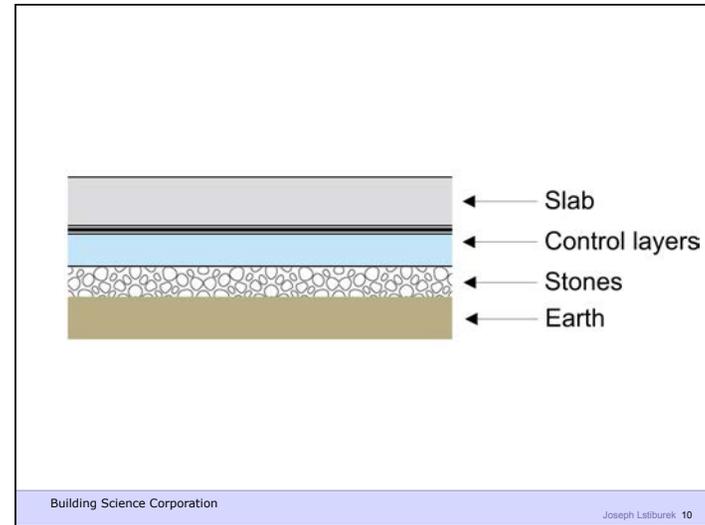
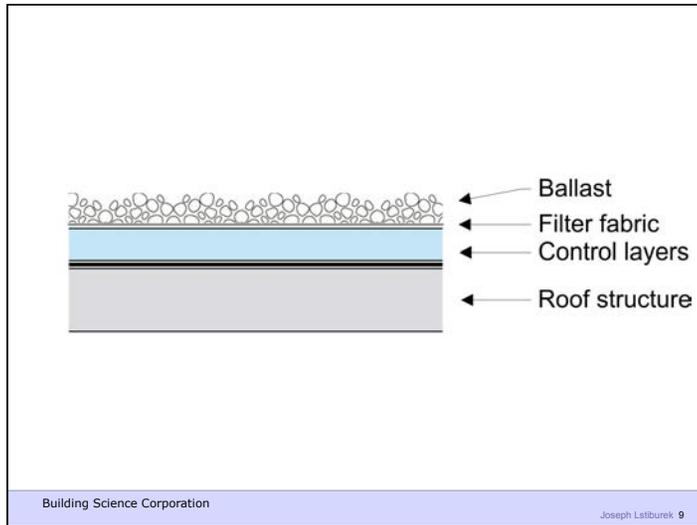
Heat Flow Is From Warm To Cold
 Moisture Flow Is From Warm To Cold
 Moisture Flow Is From More To Less
 Air Flow Is From A Higher Pressure to a Lower Pressure
 Gravity Acts Down

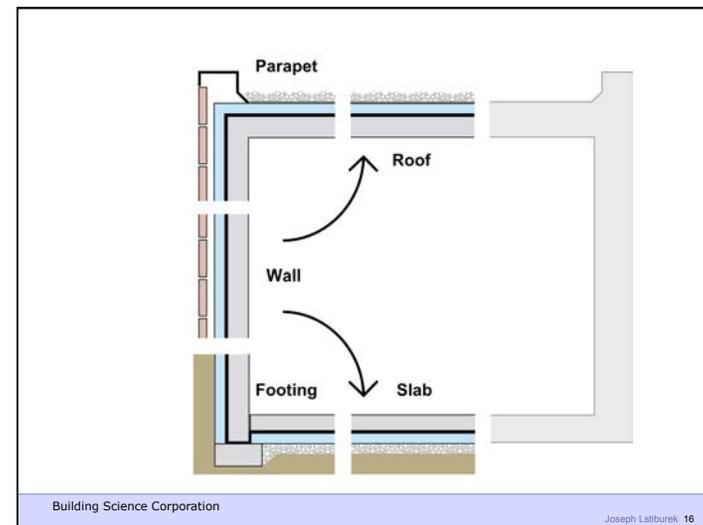
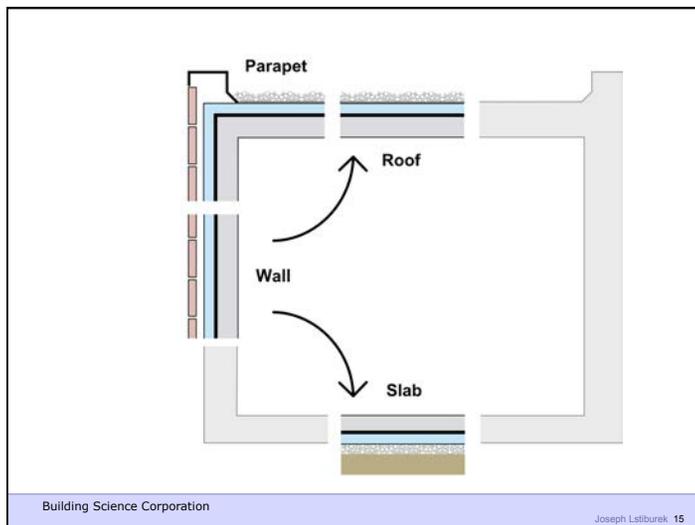
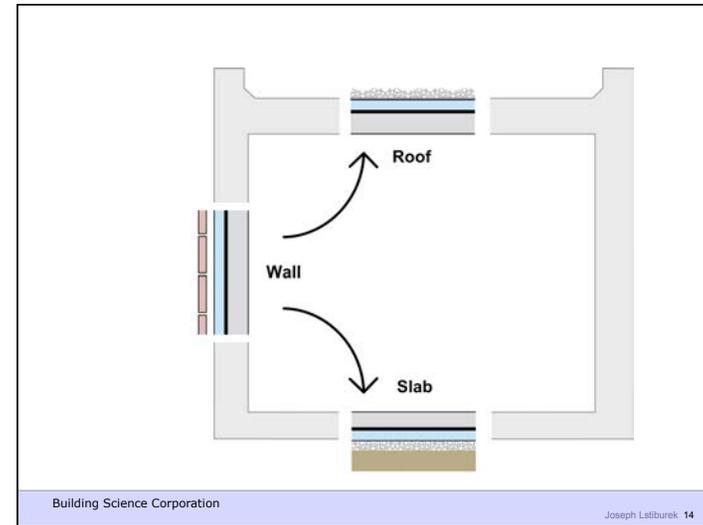
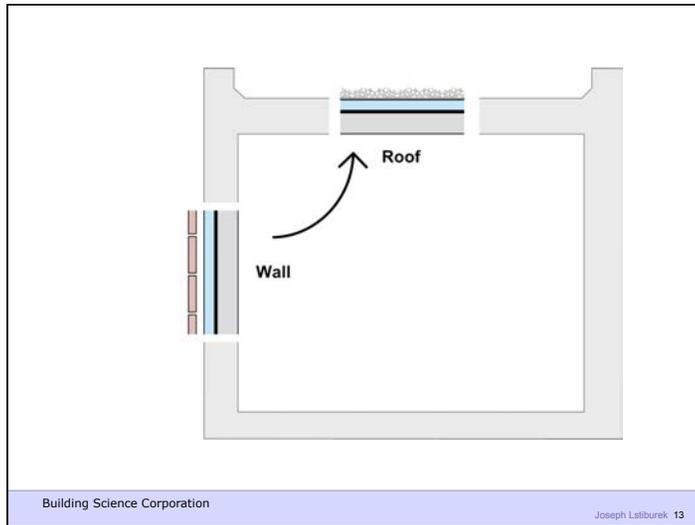
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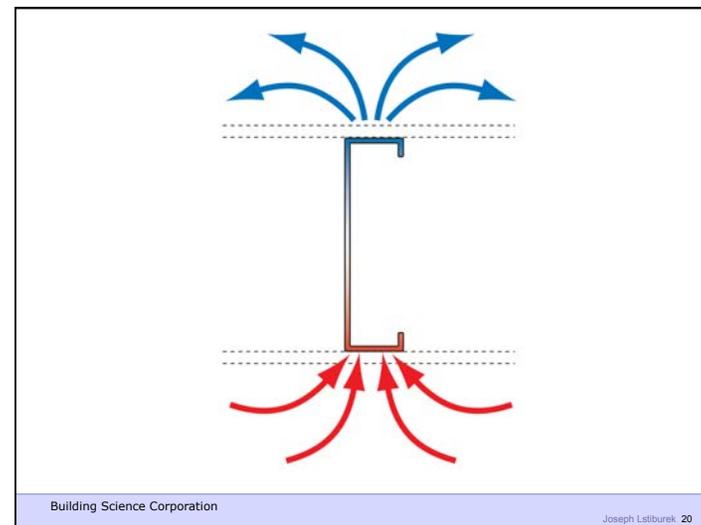
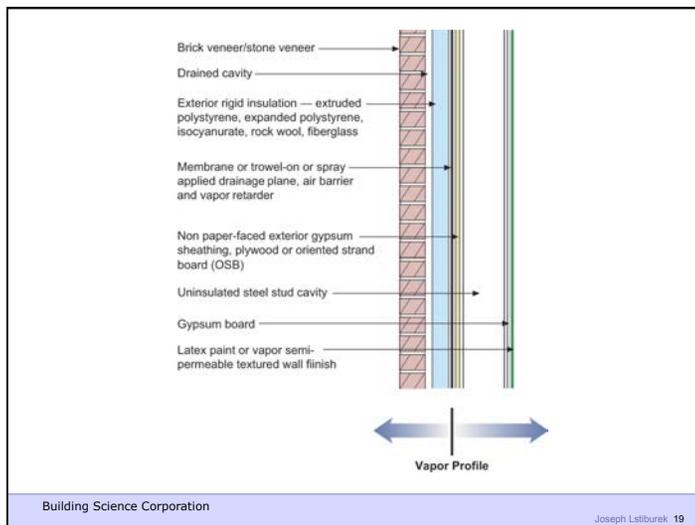
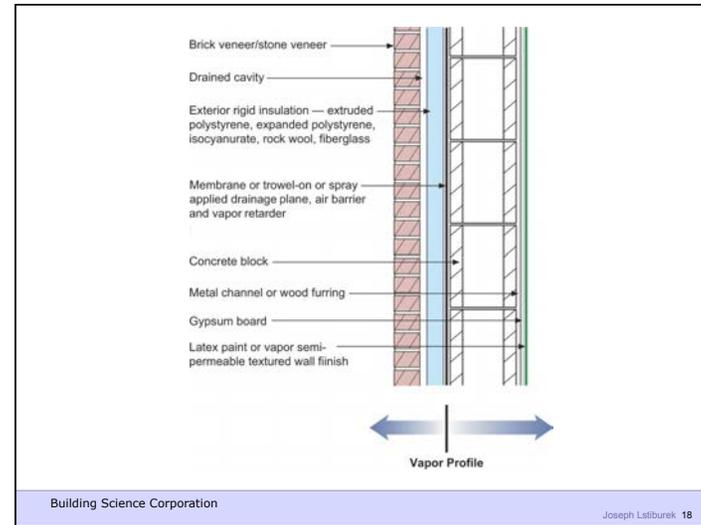
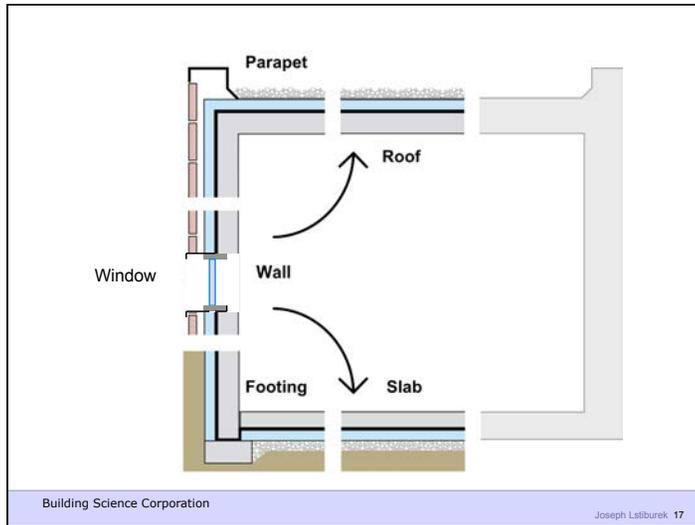
Water Control Layer
 Air Control Layer
 Vapor Control Layer
 Thermal Control Layer

