Experimental Investigation of Water Penetration and Thermal Insulation Properties of Semi Interlocking Masonry (SIM) Walls

A Thesis Submitted for the Degree of

Master of Philosophy

By

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B. Eng.

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AUSTRALIA
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Yuri Totoev
Related conference

Experimental Investigation of the Water Penetration through Semi Interlocking Masonry (SIM) Walls
R. Forghani, Y. Totoev, S. Kanjanabootra, AIJ annual meeting Sep 2014.

Contribution

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Related paper

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R. Forghani, Y. Totoev, S. Kanjanabootra, A. Davison, Manuscript in preparation for publication.

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Abstract

The semi interlocking masonry (SIM) was originally designed and developed at the University of Newcastle for use in seismically active zones as an energy dissipation device in buildings. Interlocking SIM bricks are the primary units used in mortar-less walls or panel construction and are available in two types: mechanical (which use dowels) and topological (which use particular shapes). The interlocking prevents the relative out-of-plane movement, but allows for longitudinal relative movement along bed joints. As a mortar-less masonry system, SIM has unavoidable gaps in both its bedding and perpend joints. This reduces the overall performance of SIM walls in terms of thermal efficiency and water penetration.

The main objective of this study was to evaluate water penetration and the thermal performance properties of dry-stacked SIM walls. Additionally, this study aimed to determine whether an alternative construction technique (i.e., the use gap-fillers) led to any improvement in the properties. Two standard test methodologies (i.e., ASTM E514 and C1363) were used to evaluate water and heat transfer through walls. Non-adhesive putty and foam tape were used as gap-fillers to examine the potential improvement in restricting water and heat transfers and their suitability for intended application.

In the water penetration experiment, the performance results of a traditional masonry wall were used as the benchmark against which the results of the SIM wall were compared. The results of the water penetration tests showed a high volume of leaked water through the dry-stacked SIM wall compared to the gap-filled SIM wall. The traditional masonry wall had the least amount of water leakage followed by the topological SIM wall that used putty. However, the area of dampness in the traditional masonry wall was higher than the area of dampness in the gap-filled SIM walls.
In the second part of this study, a hot box apparatus was used to evaluate the thermal properties of the gap-filled SIM walls. The results of thermal tests showed that the thermal resistance of the SIM wall was equal to the traditional concrete masonry wall. It was also found that the type of gap-filler used had a slight effect on the thermal performance of the SIM walls. However, the SIM walls with the putty was more thermally efficient.