


Water Penetration through Clay Brick Veneer Walls

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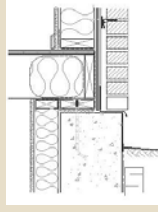


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Background

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- CSA S304.1-04 (R2010): Design of Masonry Structures specifies the minimum thickness of the exterior veneer to be
 - 75 mm for engineered walls (solid or hollow)
 - 90 mm for non-engineered walls



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Background

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- Codes
- Environmental impact
- Masonry industry
- Durability
- Architecture

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Summary of tests performed

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- Physical properties
ASTM C67: Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
- Water absorption
ISO 15148: Hygrothermal performance of building materials
- Initial rate of absorption
ASTM C67
- Mortar compression test
CSA A179-04: Mortar and Grout for Unit Masonry
- Modulus of rupture
ASTM E 518: Standard Test Methods for Flexural Bond Strength of Masonry




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Clay Brick Samples

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	Type A	Type B	Type C	Type D
	256mm x 90mm x 79mm	257mm x 75mm x 79mm	189mm x 90mm x 56mm	249mm x 75mm x 70mm



Brick	Weight	Length	Width	Height	Void Area	Contact Area	Void Volume	Net Volume	% of Voids
	kg	cm	cm	cm	cm ²	cm ²	cm ³	cm ³	%
Type A	2.57	25.60	8.96	8.00	52.74	204.80	421.92	1413.1	22.99
Type B	2.07	25.70	7.46	8.00	45.45	205.60	364.32	1169.5	23.75
Type C	1.38	18.96	8.94	5.62	37.65	106.56	211.62	741.02	22.21
Type D	2.19	24.92	7.52	7.00	24.61	174.44	172.27	1139.5	13.13

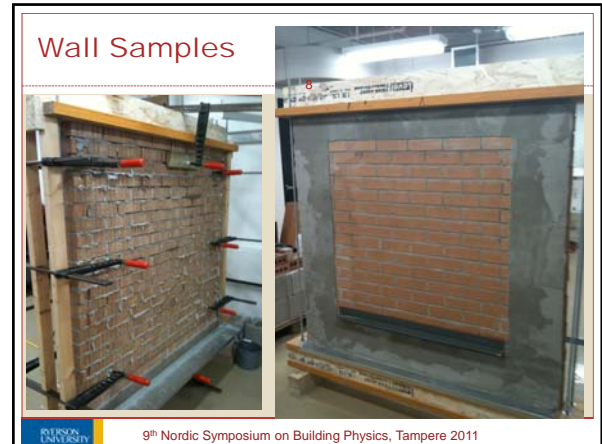
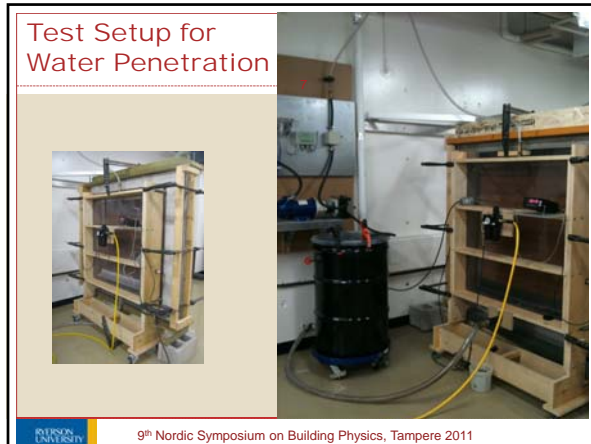
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Face absorption & IRA

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Brick / Mortar Samples	Water Absorption Coefficient	Initial Rate of Absorption
	kg/m ² /s	g/min/193.55 cm ²
Brick Type A	0.0230	13.16
Brick Type B	0.0706	36.55
Brick Type C	0.0556	20.84
Brick Type D	0.1133	33.76
Mortar Type S	0.0294	-
Mortar Type N	0.0462	-

