

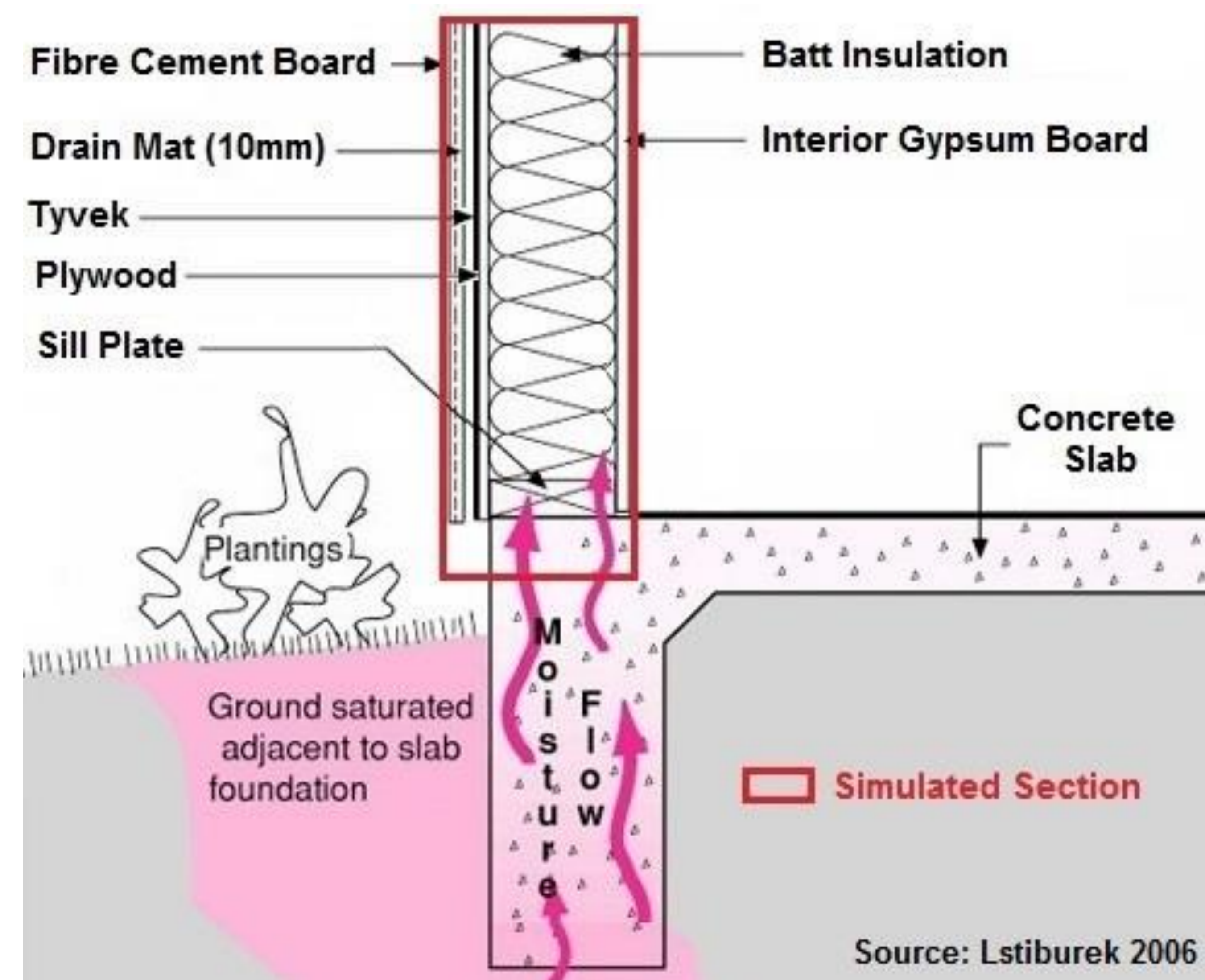
Experimental Investigation of Moisture Transfer between Concrete Foundation and Sill Plate

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Introduction

Concrete Foundation & Moisture

The foundation of a wood framed residential house may often be under continuous exposure with moisture mainly due to wet soil in a wet climate zone, high water table, or a combination of both, such as in Vancouver, BC, Canada. Unprotected concrete will absorb large amounts of moisture overtime. Although considered as relatively slow processes, driving forces including vapour diffusion and capillary action can still cause problems to wood structures if not addressed properly. Ground moisture migration can be as much as 105 pints (50L)/day (Brook, 1994). Sill plates directly in contact with the concrete foundation and studs above can suffer water-induced deterioration.