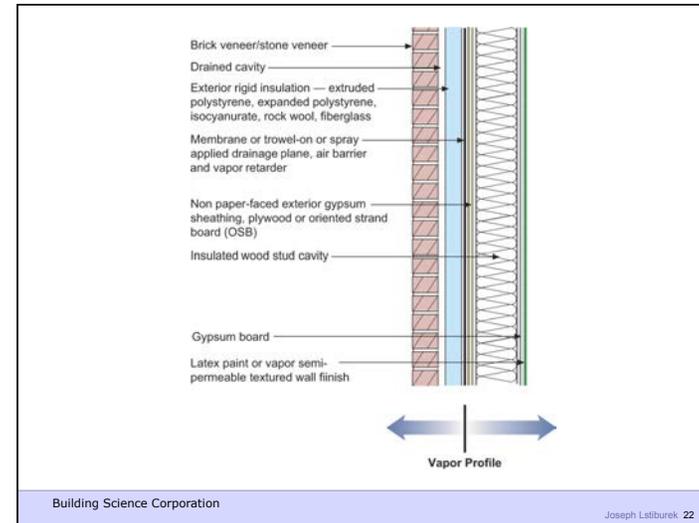
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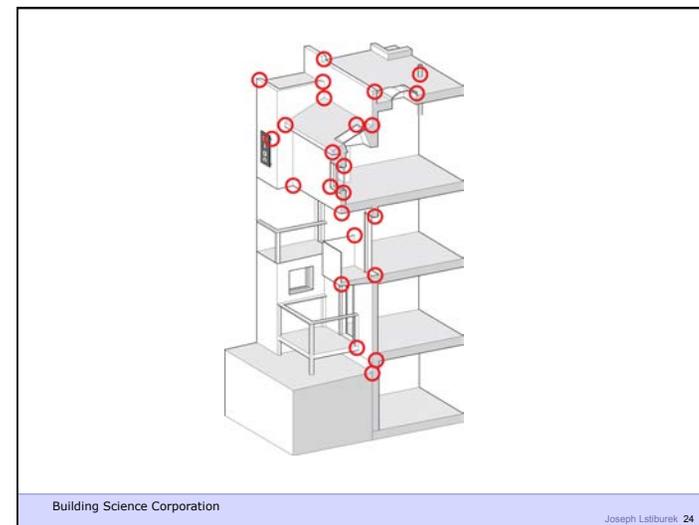


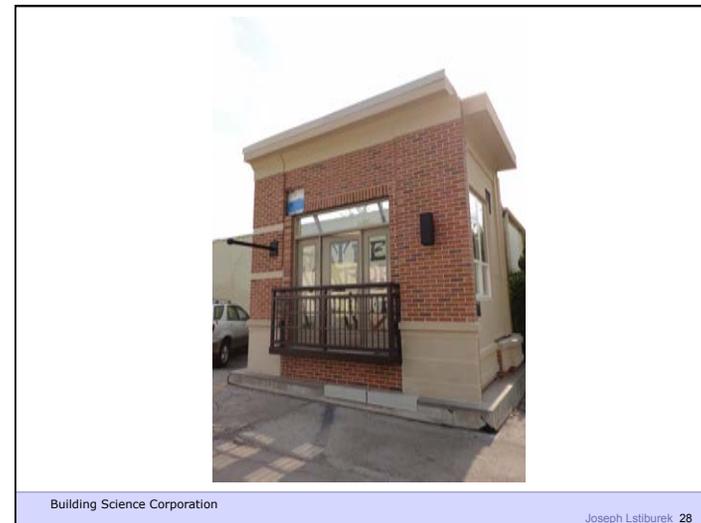
Commercial Enclosure: Simple Layers

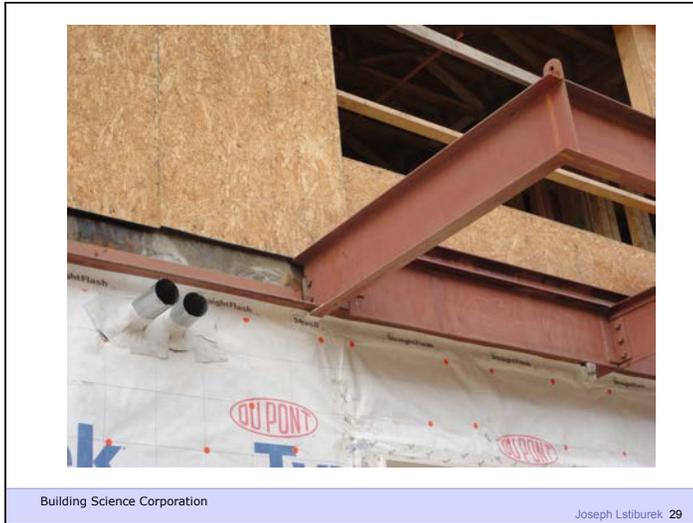
- Structure
- Rain/Air/Vapor
- Insulation
- Finish

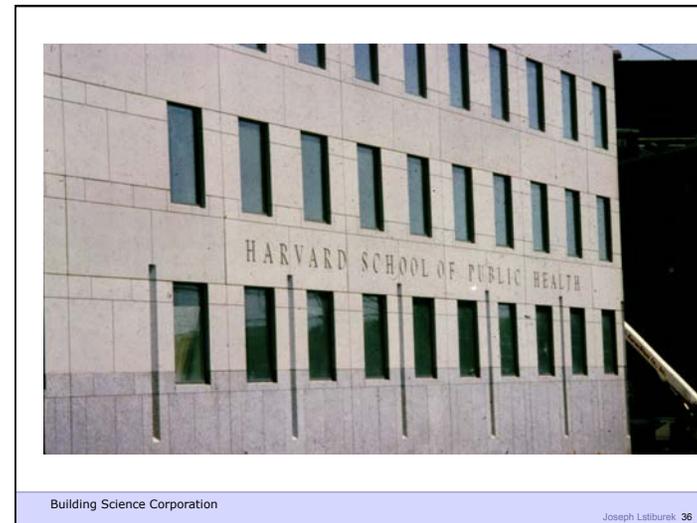
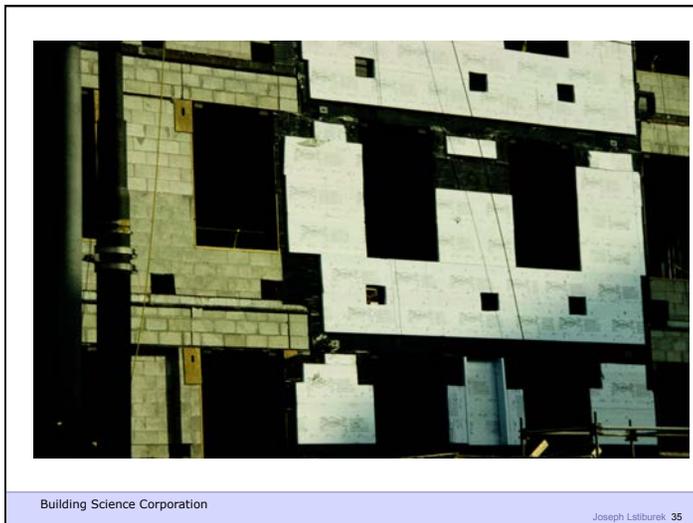
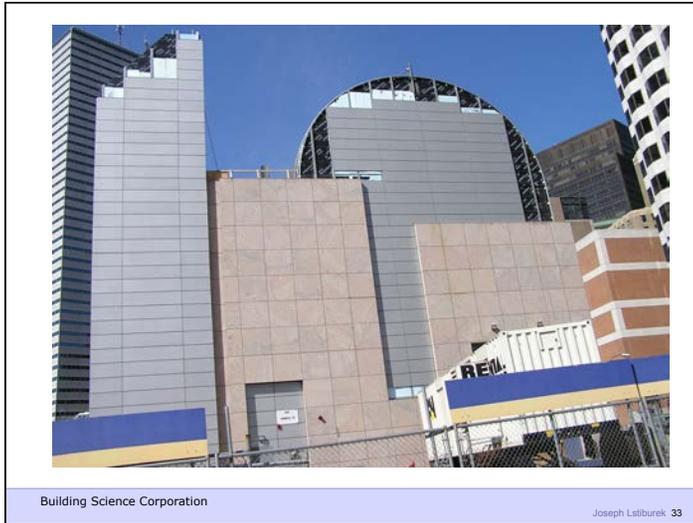
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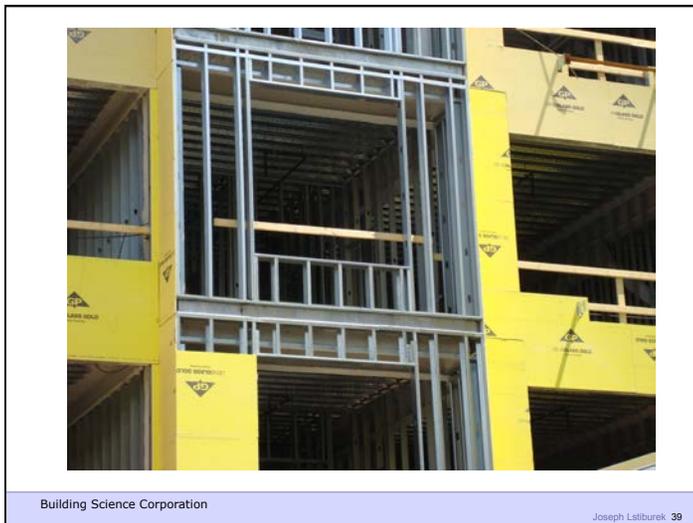
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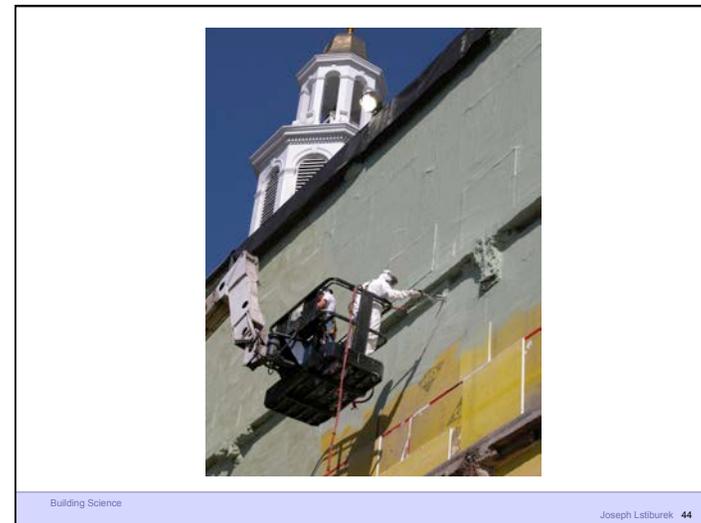
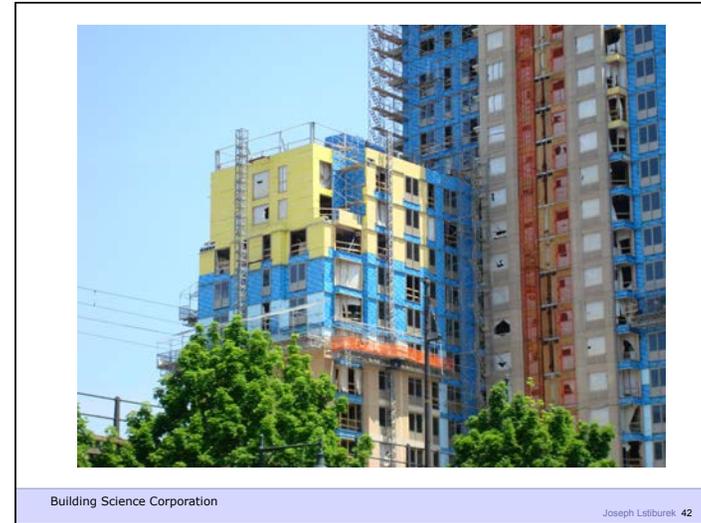




