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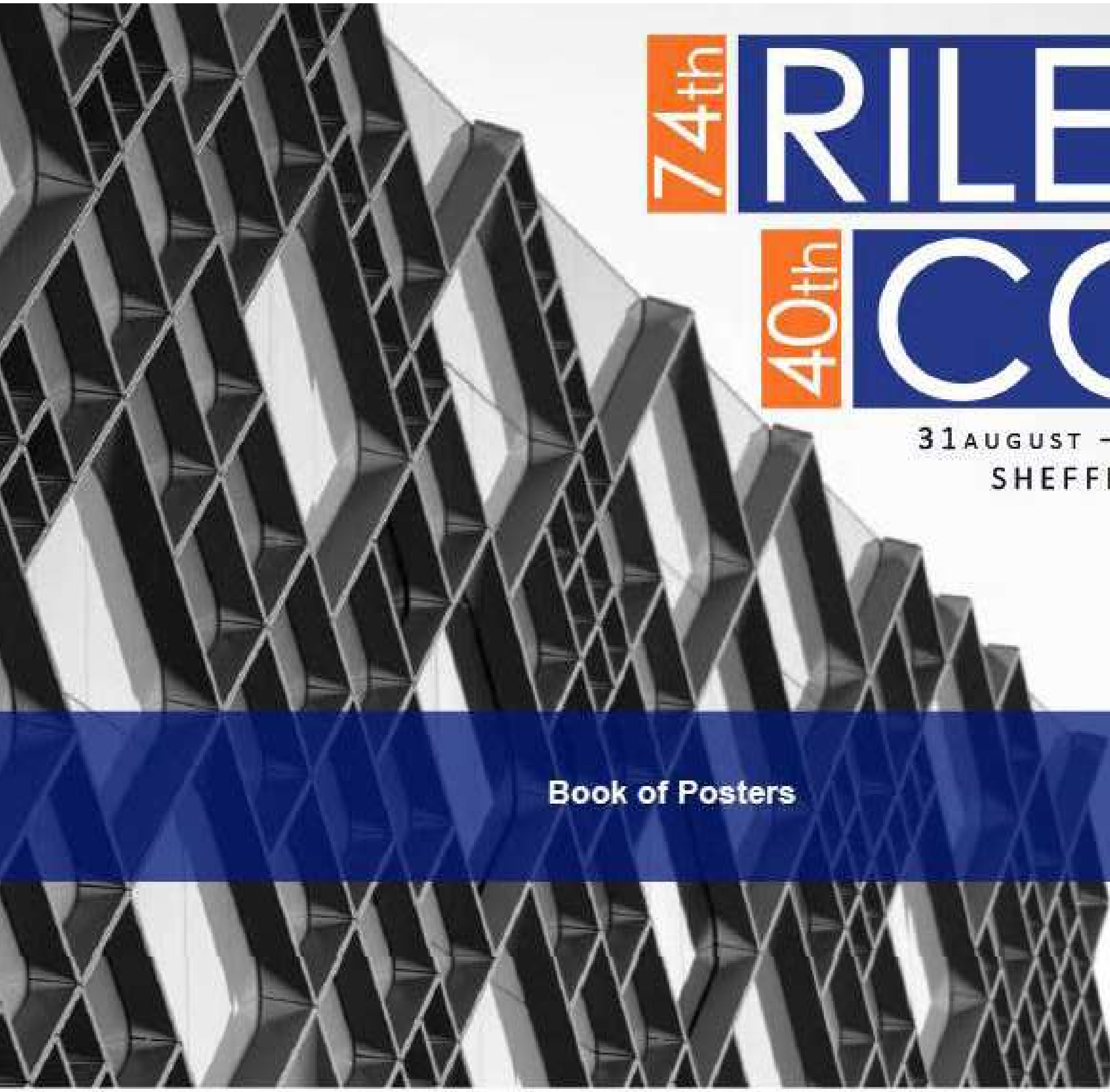

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A method for measuring the liquid permeability of mortar-masonry systems

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Introduction

Moisture transport through mortars is well researched, but mortars are typically studied in isolation which overstates a mortar's permeability[1]. A permeability test is being set-up to measure the liquid permeability of mortar-masonry systems. The saturated permeability, K_S, of porous building materials can be calculated using a range of permeability tests. Here a triaxial cell is being utilised in line with volume change transducers.

