

Masonry Walls Treated With Water-Repellents

**John Straube
Justin Liang**

In partnership with
**CHMC and Masonry
Canada**

**Building Engineering Group
University of Waterloo**

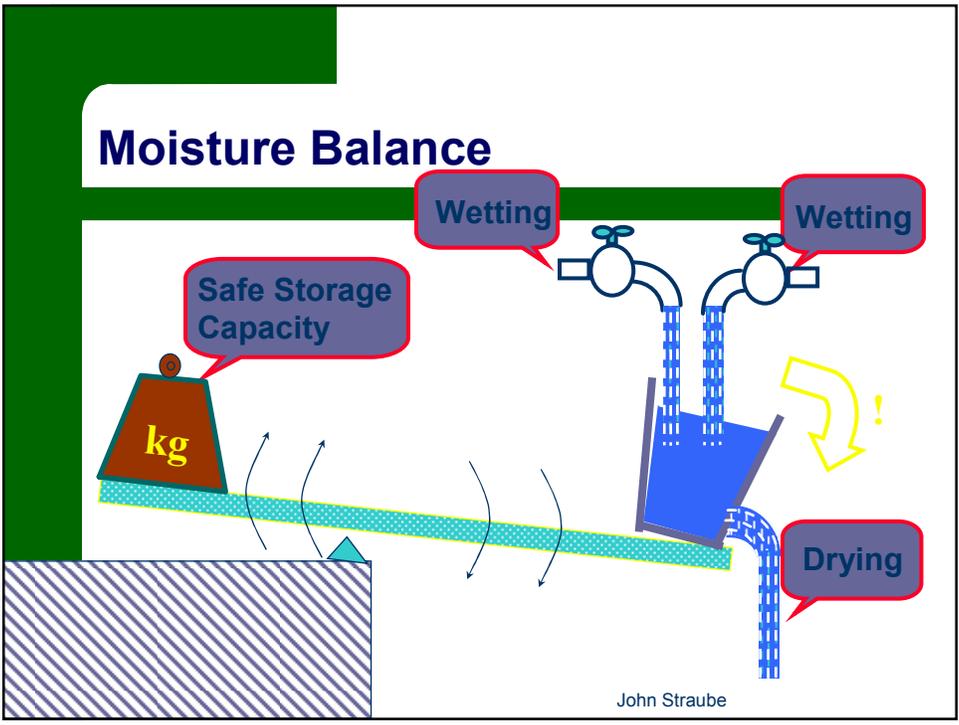
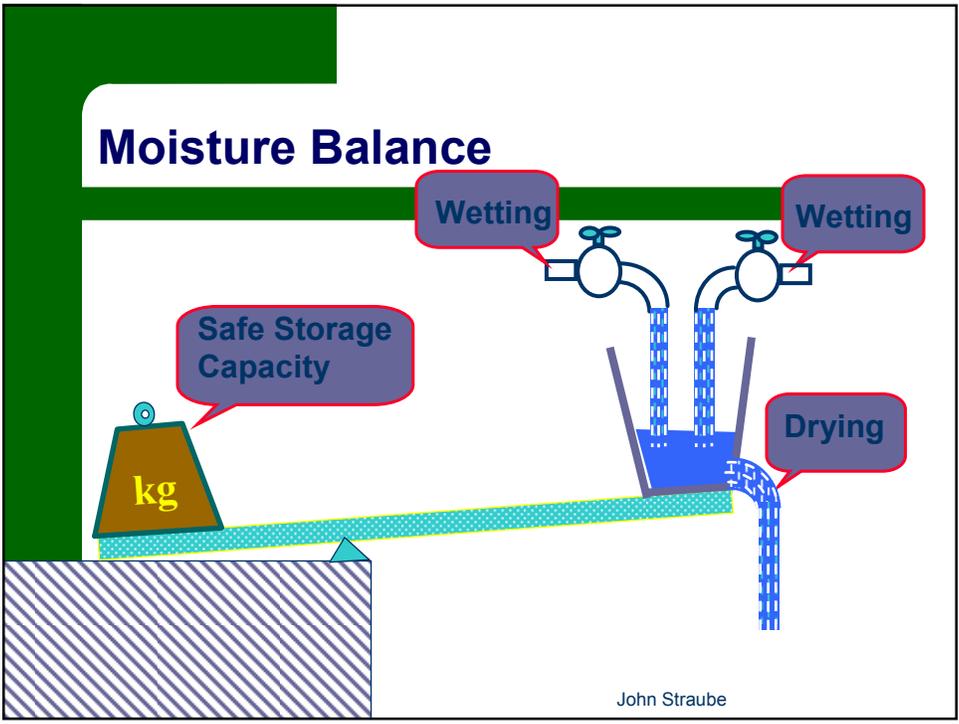
Thanks to: **Silvio Plescia
CMHC
Patrick Kelly, Masonry
Canada**