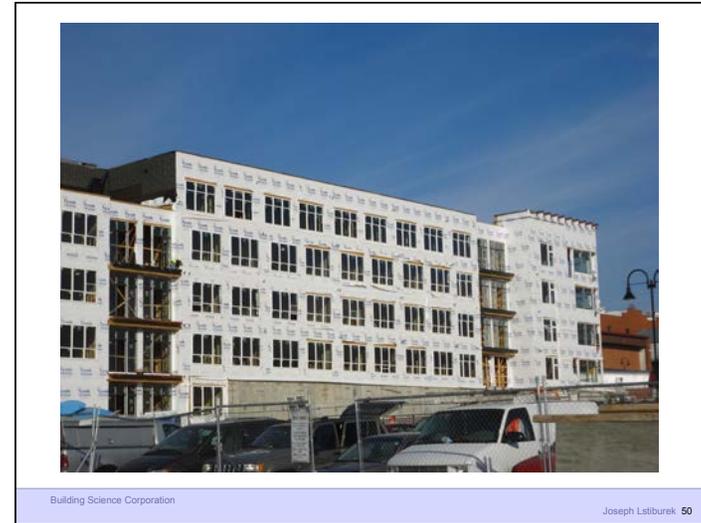


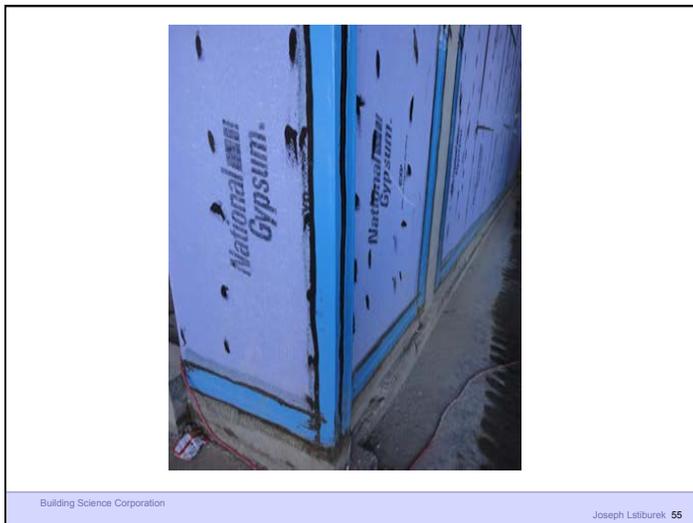




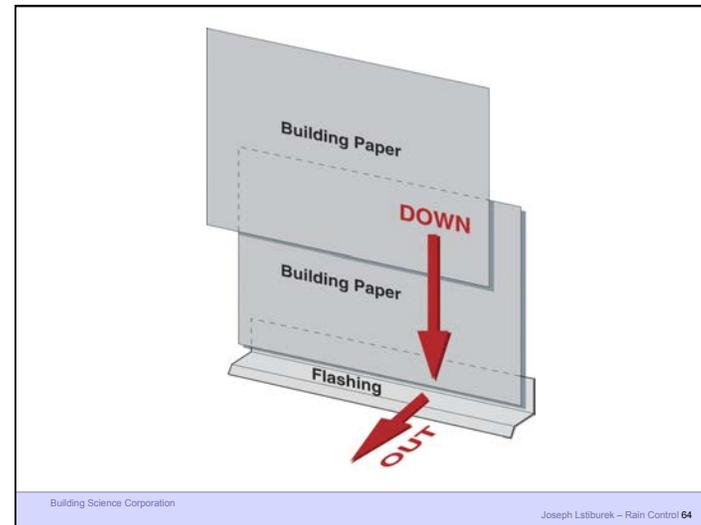
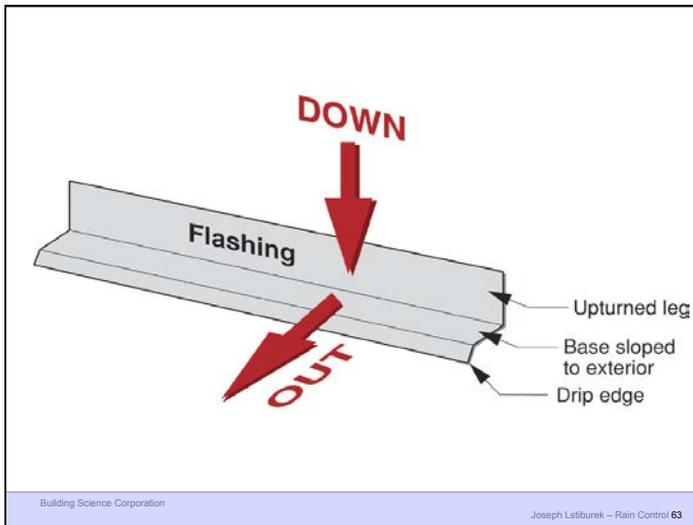
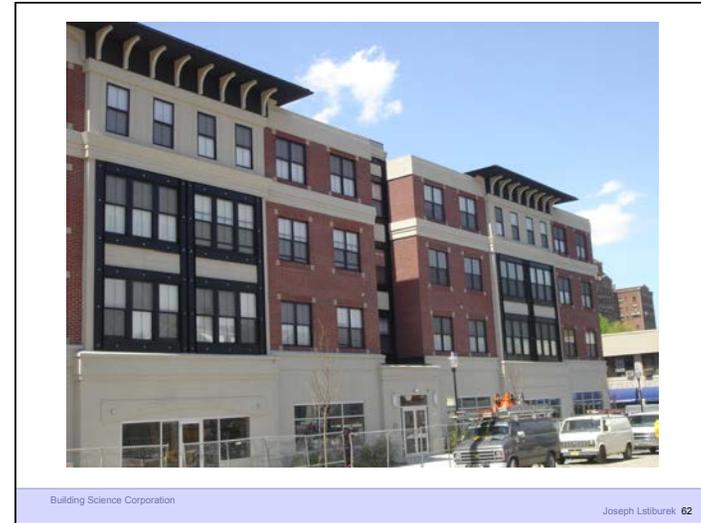
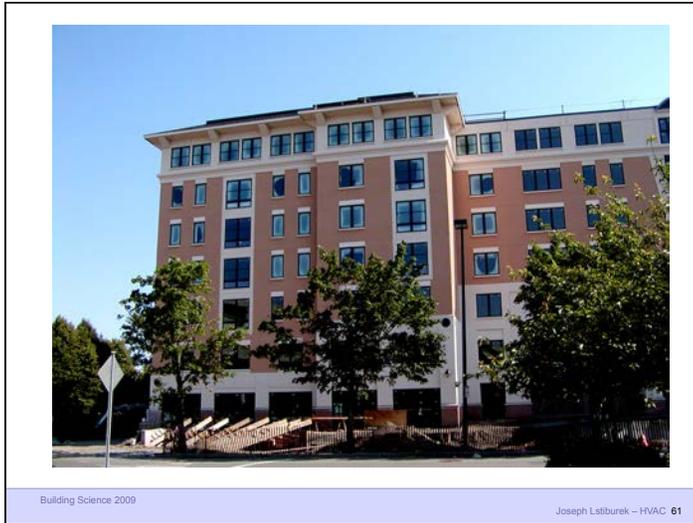


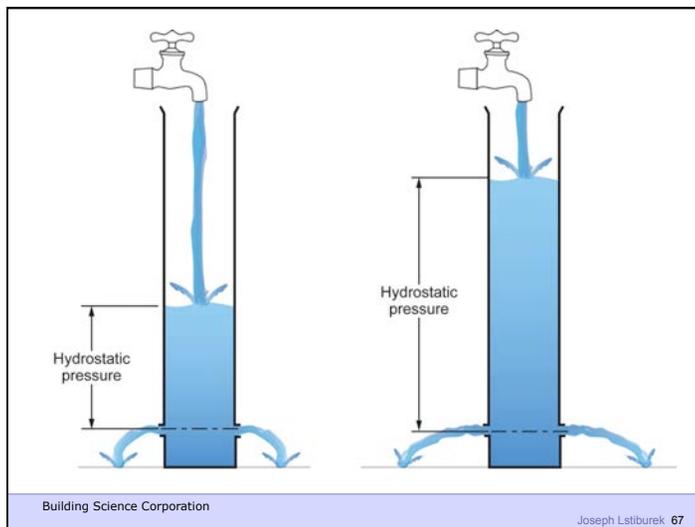


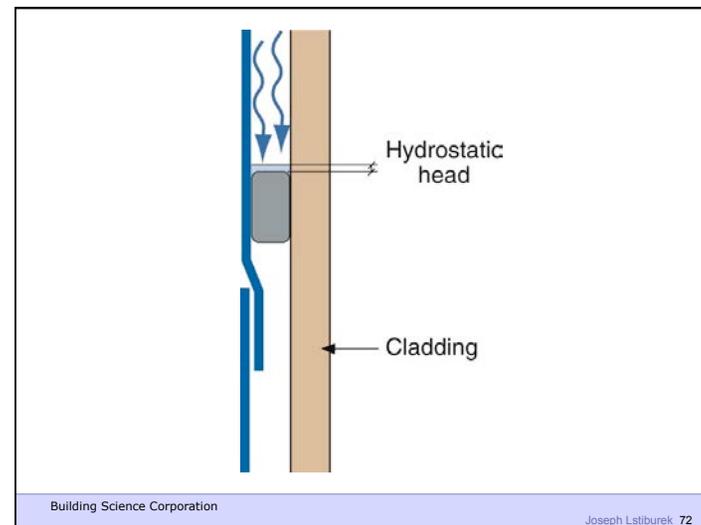
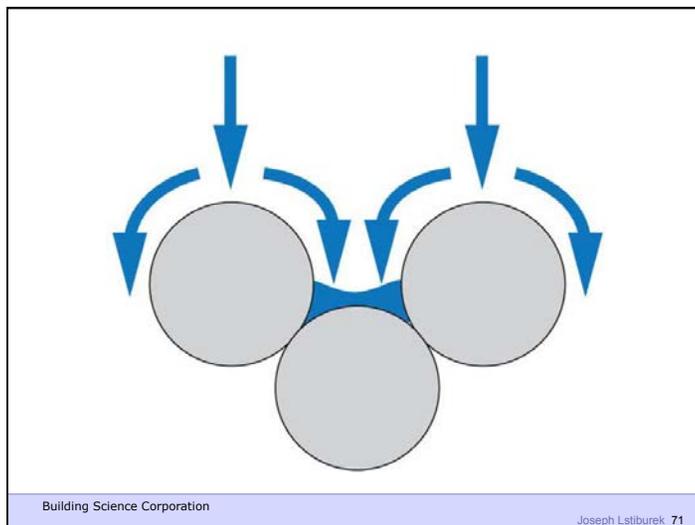
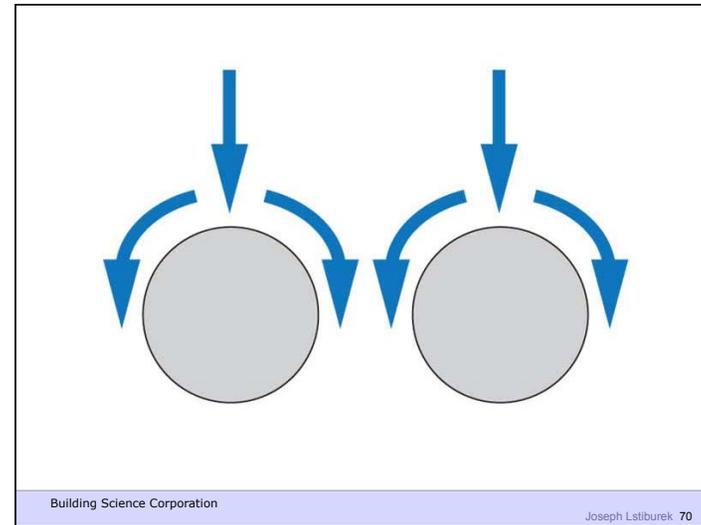
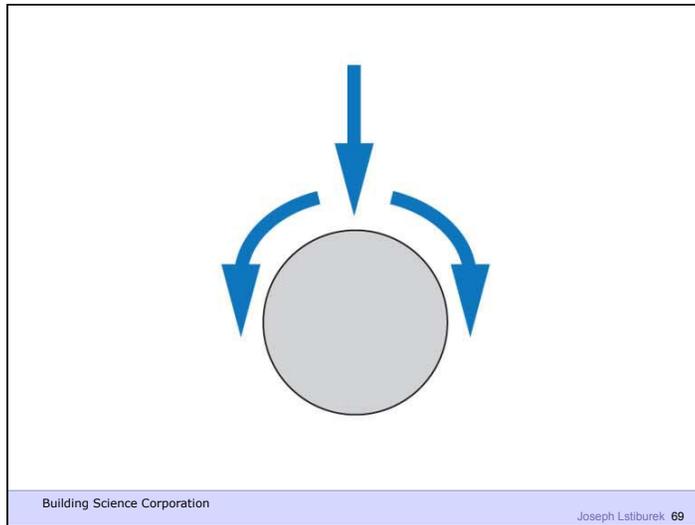


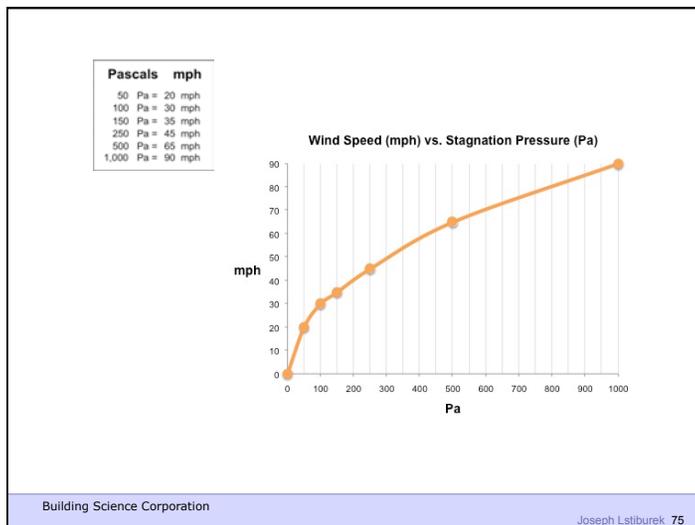
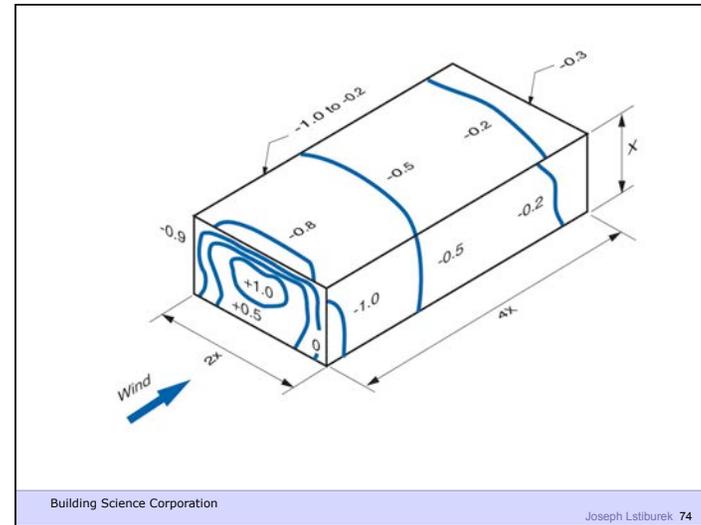
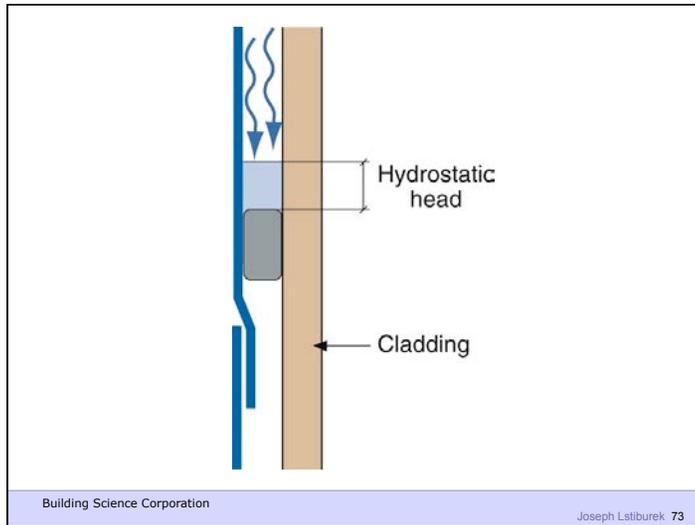