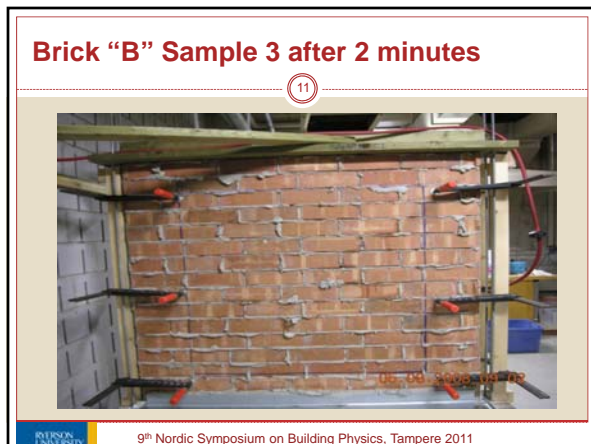
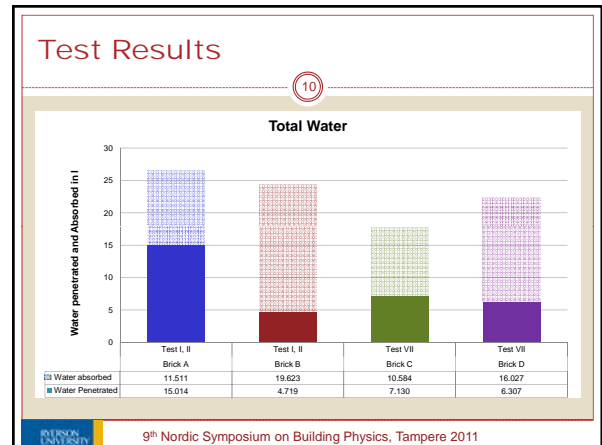
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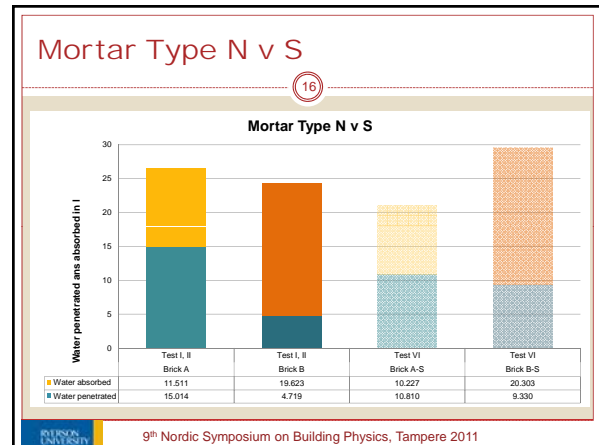
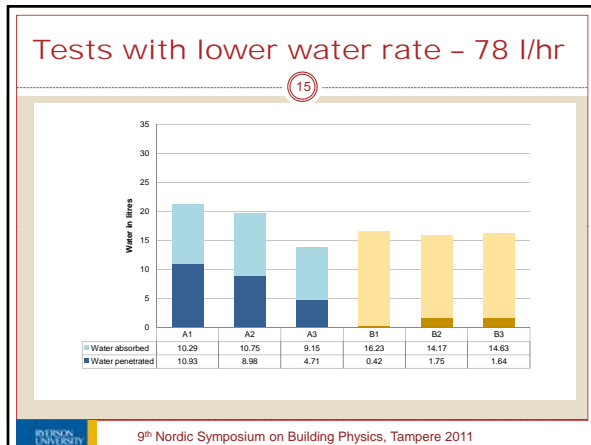
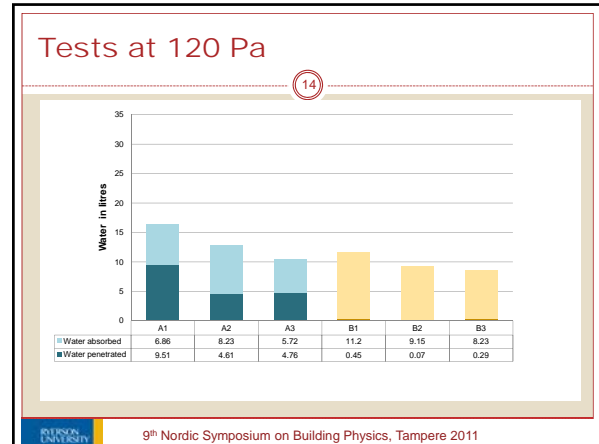
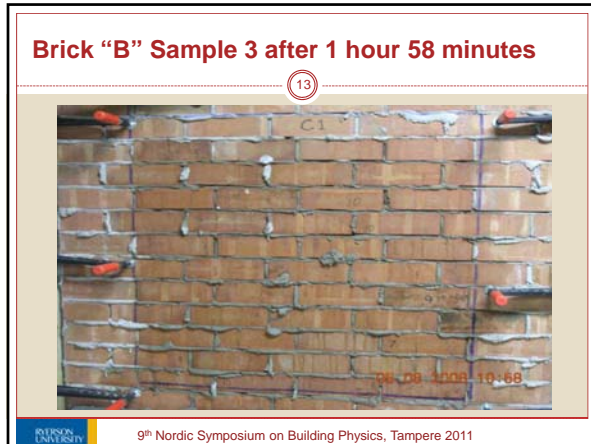


Test Summary

TEST	Brick A			Brick B			Brick C			Brick D			Mortar Type	Pressure in Pascals	Flow Rate in l/hr	Date
	1	2	3	1	2	3	1	2	3	1	2	3				
I	✓	✓	✓	✓	✓	✓							N	500	155	July, Aug. 2008
II	✓	✓	✓	✓	✓	✓							N	500	155	July, Aug. 2010
III	✓	✓	✓	✓	✓	✓							N	120	155	Aug. 2010
IV	✓	✓	✓	✓	✓	✓							N	500	78	Aug. 2010
V ¹⁾		✓			✓								N	500	155	Aug. 2010
VI	✓	✓	✓	✓	✓	✓							S	500	155	Sept., Oct. 2010
VII							✓	✓	✓	✓	✓	✓	N	500	155	Sept., Oct. 2010

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Conclusions

- The decrease in thickness of clay brick veneer wall does not significantly change the behaviour of the veneer wall with respect to water penetration.
- The magnitude of "the water problem" is of the order of 20 - 25 litres per 4 hours.
- Standard bricks allowed more water to penetrate while thinner bricks allowed for more absorption.
- Water penetration into the cavity is easier to deal with good construction practices of well drained cavity.

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Conclusions

- Water absorption is a potential problem as it may freeze in the brick due to drop in temperature over night.
- Wall behaviour with respect to water penetration and absorption is directly related to brick properties. More absorptive (thinner) bricks absorb more water, allowing less water to penetrate.
- Does not matter what but water appears in the cavity within a minute of a gust driven rain.

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Acknowledgments

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Thank you for staying for the last presentation!

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