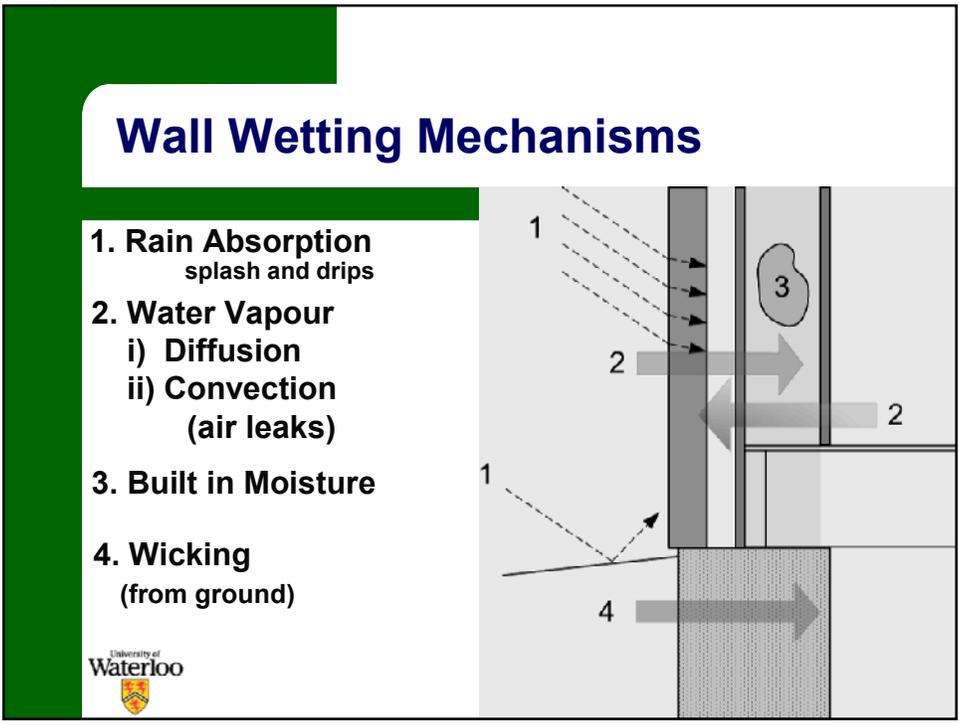
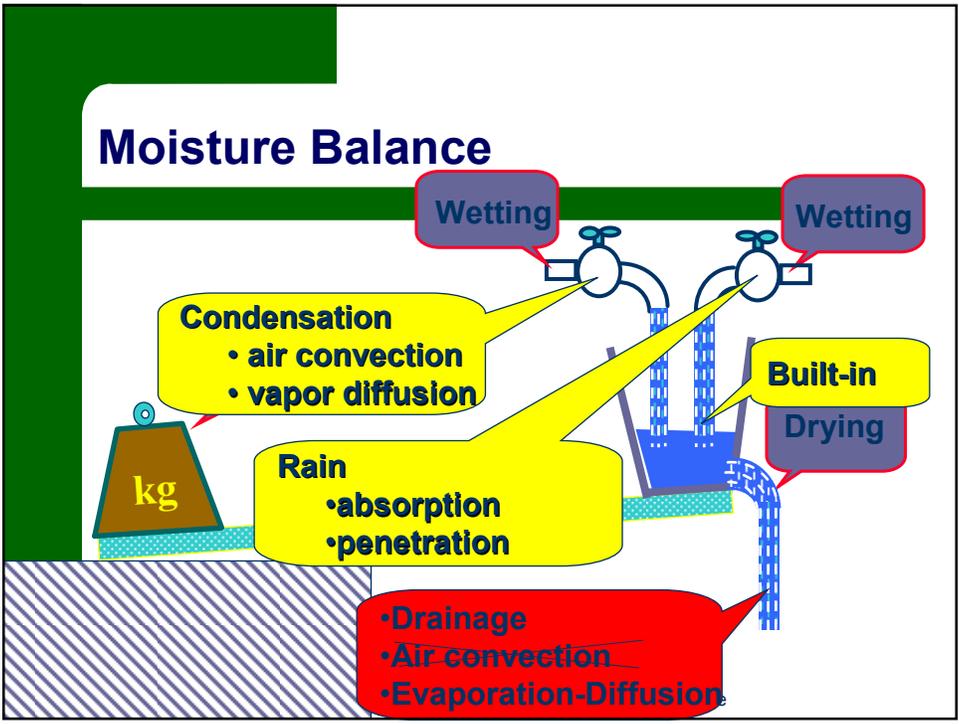
Introduction