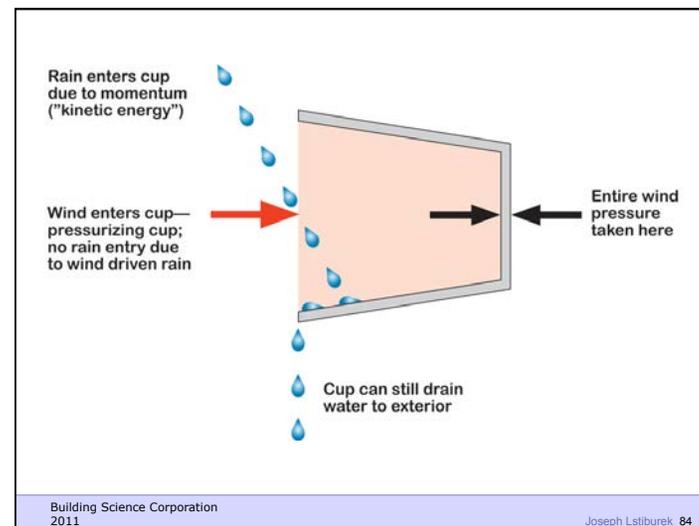
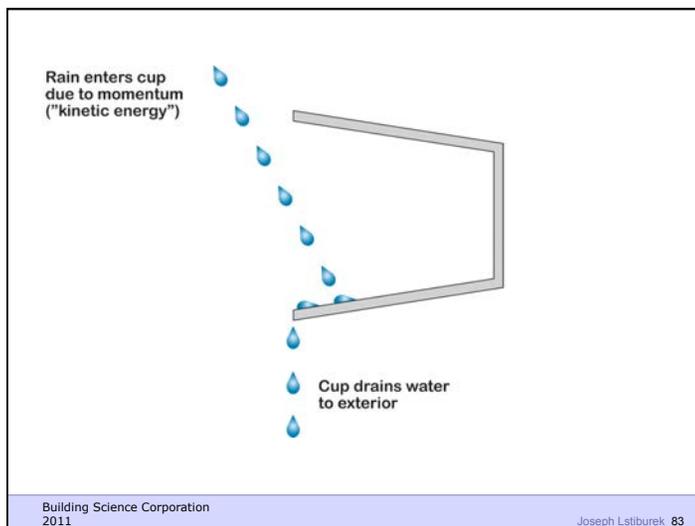
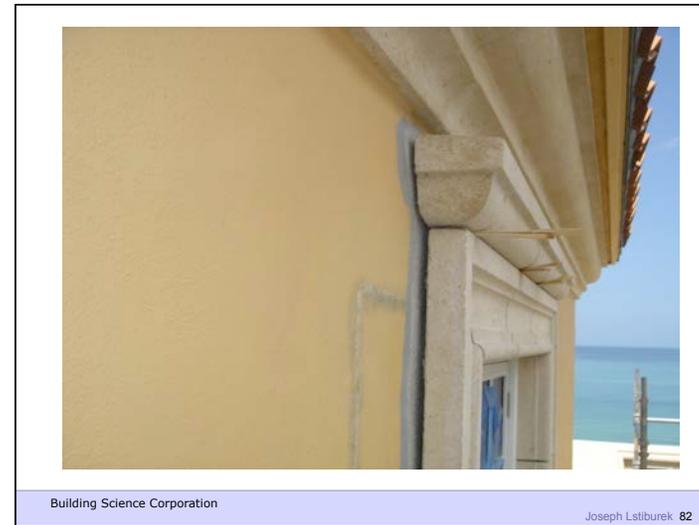
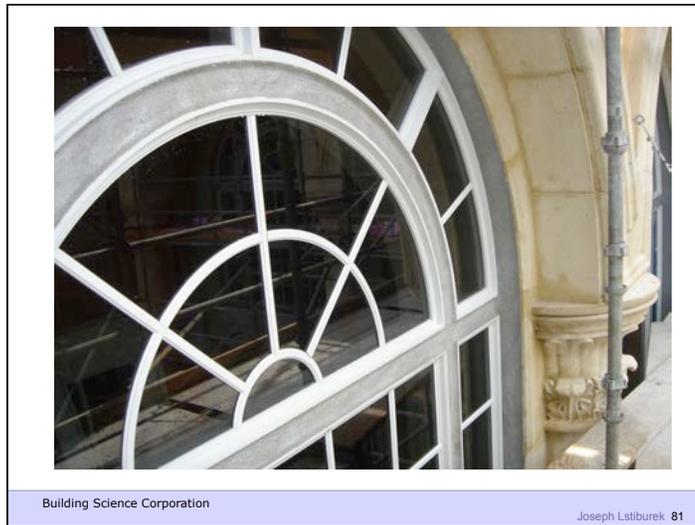


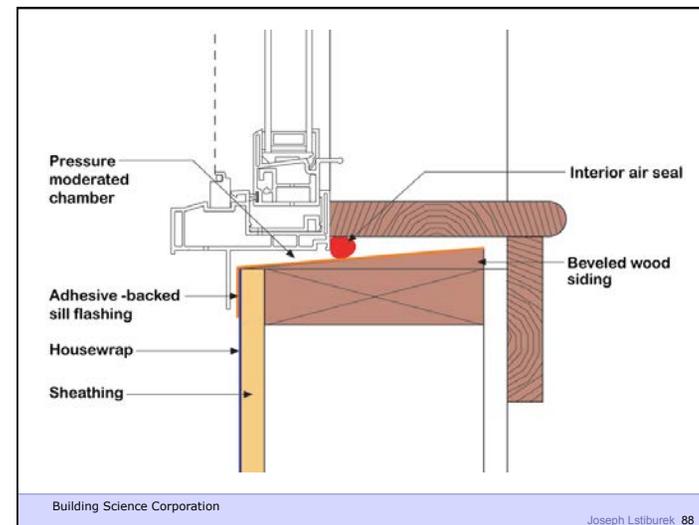
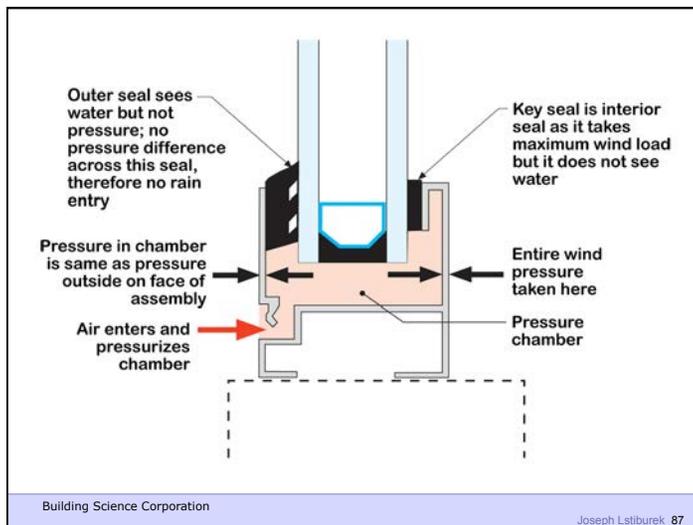
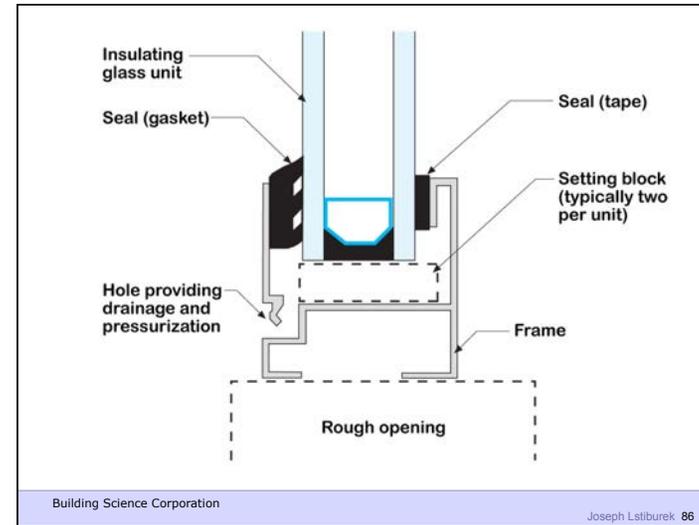
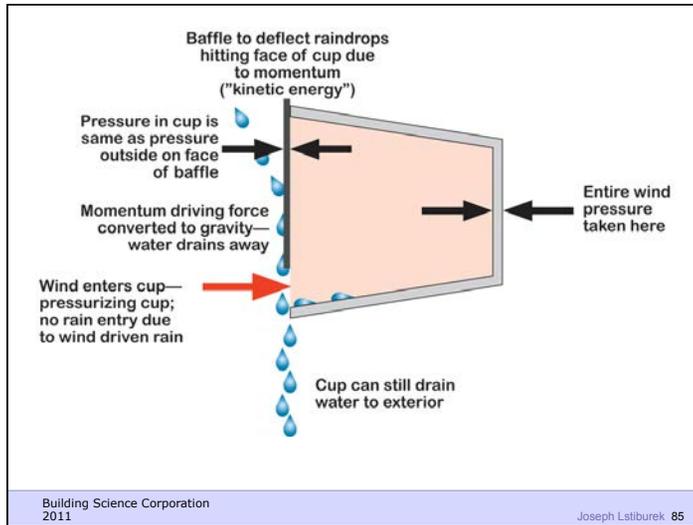


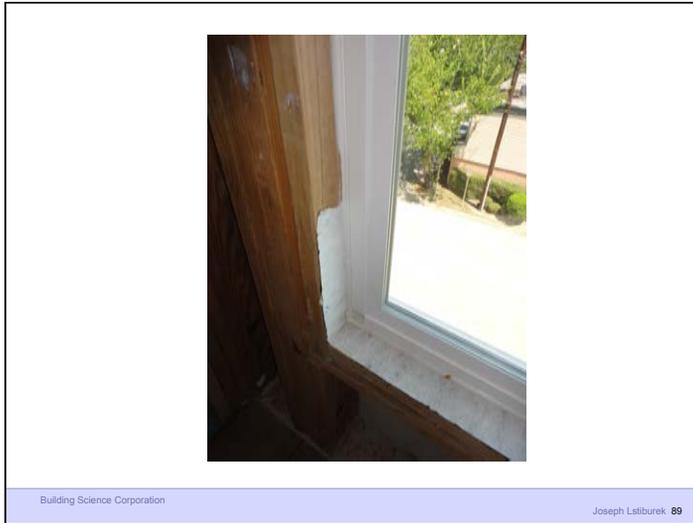


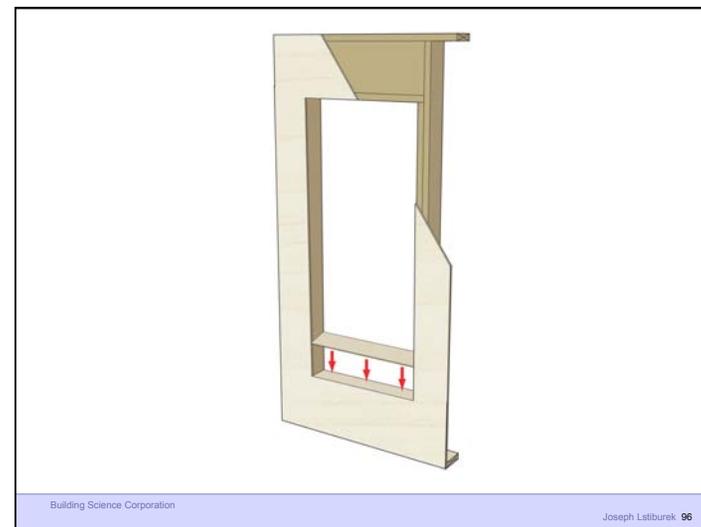
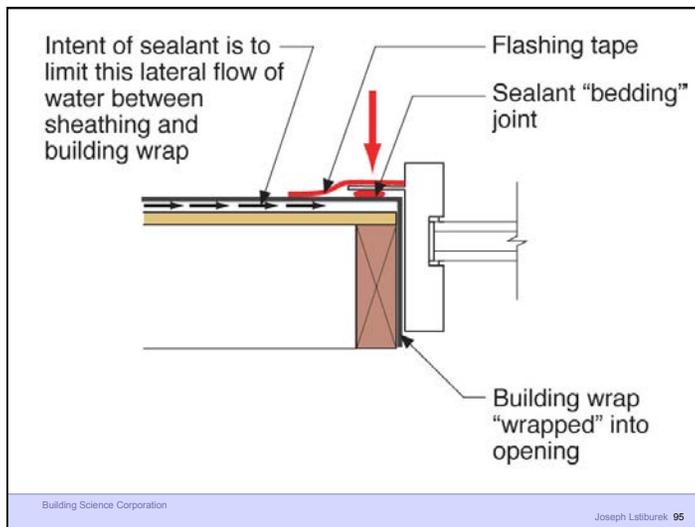


