Energy & Low-Income Tropical Housing

EWP IIB-8 "ISSB Walling Research - Experimental data from East Africa"

NHBRA, UMU & Warwick University 2009-16

This ELITH Working paper, and its subordinates EWP IIB-8-1 to EWP IIB-8-8, record data gathered in East Africa relating to the performance of ISSB walling. They are published in the hope the data will have some value to building material researchers in East Africa and elsewhere.

All the data relates to unmortared masonry of stabilised-soil blocks. Omitting mortar from block-walling can significantly reduce its cost and its contribution to greenhouse-gas emissions. However unmortared but interlocked stabilised-soil masonry (i.e. of ISSBs), especially if hand-moulded and hence not very accurate, has a low stiffness and low resistance to out-of-plane forces. It also is likely to be seriously 'out-of-plumb', the top course overhanging the base course. Therefore many field experiments and laboratory experiments have been performed to investigate this lack of stiffness and lack of straightness of ISSB walling. The most extensive experiments – in a laboratory and using a large set of quite accurate half-sized ISSBs - were performed by Simion Kintingu, sometime NHBRA Director, as a PhD student at Warwick University and are fully described in his thesis: Kintingu S, 2009, *Design Of Interlocking Bricks for Enhanced Wall Construction Flexibility, Alignment Accuracy and Load Bearing*.

Since 2009 however, a number of field trials have been undertaken in East Africa, many in collaboration between Warwick University, NHBRA (Tanzania) & Uganda Martyrs University. The data from these is recorded in this EWP IIB-8 series of ELITH working papers, usually accompanied by some analysis and discussion. Most of these trials have been performed employing a block design developed at NHBRA. The design allows neat fully-interlocked corners and tee joints to be produced, blocks to be reversed if desired and some hollowness to be incorporated in them. However production is only by manual press (pressures up to 2MPa) and block accuracy is often poor. Typical block size is 300mm x 150mm x 100mm, with interlock features only on the top and bottom faces.

There are a number of techniques that have the potential to improve the stiffness, strength, straightness or all three, of ISSB walling. These include:

- Preselection of blocks to remove those most distorted
- Grooving to prevent block-to-block contact occurring close to a wall's centreline
- Cleaning to remove small protuberances
- Laying blocks while they are still 'green'
- Selectively reversing blocks during assembly
- Micro-mortaring, e.g. using mortar under 1mm thick
- Post-construction 'pointing' or the injection of a fine mortar filler
- Applying a cementitious render
- Applying a fibre-cement render
- Careful selection of the ingredients of any stabilised soil mix
- Changes to the wall plan, e.g. from straight to crenelated.

With the exception of changes in wall-plan, all these techniques can be applied to a column of blocks. Experimental work is much easier and cheaper to perform with block-columns than with complete walls and therefore most of the data presented was derived from tests on 300mm x 150mm columns of height 1.0 to 1.5m

The component ELITH working papers making up EWP IIB-8 are as follows:

EWP IIB-8-1	ISSB column stiffness data A Kagadi 2009 McDonald M, Stegman A, Coker L, Maxwell A, Simmonds M, Taylor N, African Field Course Project Report, Excerpt pp 10-25
EWP IIB-8-2	ISSB column stiffness data B Kagadi 2010 African Field Course Project Report
EWP IIB-8-3	ISSB Column stiffness testing (C) UMU 2013, Le Conte, Price, Riat & Shore, African Field Course Project Report (pdf)
EWP IIB-8-4	ISSB column stiffness Data D NHBRA 2016 F Qamar (Warwick Uni), B Chilla & H Hatibu (NHBRA) Effect of column-plastering with & without fibres in plaster
EWP IIB-8-5	Crushing experiments with ISSBs NHBRA 2016 F Qamar & A Juma Comparison of block strength with prism (2x2 blocks) strength
EWP IIB-8-6	Small structure to investigate the stiffness of ISSB Walling UMU 2014 Naidoo J, Yeung V & Harding R, African Field Course Project Report 3m x 3m ISSB house with 3 walling variants
EWP IIB-8-7	Lateral stiffness of crenelated walls plans NHBRA Jul 2016 F Qamar, H Hatibu, TH Thomas Comparison of a 3m crenelated wall and a 3m straight wall.
EWP IIB-8-8	ISSB Block and Column tests in Dar Mar 2016.xls H Hatibu, B Chilla, TH Thomas 140 ISSBs & 60 columns measured for overhang and lateral stiffness