- **Moisture Control**
- **Why use water-repellents?**
- **How do water-repellents work?**
- **Potential problems with impregnated masonry**
- **Experimental Program/ Progress**
- **Future**



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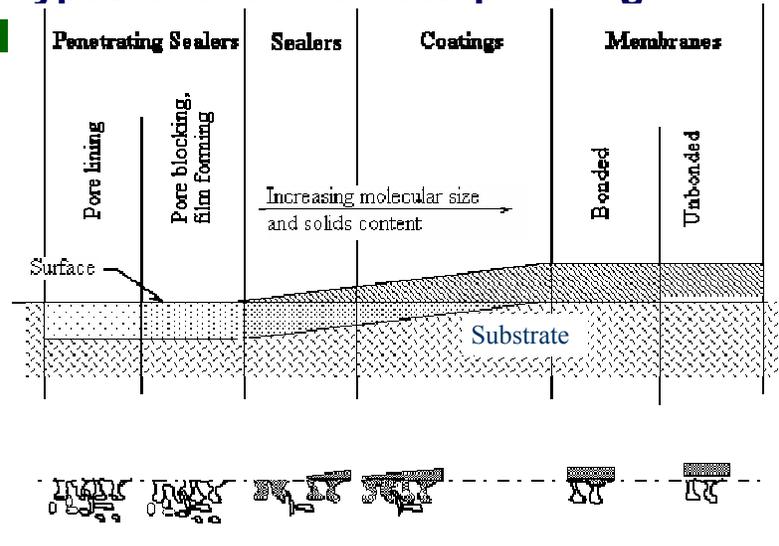
Water Repellents

- Water repellents reduce wetting from rain absorption by creating an exterior hydrophobic surface
- They may also reduce drying
- Do they reduce wetting more than drying?
- Need measured properties to answer this



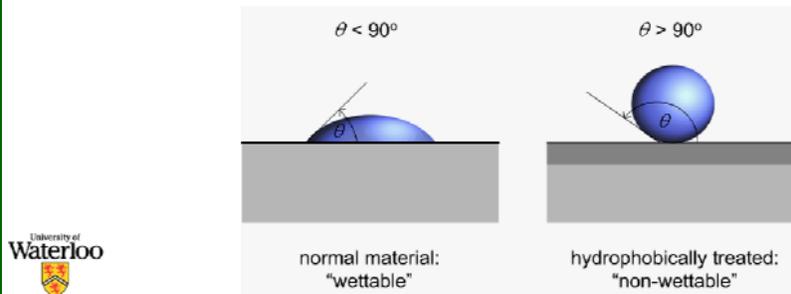
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Types of Sealant/Waterproofing