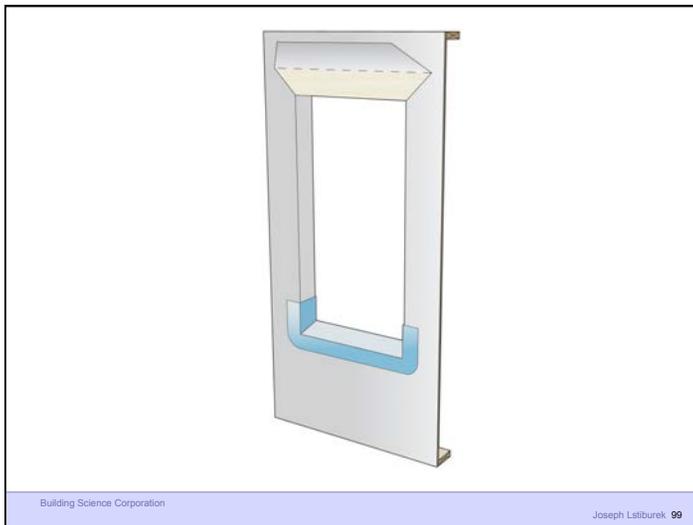
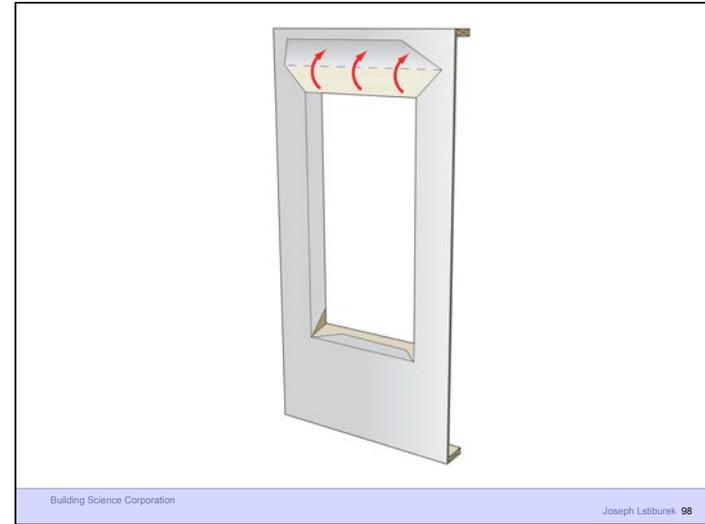
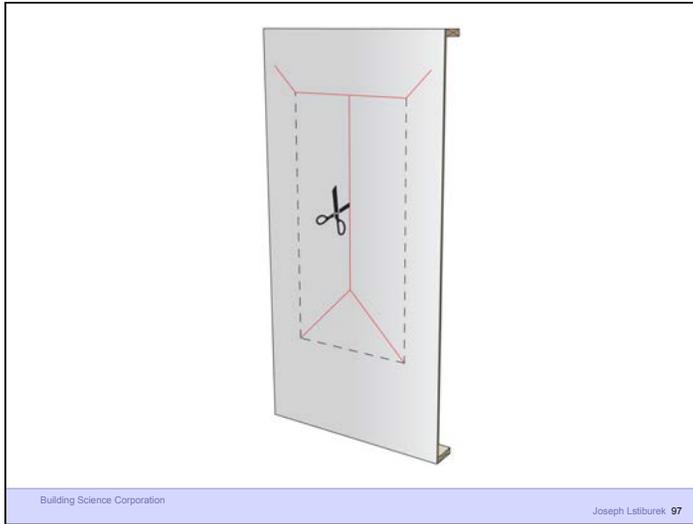


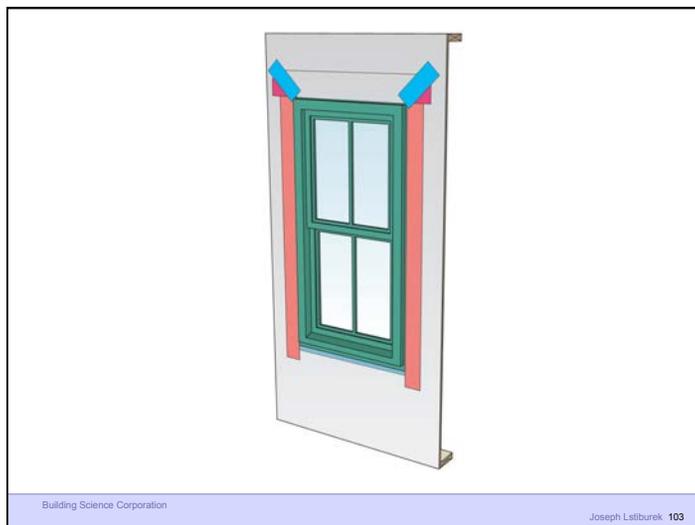


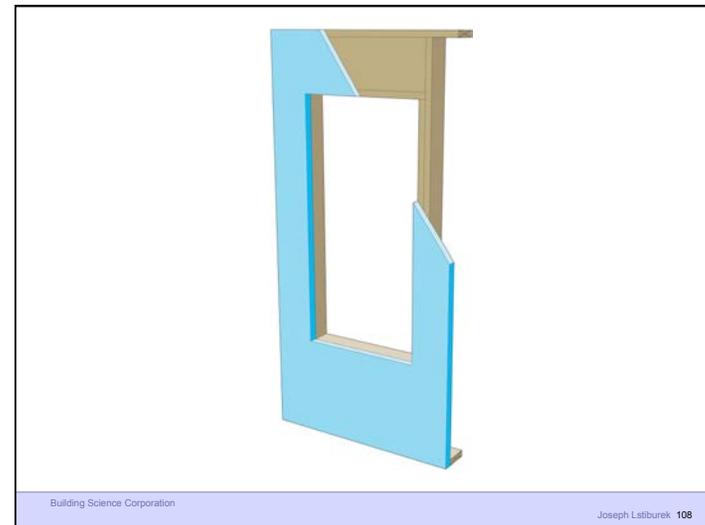
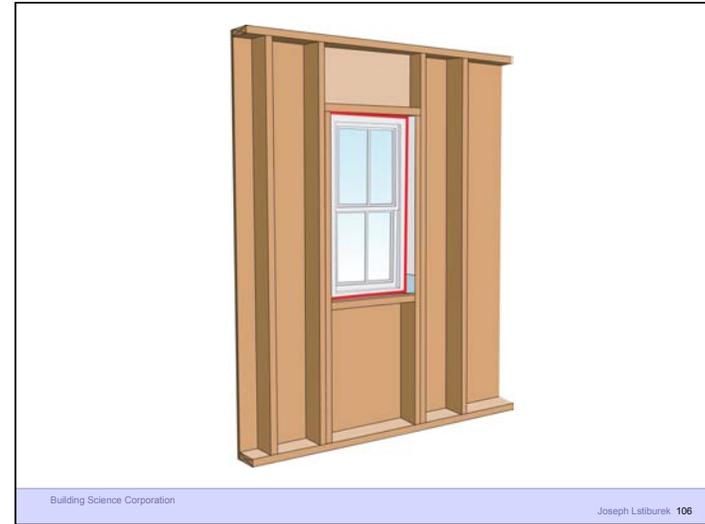
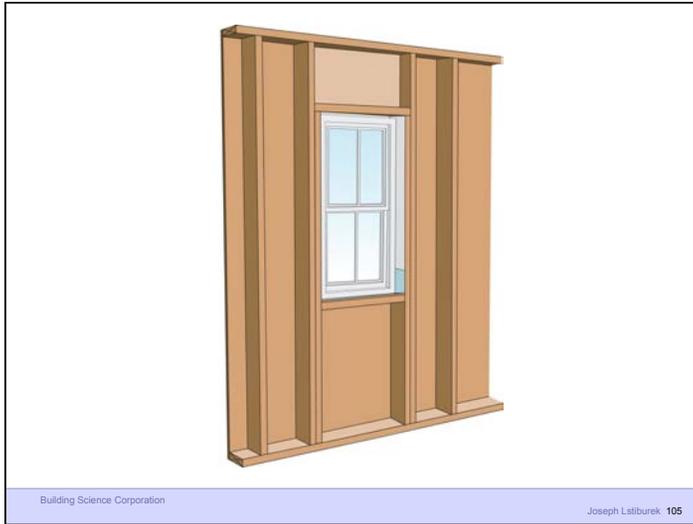


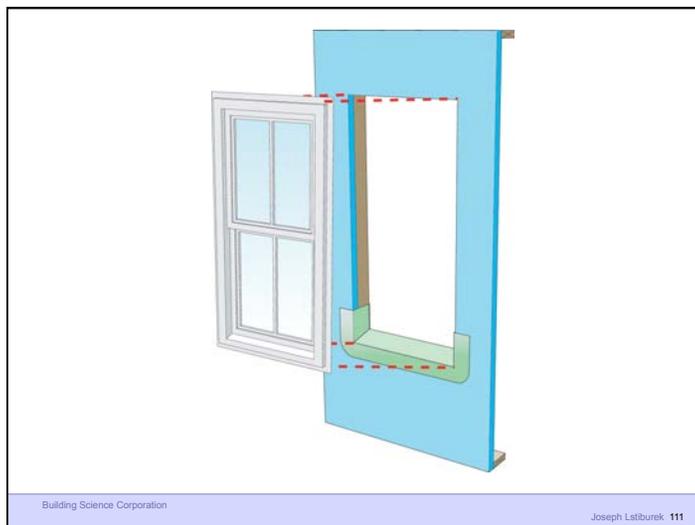
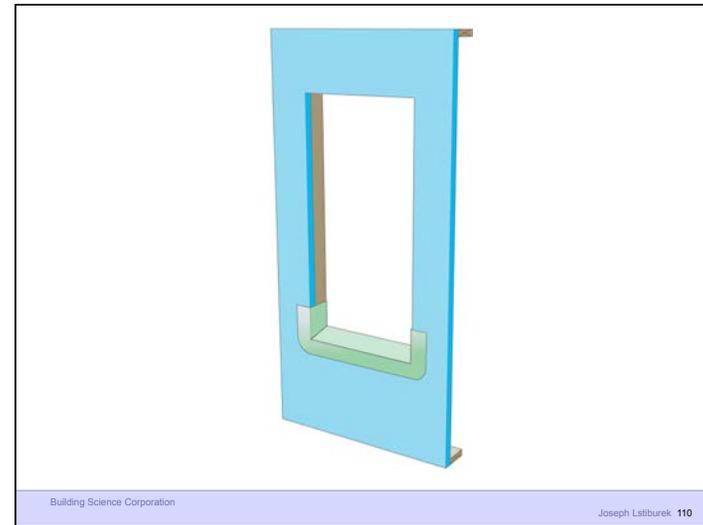
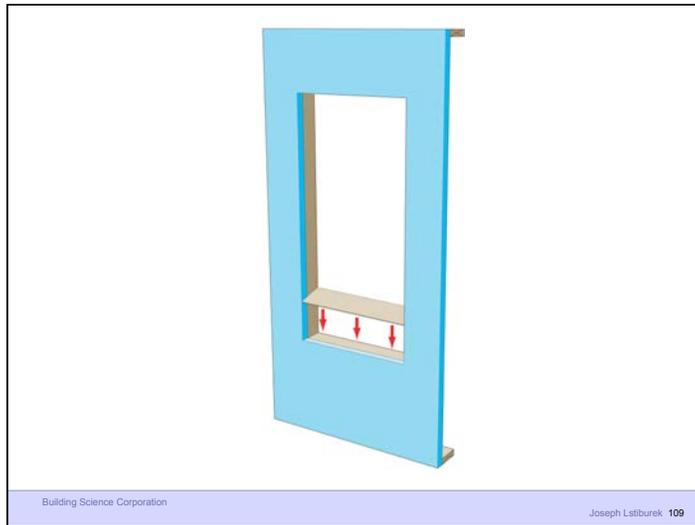