Source: Lstiburek 2006

Building Code

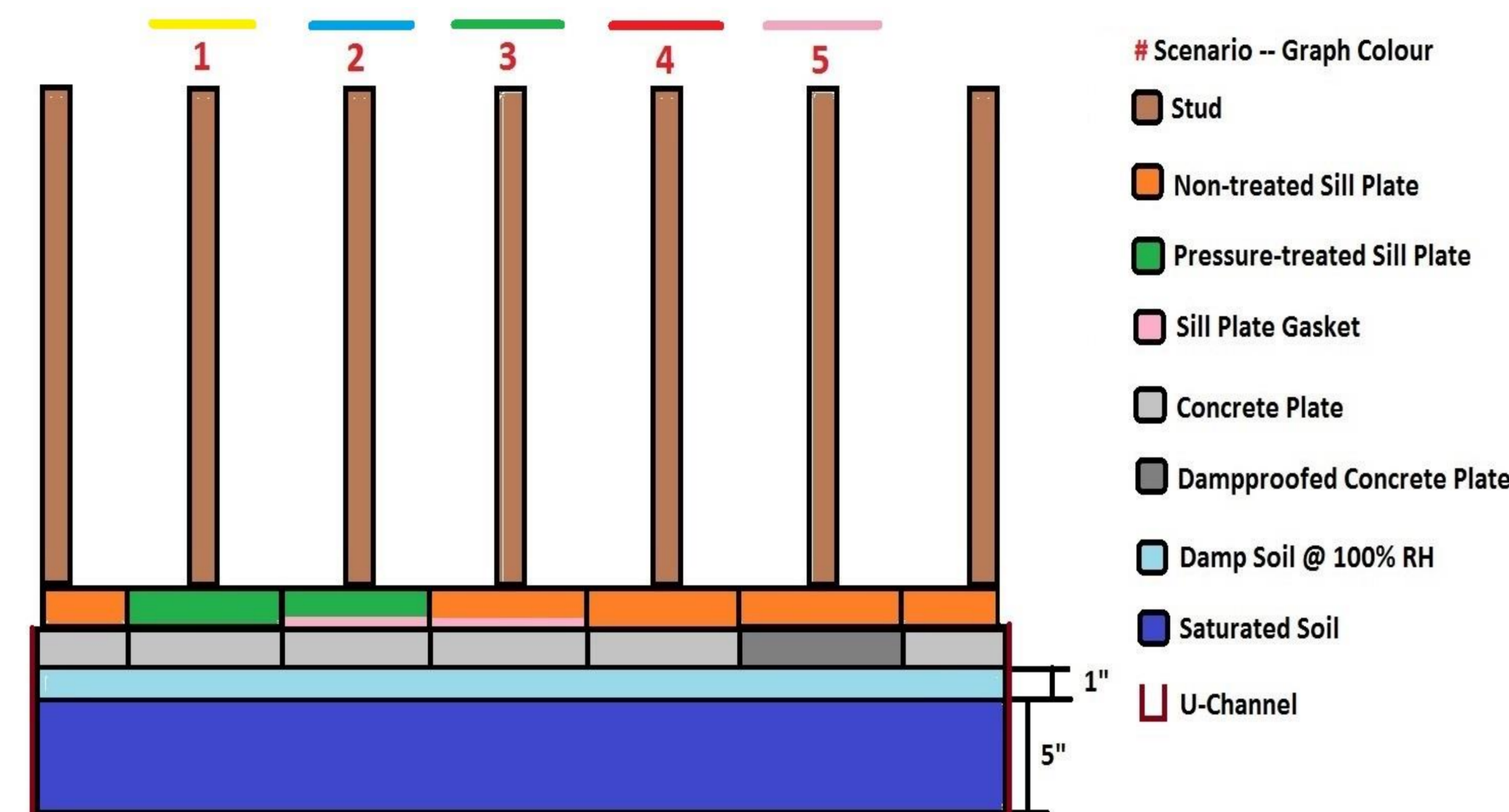
- International Residential Code (IRC) and British Columbia Building Code (BCBC) state that preservative-treated sill plates are required if used less than 8 inches above grade
- Untreated wood can be used if and only if the concrete foundation has been dampproofed
- Code requirements for wood-concrete contact might treat the symptoms of rot in the sill plate, but not the cause

Objective

The objective of the research is to study the rate of moisture transfer and distribution in the sill plates and studs with different concrete foundation-to-wood frame interface approaches that are commonly used in the industry today. The research investigates quantitatively, the effectiveness of sill gaskets as a moisture transfer retarder, in addition to its role as an air barrier.

Methodology

A wall frame with 5 different combinations of sill plate and foundation interface is fabricated, and placed in contact with saturated soil that is enclosed in an U-shaped channel. Water is supplied to the U-channel from a water tank through tubes to keep the soil moisture at saturation level. Using insulated moisture pins, moisture contents at different sections of the sill plates and studs are calculated based on measured electrical resistance and local temperature.