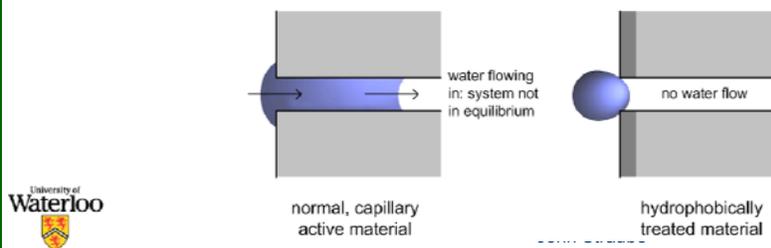
How do Water-repellents work?

- Repellents make surfaces hydrophobic
- hydrophobic surfaces have contact angle greater than 90 degrees
- Treatments either changes the surface layer of molecules or provide a coating that has a hydrophobic surface



How do Water-repellents work?

- Significant pressures needed to push water into hydrophobic cracks
- E.g. typical repellent
0.3 mm crack requires 370 Pa
0.1 mm crack would requires > 1000 Pa of hydrostat



Potential Problems with Impregnated Masonry

- Freeze-thaw
- Peeling coatings



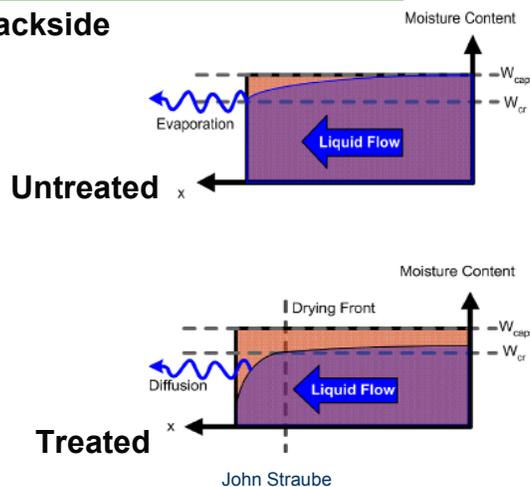
Potential Problems w/ Impregnated Masonry

Restricted Drying!



Moisture Movement

- If water gets to backside

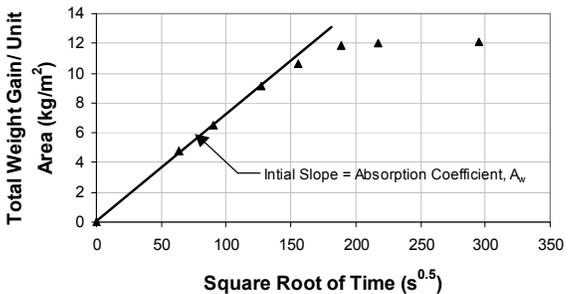
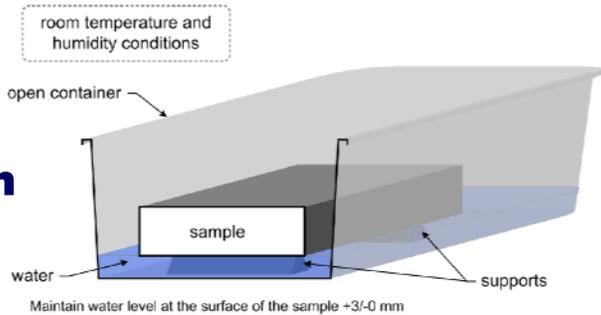


Experimental Program

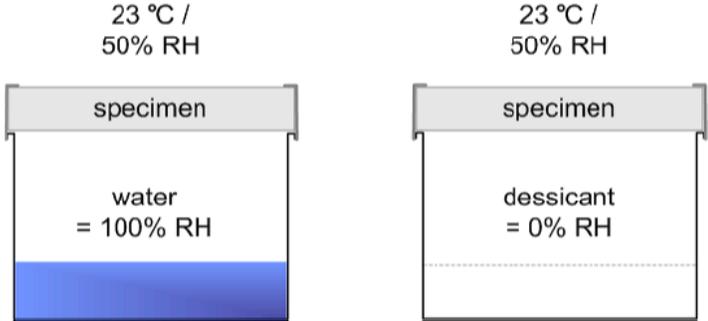
- Three Tests to compare/investigate performance
 - Water-uptake test: Absorption
 - Modified Wet-cup Test: Vapour Permeability
 - Initial Drying Rate Test: Drying

Water Absorption Tests

How well does water pass through front side?