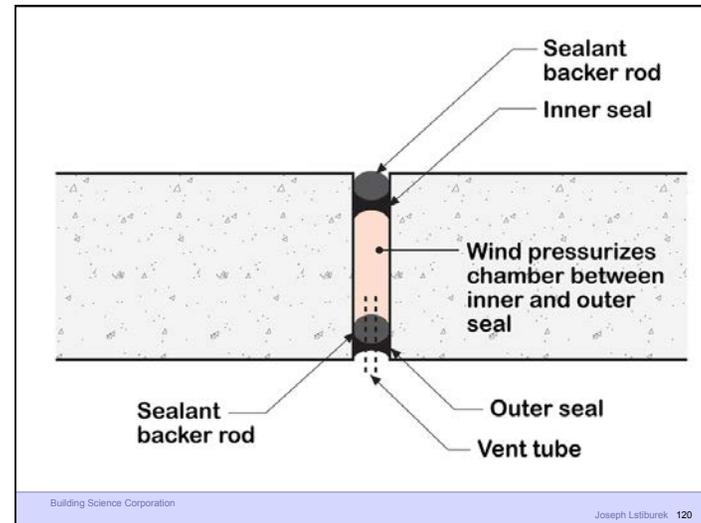


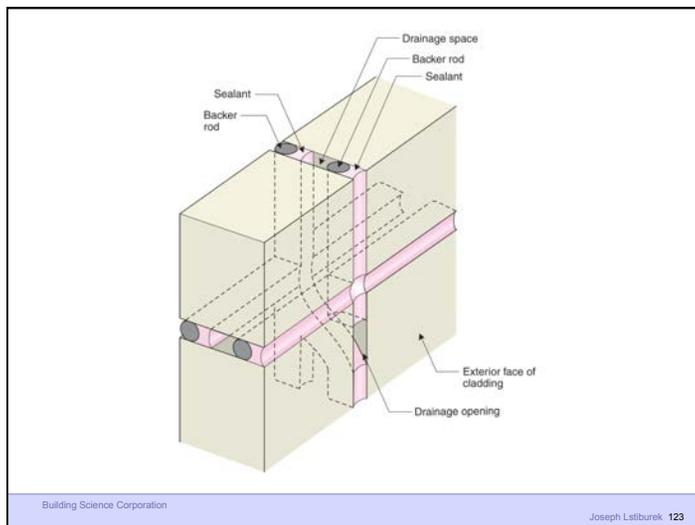
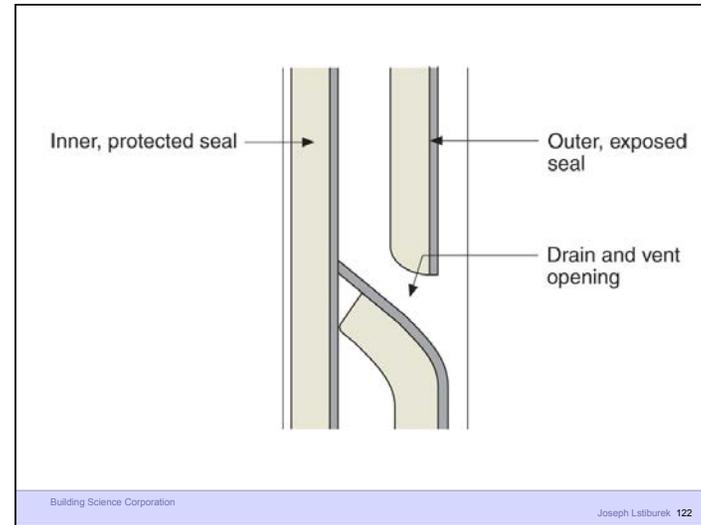
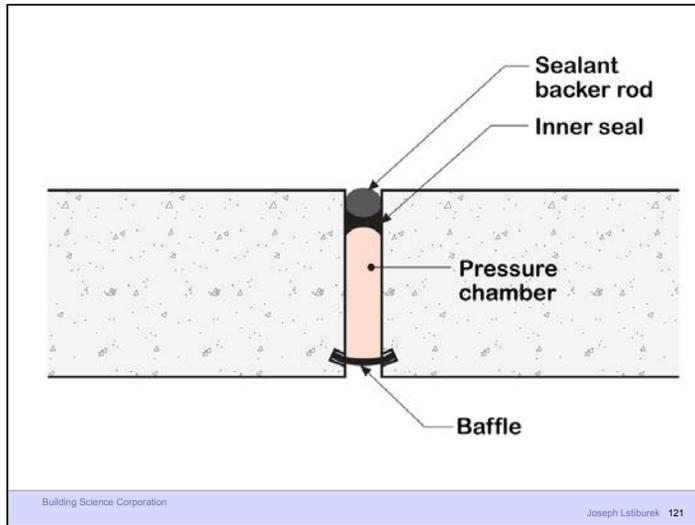


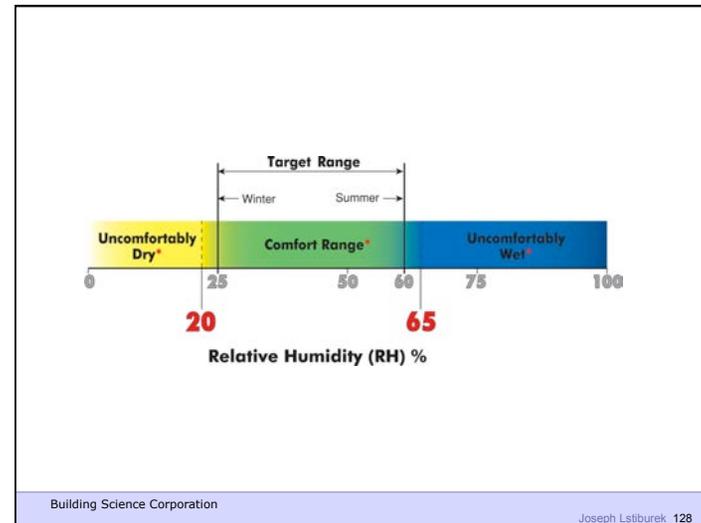


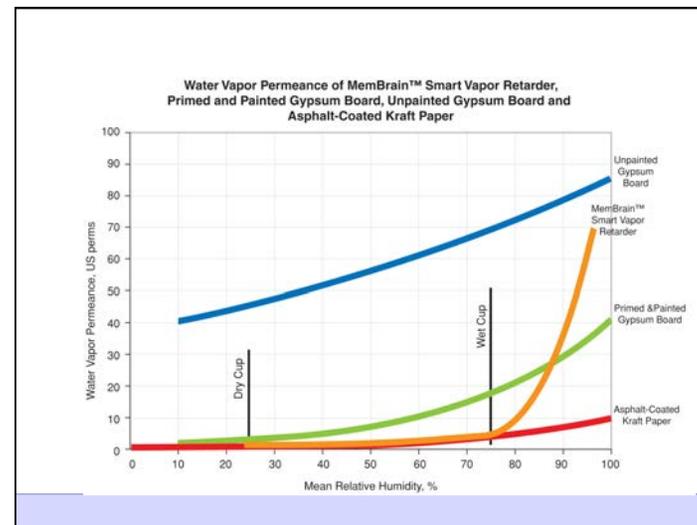
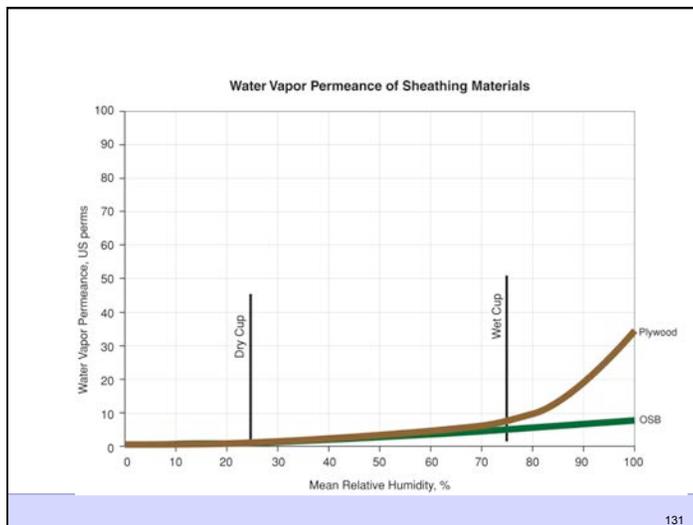
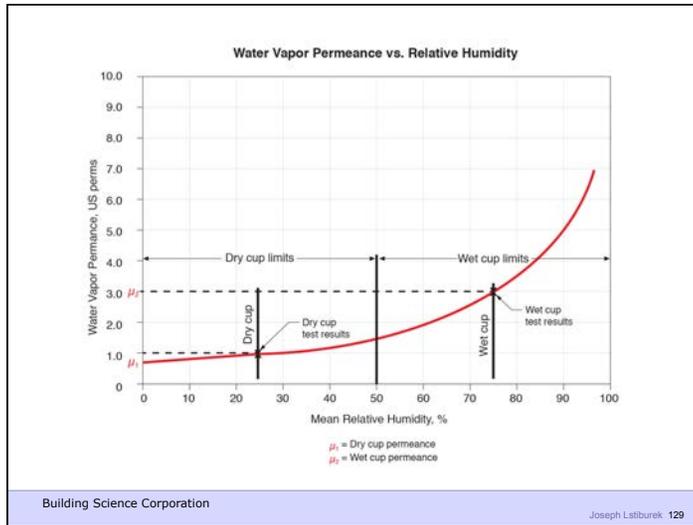


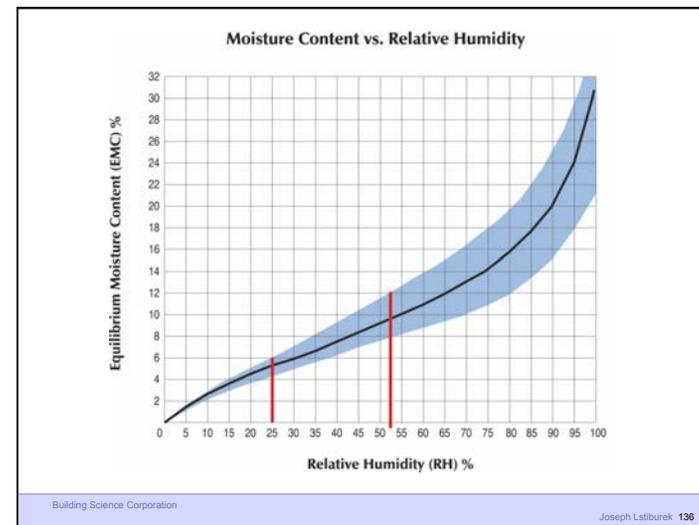
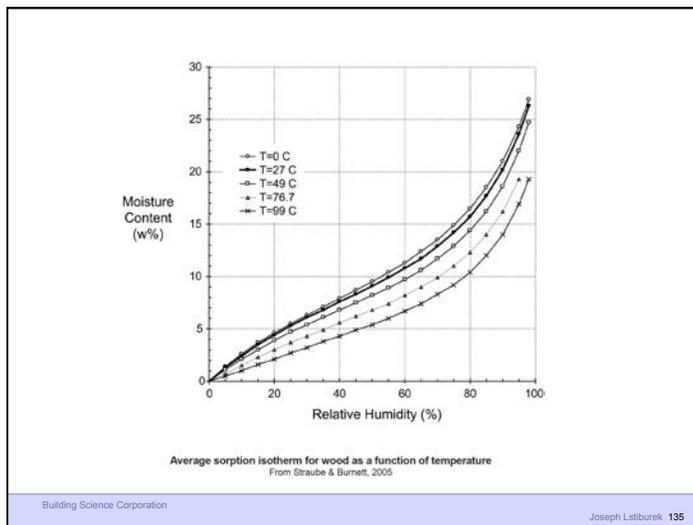
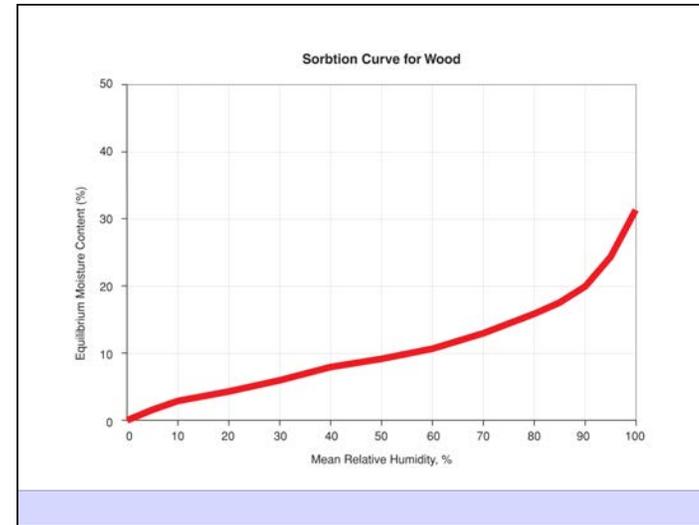
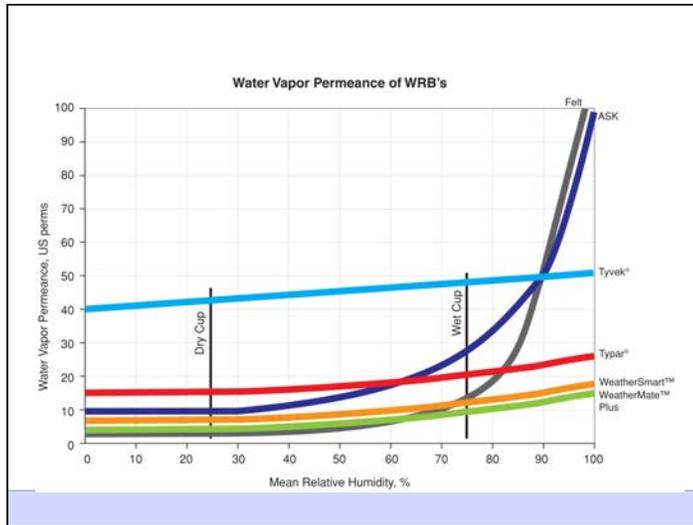


