Submission for the Symposium on Construction Ergonomics

Submitted by: Nadine Marks Construction Safety Association of Ontario
Peter Vi

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Optimal Ergonomic Design of Concrete Cellular Block

In the near future, builders may have the option of using concrete cellular blocks (CCB) instead of compressed wood to build residential housing walls and foundations. This is mainly due to increased cost of lumber and the inferior quality of compressed wood. Furthermore, residential housing which are built with CCB will have a decreased risk of fire(higher fire rating) and termite problems.

Presently, there are three types of block design. The mass of the three types of block design varies between 16 kg and 19.5 kg, depending on the moisture content. These blocks are used to construct a wall or foundation in a similar work procedure as layering bricks and concrete blocks. However, the three types of CCB will require less number of blocks per specific area then building with bricks.

An earlier study conducted by the present authors revealed that the major concerns with the present CCB design are that they are not easy to handle, and may expose workers to high risk of low back injury. This is mainly due to the awkward size, and heavy weight of the CCB. To increase the efficiency of the working process with the CCB and also to decrease the risk of injury, this study group will re-evaluate the existing CCB design and two proposed re-design CCB and determine which design features will decrease the risk of low-back injury and increase work efficiency.

To objectively determine which CCB design is safer and easier to handle, six male participants were asked to perform lifting of the old-design, and new-design (version 1 B grip located at the top), and new-design (version 2 B grip located at the bottom) blocks from the floor to a tabletop (31@ from the ground). For each CCB design, the participants were asked to perform six repetitive lifting of each block design. While the volunteered participants were performing the lifting task, videotape of the participants= working postures were performed. After videotaping the participants, the videotape and the weight parameter of the blocks were used to estimate the L4/L5 trunk moment, and spinal compression and shearing forces (dependent variables).

Results from the experiment shown that weight of the block, and block design are both statistically significant ($p<0.05$) effect the dependent variables. For all dependent variables, post hoc test using Tukey=s method, show that old design (19-kg block) is significantly ($p<0.05$) higher than 12-kg block with grips located at the top. No significant differences ($p>0.05$) between existing design and new-

design (version 2 B grip located at the bottom) were found for all dependent variables. Based on these findings, it is concluded that the new design, with grip located at the top, is safer to handle in terms of predicted injury rate and worker acceptance of the blocks than the original design.