Standard Wet & Dry Cup Tests



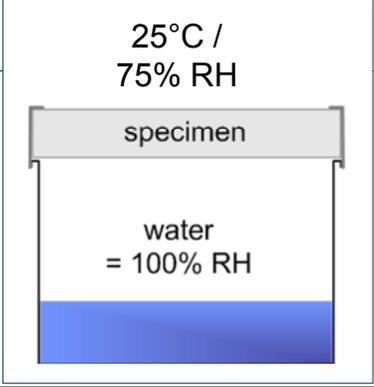
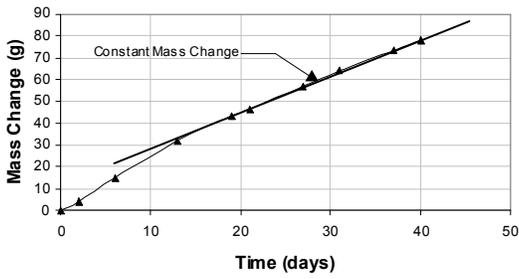
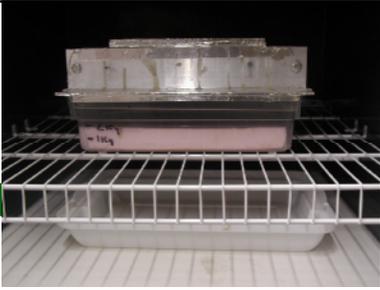
Tests as per ASTM E96



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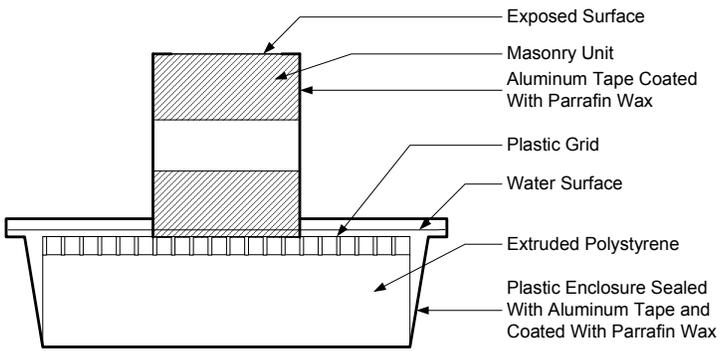
Modified Wet Cup

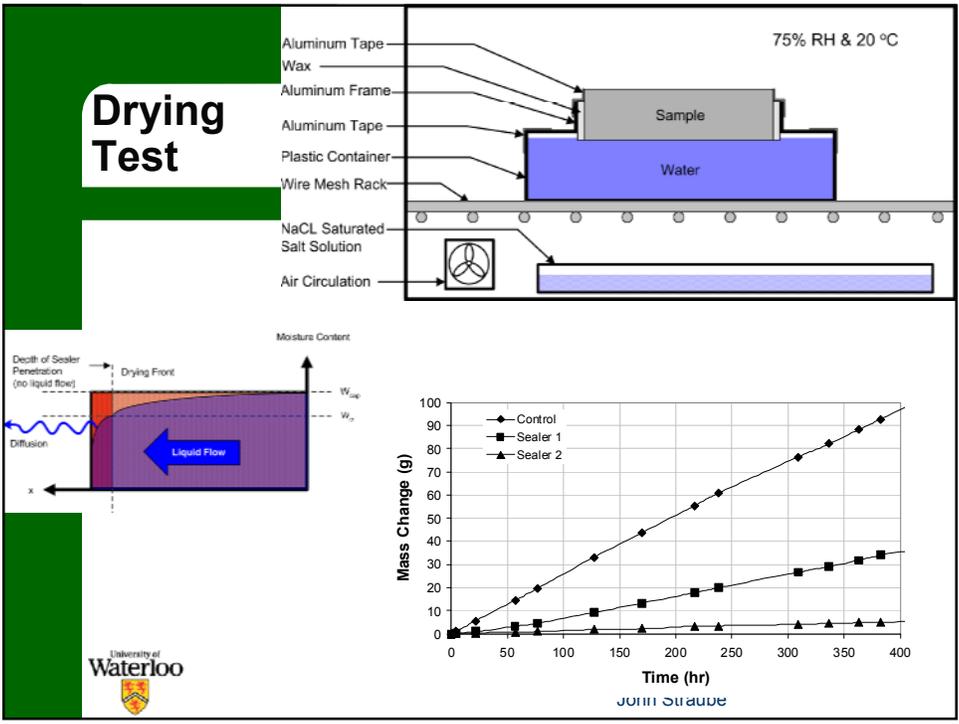
- How well does vapor pass through brick?