Experimental Variables

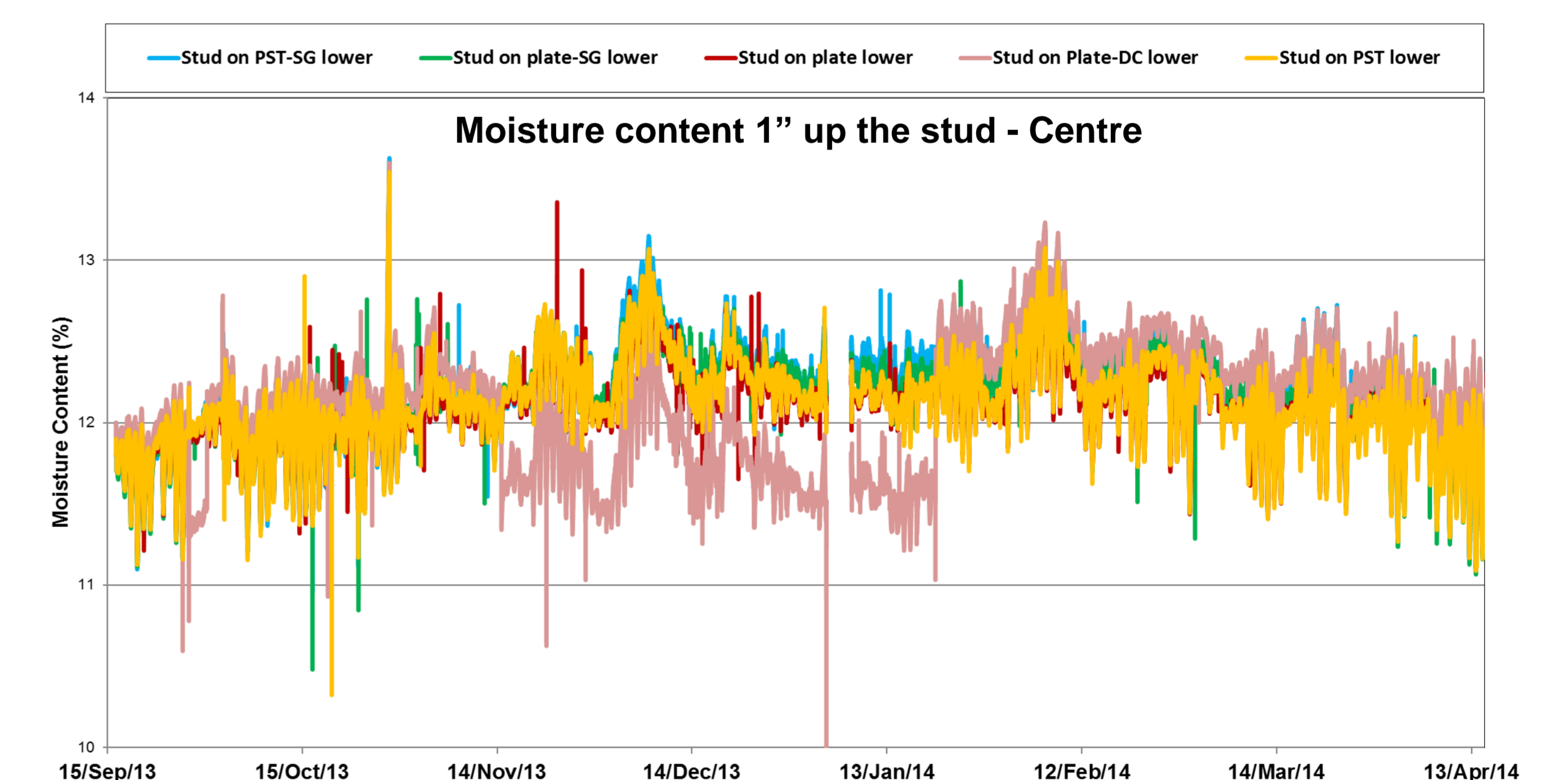
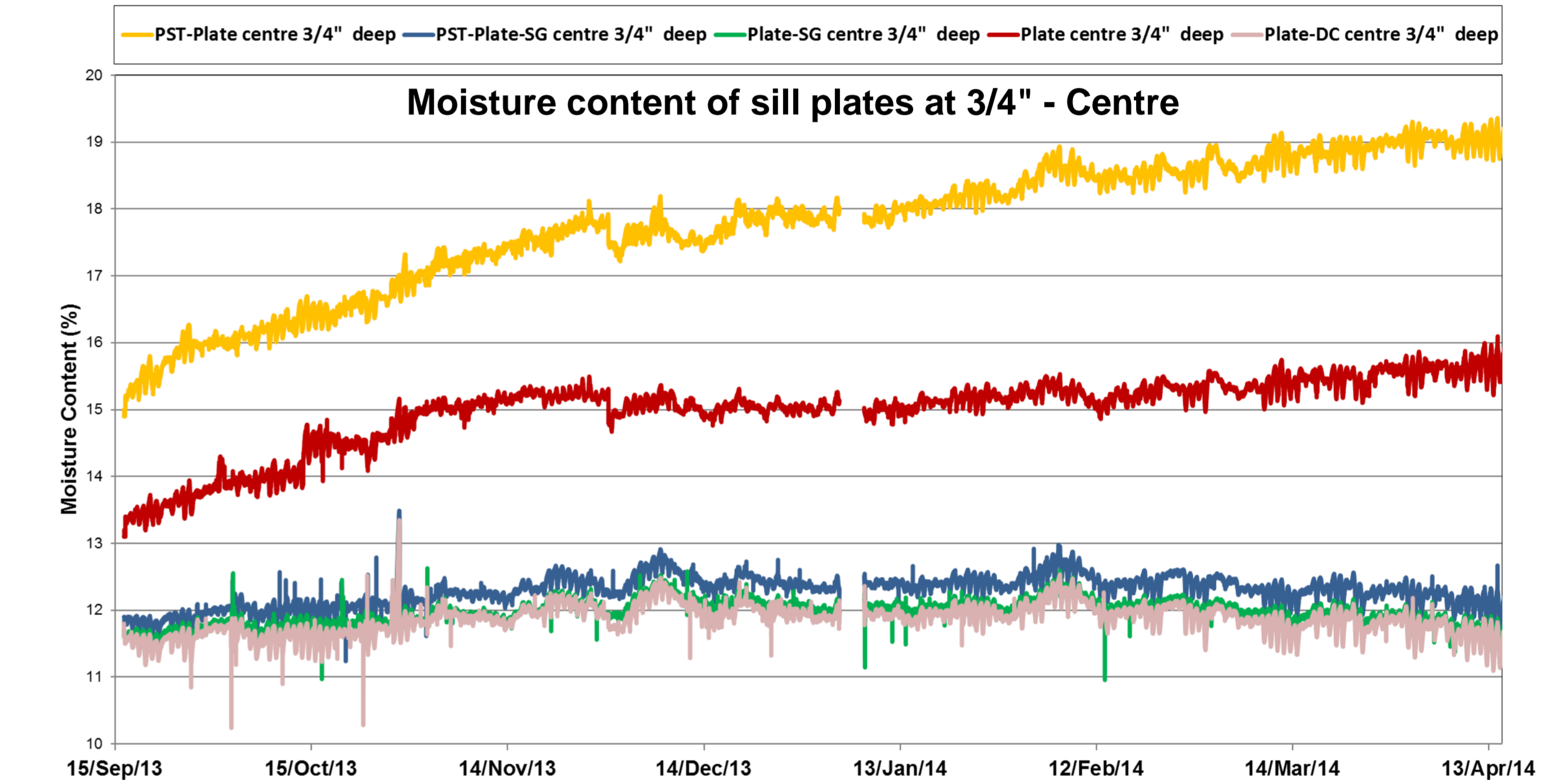
Five test scenarios with two experimental variables, sill plate and moisture barrier types, are considered in the study. Scenario 1 & 2 consist of pressure-treated wood (PST) while the others consist of standard lumber. Scenario 2 & 3 are fitted with sill gaskets (SG) and scenario 5 uses damp-proofing (DC) on the top side of the concrete plate. Scenario 4 is set up without any kind of protection from moisture with standard lumber in direct contact with the concrete plate.



Experimental Setup

The project is located at the Building Science Test Facility (BETF) at the British Columbia Institute of Technology in Burnaby. Five interface scenarios are setup side by side, each isolated by a vapour barrier. The moisture pins and thermocouples are located at different depths ($\frac{1}{4}$ ", $\frac{3}{4}$ ", $1\frac{1}{4}$ ") on the sill plate as well as different heights (1", 3", 7") on the stud. The custom built U-channel is lined with membrane and sealed with caulking. Concrete plates are placed snugly above the damp soil in the U-channel with the water tank connected. The concrete plates are constantly in contact with damp soil that is conditioned at approximately 100% relative humidity. The temperature and moisture contents at different sections of sill plates and studs are then continuously recorded and analyzed.

Preliminary Results



Conclusion

- Scenarios with sill gaskets demonstrated the least amount of overall increase in moisture content in the sill plate
- Damp-proofing of the concrete appeared to be the second best option next to sill gaskets
- The moisture content at all locations for the studs have similar values, between 11% to 13% during the test period
- Due to the short duration of the experiment, moisture hasn't reached to the stud just yet
- The experiment is on-going and updated results will be presented