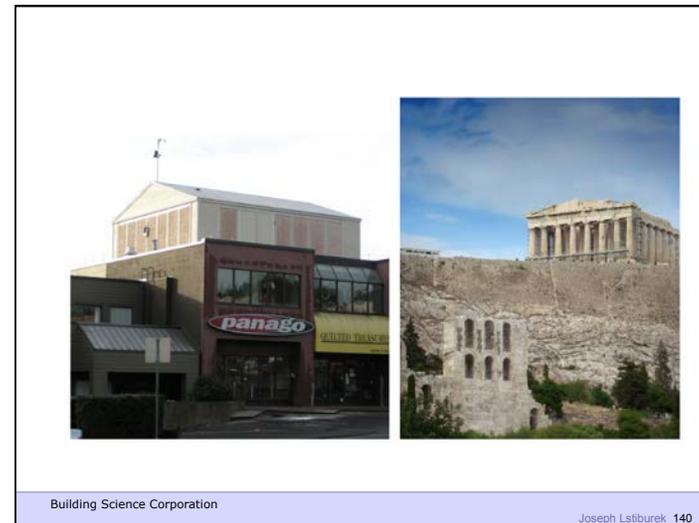
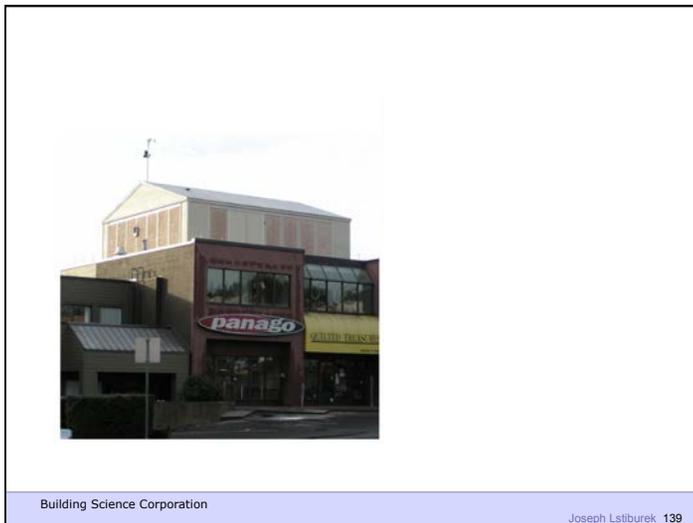
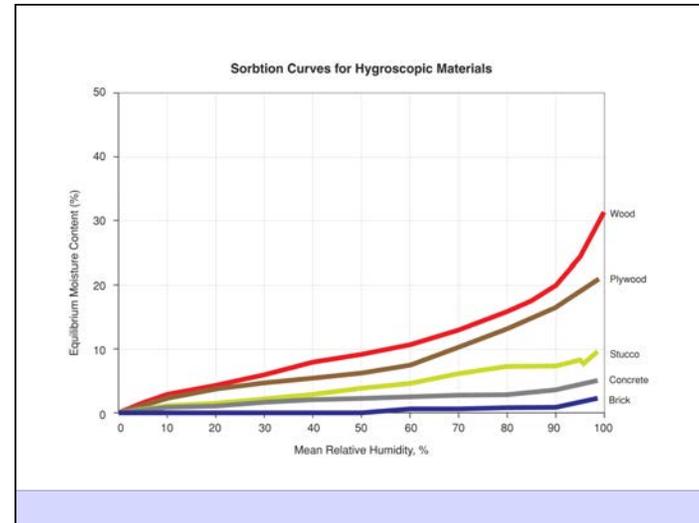




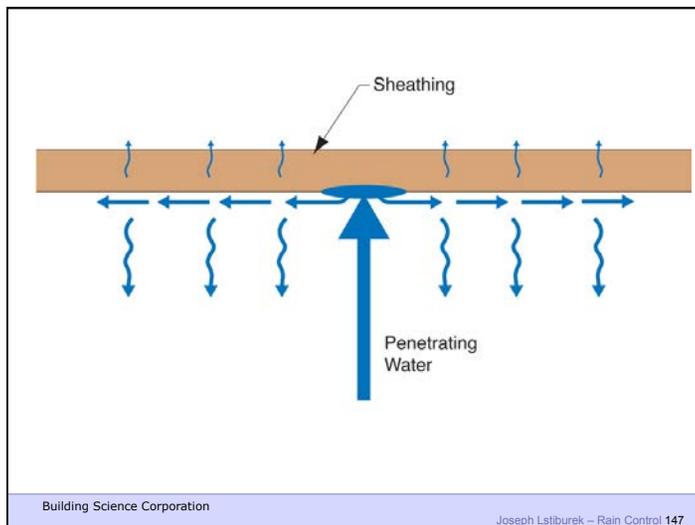
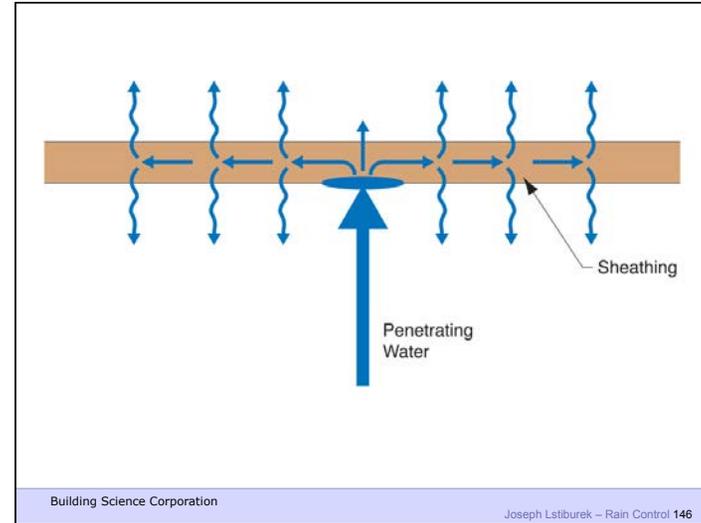






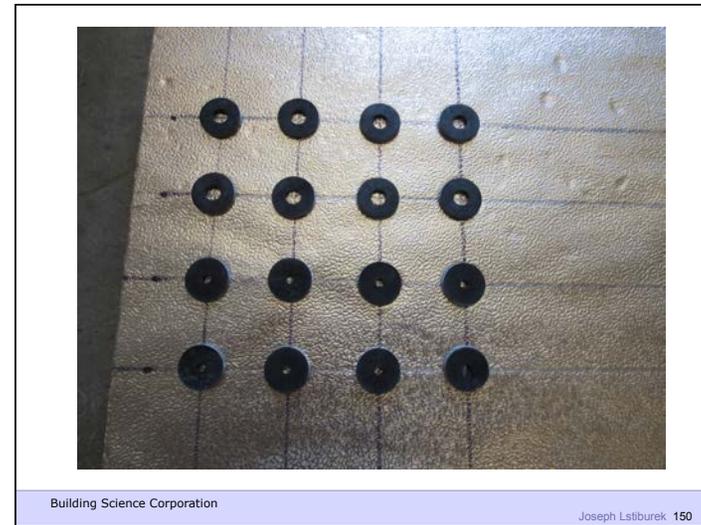






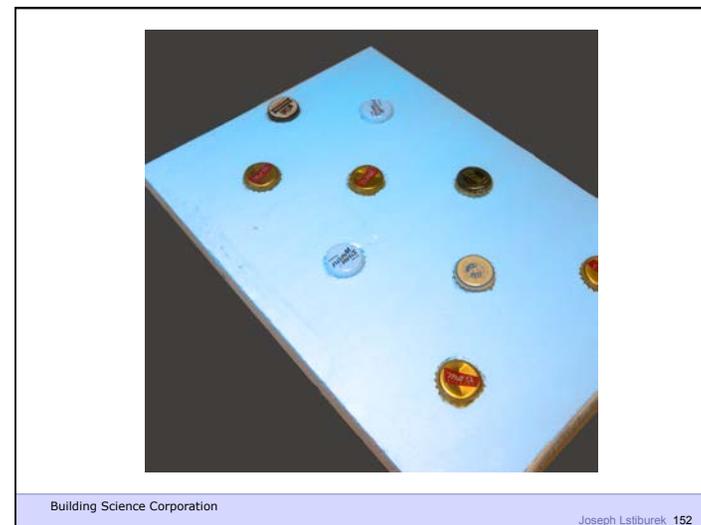
Rain Screen

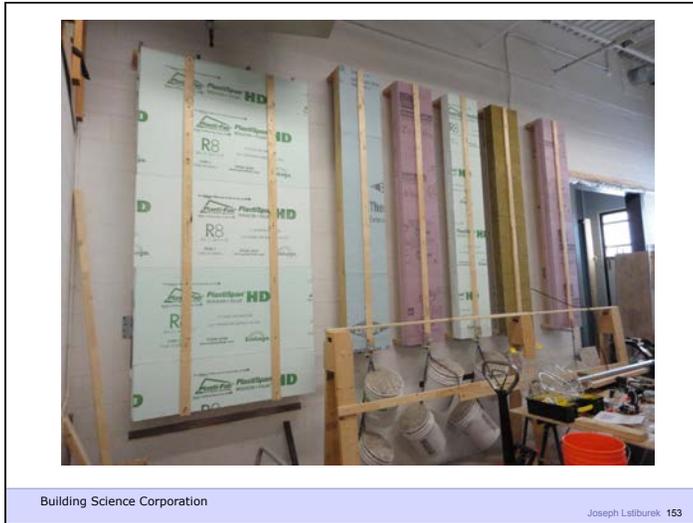
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Beer Screen?