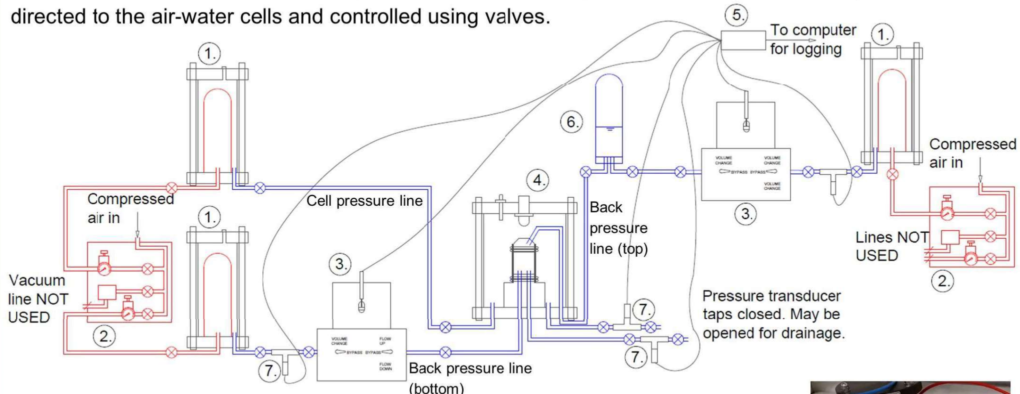
Equipment: Triaxial Cell

K_S can be obtained from falling head and constant head systems for $K_S > 10^{-7}$ m/s [2], though these tests are not accurate for low permeabilities. Low permeability materials with $10^{-17} < K_S < 10^{-11}$ m/s, can use an oil permeameter or Hassler cell to generate measurable flows[3-5], but this range is too low for some of the proposed materials. The adopted approach employs a triaxial cell in line with two volume change transducers. It is suitable for permeabilities of $10^{-11} < K_S < 10^{-5}$ m/s[6-7], making it appropriate for materials including limestone, sandstone, brick, mortar, and concrete.

The three taps on the right of the triaxial cell are for the cell pressure and two back pressure lines. The two taps on the left are for pressure transducers for measuring cell and pore pressures.

Experimental Set-up

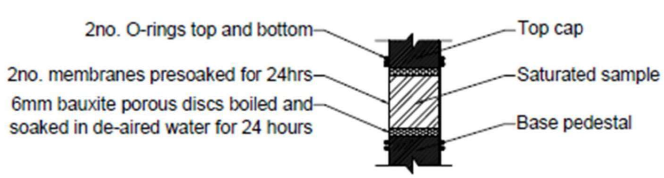
The permeability test is a closed system that uses de-aired water and compressed air. The de-aired water is used to fill the three air-water cells, one triaxial cell and all pressurised water lines. Compressed air is directed to the air-water cells and controlled using valves.



Number	Equipment
1	Air-water cell
2	Compressed air board with valves
3	Automatic volume-change unit
4	Triaxial cell
5	Data acquisition unit
6	Air trap
7	Pressure transducer

Compressed air is contained in a bladder in the air-water cell enabling the water to be pressurised without introducing air back into the de-aired water. One air-water cell is required for the cell pressure line and one more on each of the back pressure lines.

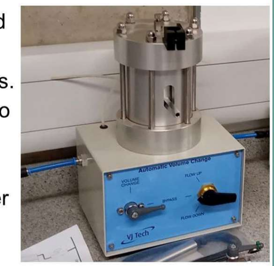
The back pressure lines lead to the sample top and sample bottom. Each back pressure line is controlled to create a hydraulic gradient which induces a flow up or down. The cell pressure is maintained greater than the maximum back pressure to prevent seepage. Samples are saturated beforehand to minimise entrained air



The whole system is flushed before use to remove trapped air. When running a test, any remaining air in the sample is caught in an air trap, preventing false readings in the automatic volume change unit.

Flow Measurement

The automatic volume-change unit is designed for detecting small volume changes in soils. It measures low flows to an accuracy of +/-0.05 ml. This gives an improved accuracy over falling and constant head methods.



Proposed Tests: Material Combinations

Mortar Binder	Substrate			
	None	Brick	Stone	Timber
CL90 S	✓	✓		
LP	✓	✓	✓	✓
NHL 2	✓	✓		
NHL 3.5	✓	✓		
NHL 5	✓	✓	✓	✓
CL90 Q Pebbled	✓	✓	✓	✓
CL90 Q Powdered	✓	✓		
None		✓	✓	✓

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