Initial Rate of Drying Test

- How well does liquid water pass through brick if wetted from backside?





Daughter Brick Vapour Permeance Test Results

Brick Number	Untreated	Treated	% Change
H1	19.1	16.2	15
H2	17.6	15.7	11
H3	12.7	9.2	27
L9	13.0	9.6	26
L10	16.8	17.6	(outlier)
P9	8.8	7.0	20
P10	13.3	6.4	51

Permeability values measured in ng/m²s·Pa.

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Daughter Brick Initial Rate of Drying Test Results

Brick Number	Untreated	Treated	% Change
H1	680	584	14
H2	440	57	87
H3	201	46	77
L9	199	28	86
L10	528	118	78
P9	27	8	70
P10	125	37	70



Permeability values measured in $\text{ng/m}\cdot\text{s}\cdot\text{Pa}$.

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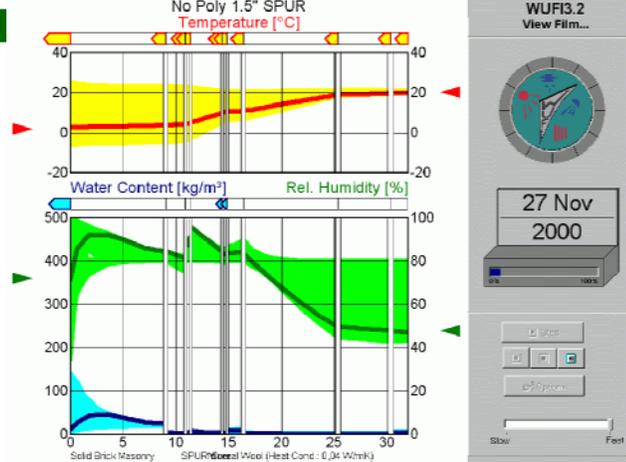
Preliminary Findings

- Water-repellents reduced the absorption by a factor of around 100!
- Vapour permeability of the entire brick samples did not change significantly,
- but ... Drying rate of a treated sample is greatly reduced
- Both due to low permeance of thin layer and less capillary flow



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Computer Modeling - WUFI

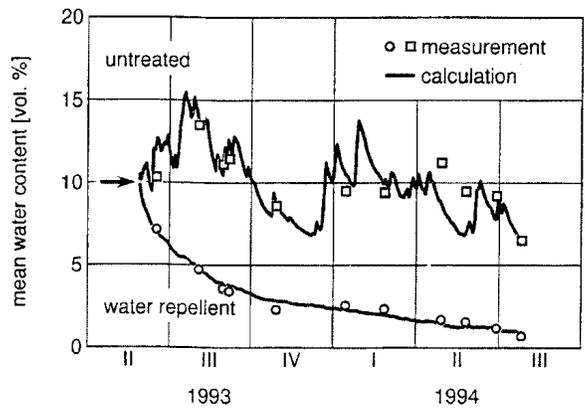


Extend Results / Enhance Understanding



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Hygrothermal Computer Modeling of Impregnated Brick and Brick Veneer Walls



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