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2010

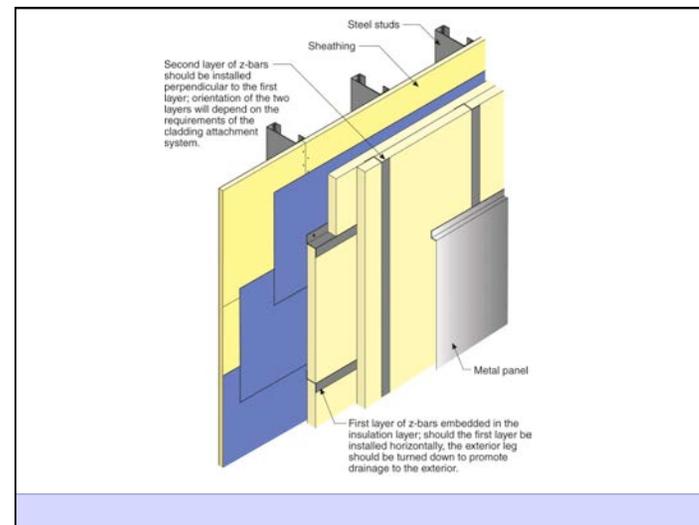
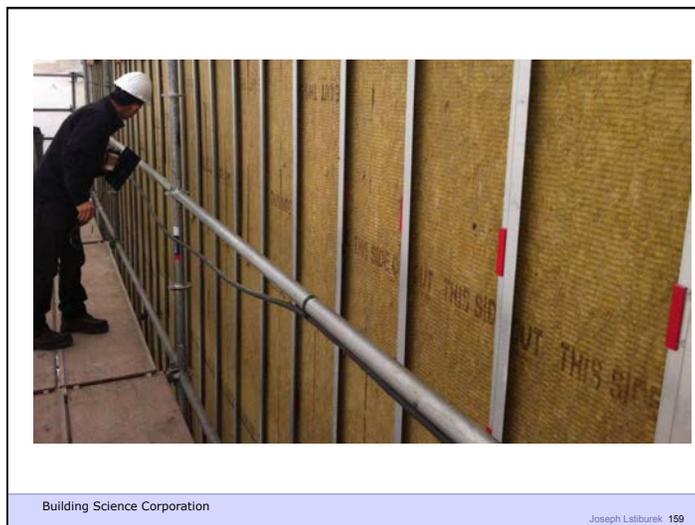
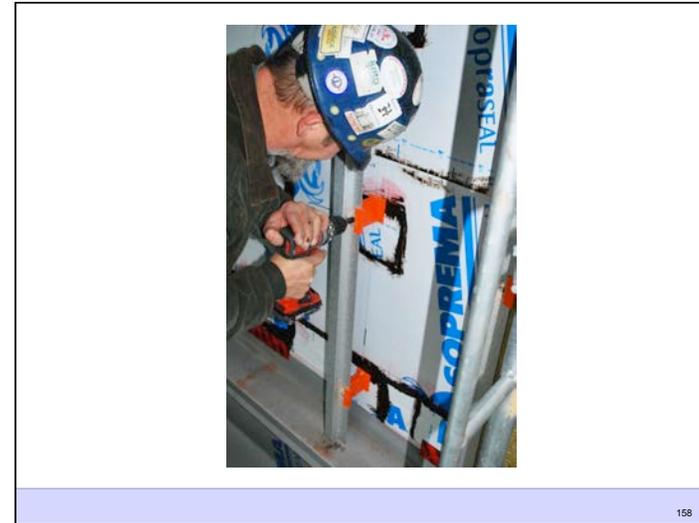
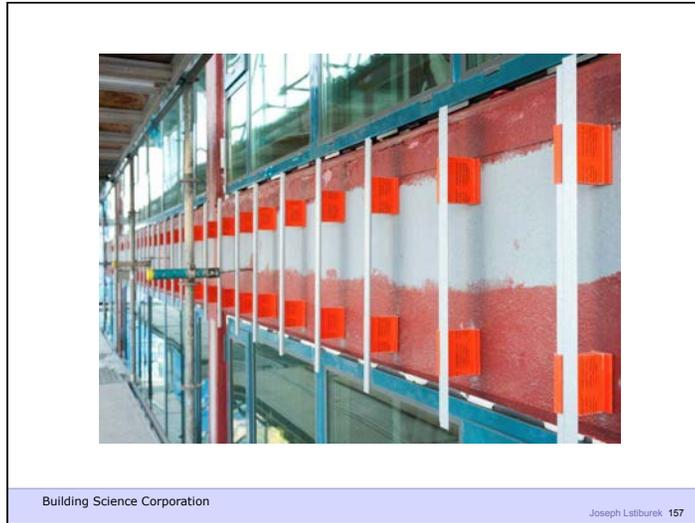
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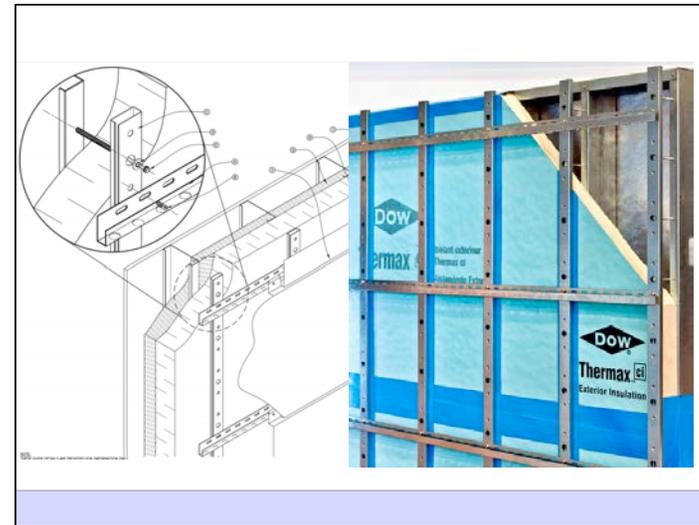
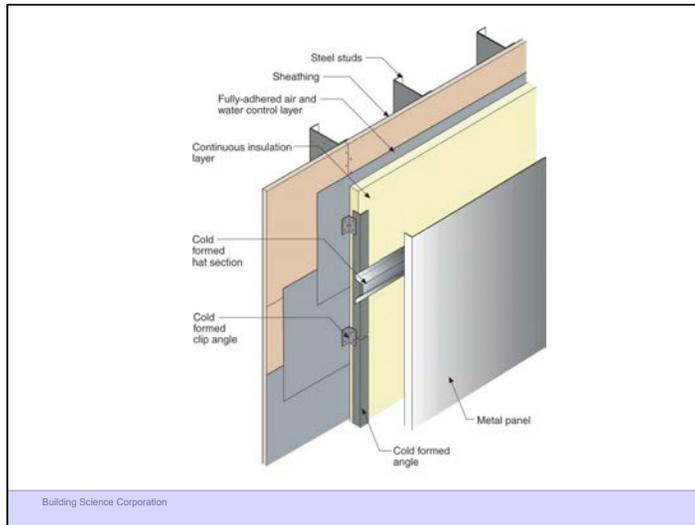


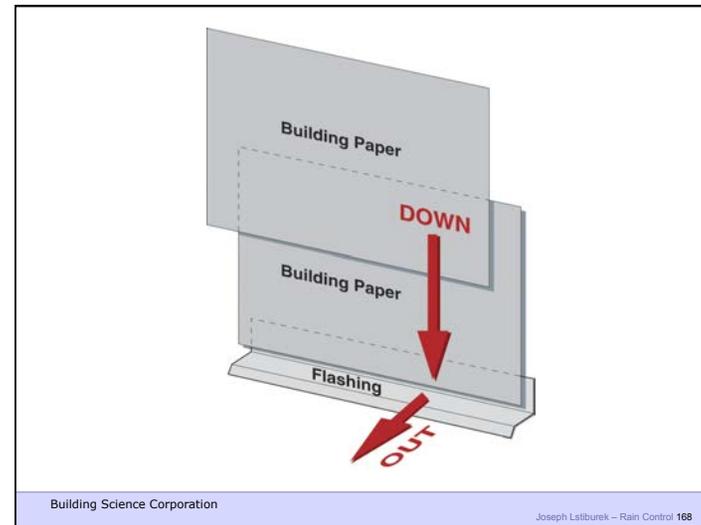
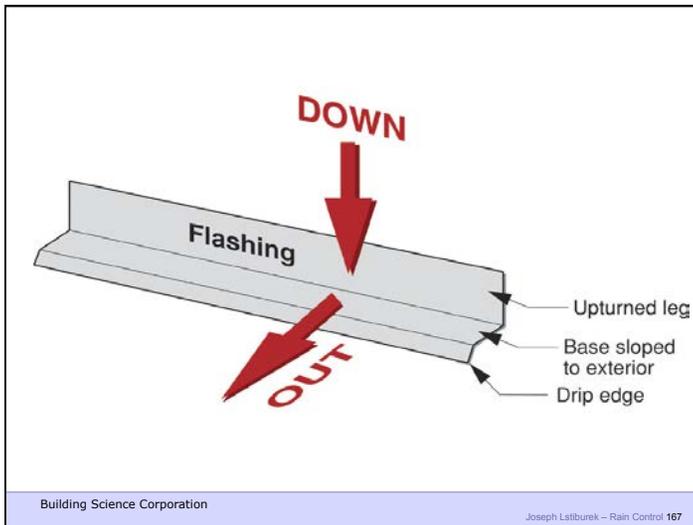
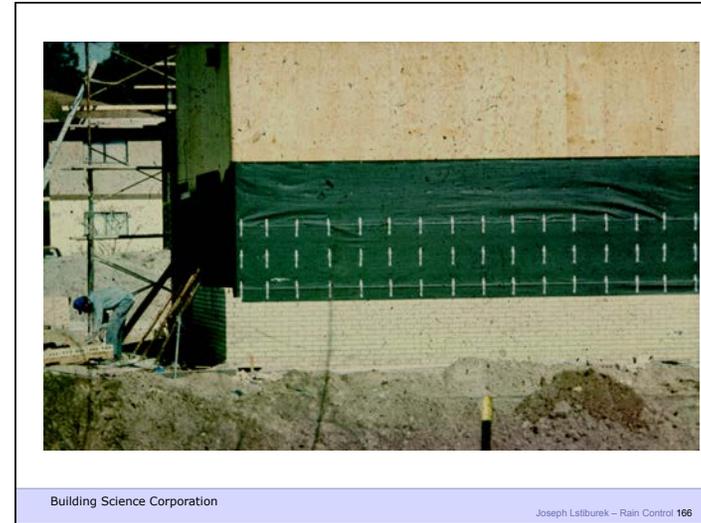
Rockwool

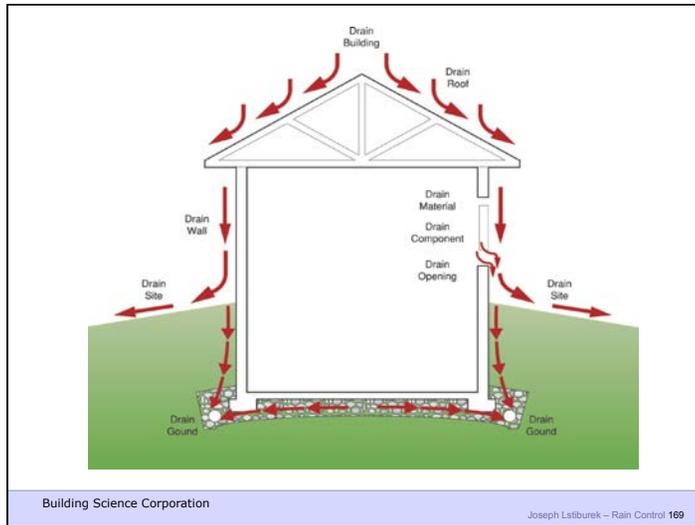
1x3 furring @ 24" o.c.
#10 screws @ 16" o.c. vertically
Result: 20 psf cladding weight
with < 2/100" deflection

Average Deflection of Framing (inches)	Vertical Load (psf) - Red Curve	Vertical Load (psf) - Blue Curve	Vertical Load (psf) - Green Curve
0.00	0	0	0
0.02	~1000	~800	~600
0.04	~1500	~1200	~900
0.06	~1800	~1500	~1100
0.08	~2000	~1700	~1300
0.10	~2000	~1800	~1400



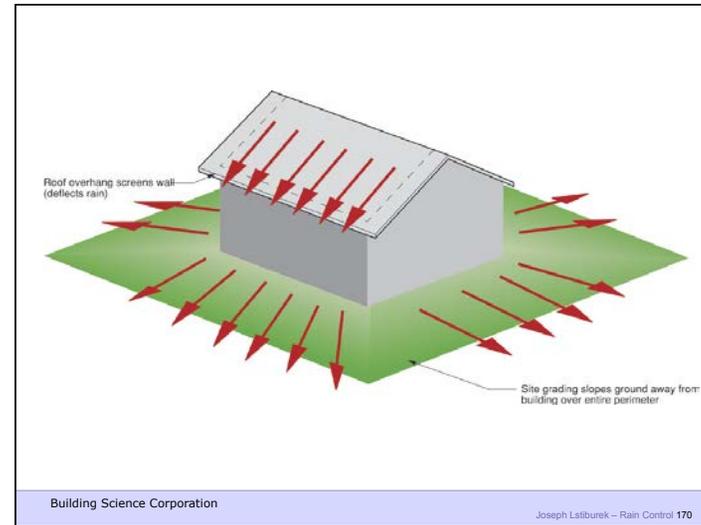






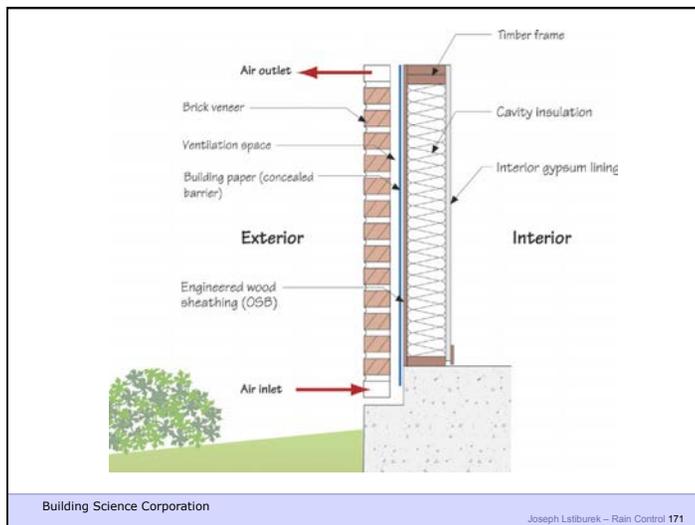
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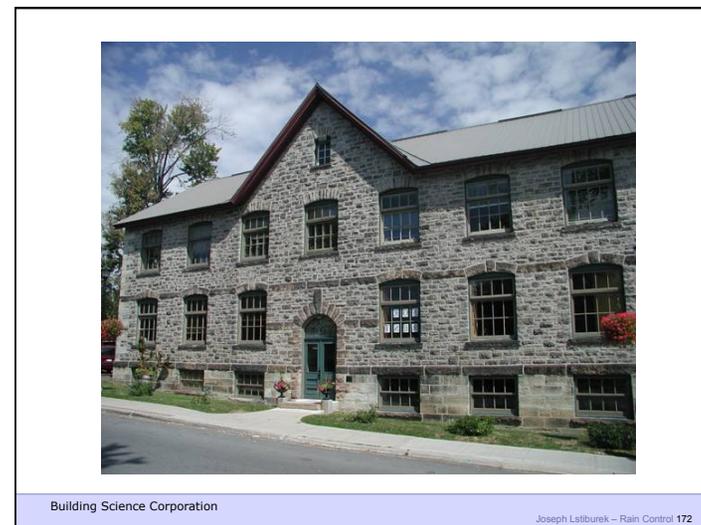
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