# Flexural Strength of Autoclaved Aerated Concrete Masonry Subjected To Out-Of-Plane Horizontal Loading. Research Aim, Programme and Methodology

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***Abstract* – The current article is focused at problem of estimation of flexural strength with planes of failure parallel and perpendicular to the bed joints of autoclaved aerated concrete thin-bed blockwork subjected to out-of-plane horizontal loading. Aim, research tasks and programme of experiment are presented.**

Key words – flexural strength of masonry, cellular concrete, blockwork, out-of-plane horizontal loading, research program

## I. Introduction

Cellular concrete masonry systems are becoming more and more popular not only in Ukraine but throughout the world. Nowadays our country is going through stage of substitution of old design codes and harmonizing them with Eurocodes but also creating new design codes to cover newly arisen spheres in civil engineering and building production. One of such documents is DSTU B V.2.6-195:2013 "Construction of walls of autoclaved aerated concrete. General technical conditions" [1]. This document sets the classification of walls dividing them to external and internal, both of them being load bearing and non-loadbearing.

As for internal non-loadbearing walls standard states that they are subjected to only one load factor – theirs own weight, but obviously they can be loaded horizontally by wind through open windows or by doors or other equipment.

DSTU B V.2.6-195:2013 provides general rules for calculation of bearing capacity of autoclaved aerated concrete thin-bed blockwork subjected to out-of-plane horizontal loading but characteristic flexural strength of masonry having a plane of failure parallel to the bedjoints, $f_{xk1}$, is set in one line of table depending only on type/strength of mortar and characteristic flexural strength of masonry having a plane of failure perpendicular to the bedjoints, $f_{xk2}$, is set in two lines depending only on type/strength of mortar and density of aerated concrete. This document allows also to clarify strength by the experiment but allowed increase should not be above 20% of table values.

The problem is that current standard doesn't take into account that flexural strength of masonry having a plane of failure perpendicular to the bedjoints $f_{xk2}$ can't be greater than the flexural strength of the masonry unit (this note is present in EN 1996-1-1:2005 [2] and DBN V.2.6-162:2010 [3]. Another problem lays in different shapes and sizes of blocks used in building industry. The ratio of thickness to width of masonry units made of aerated concrete varies greatly (in thin non-loadbearing walls there are usually used blocks with height more then 200 mm and theirs thickness is 100 mm or less ) thus we suppose that it should affect flexural strength of masonry.

## II. Aims and Objectives

Taking into account statements above the main aim of our research is experimental measuring of flexural strength with planes of failure parallel and perpendicular to the bed joints of autoclaved aerated concrete thin-bed blockwork subjected to out-of-plane horizontal loading. We decided to be focused on relatively thin masonry (100 mm thickness) as such type of blockwork is used in internal non-loadbearing walls that are the most flexible walls in a building and ratio of height to width of masonry unit used in such type of walls is most unlike the ordinary block or brick.

In order to reach aim of research we need to accomplish several tasks that are as follows:

– to perform literature review ;

– to check declared compressive strength of cellular concrete masonry units and obtain other physical properties of concrete;

– to design and manufacture laboratory models of thin masonry that meets our aim;

– to determine experimentally bearing capacity of autoclaved aerated concrete block masonry subjected to out-of-plane horizontal loading with planes of failure parallel and perpendicular to the bed joints;

– to test mortar specimens and masonry units in order to measure compressive strength of mortar and flexural strength of masonry unit;

– to compare obtained results with characteristic strength of masonry subjected to out-of-plane horizontal loading provided by [1, 2, 3];

– to prepare some recommendations or amendments to current design code for aerated concrete masonry.

Following programme and methodology of experiments are proposed.

## III. Experimental Programme and Methodology

For experiments we designed 2 types of specimens and prepared 6 masonry fragments, 3 identical specimens per each type of failure in order to solve research tasks mentioned above. The shape of test specimens is shown on Fig. 1. Each specimen consisted of four masonry rows with 1.5 or 2 blocks in a row.

As cellular concrete masonry units we used prefabricated autoclaved aerated concrete blocks AEROC Classic (D500 density grade) with declared compressive strength not less than C2.5 class. Nominal sizes of blocks were 600×200×100 mm.

Blockwork was made with thin mortar layers with the depth of the mortar set to 3 mm or less. Pre-mixed cement-based mortar produced by local manufacturer (TERMIT™ TK-16) was applied to the bed joints and perpends. Simultaneously there were prepared 3 cubes from the same mortar measured 70.9×70.9×70.9 mm to be tested for compressive strength. Testing to be performed under GOST 5802-86 requirements.

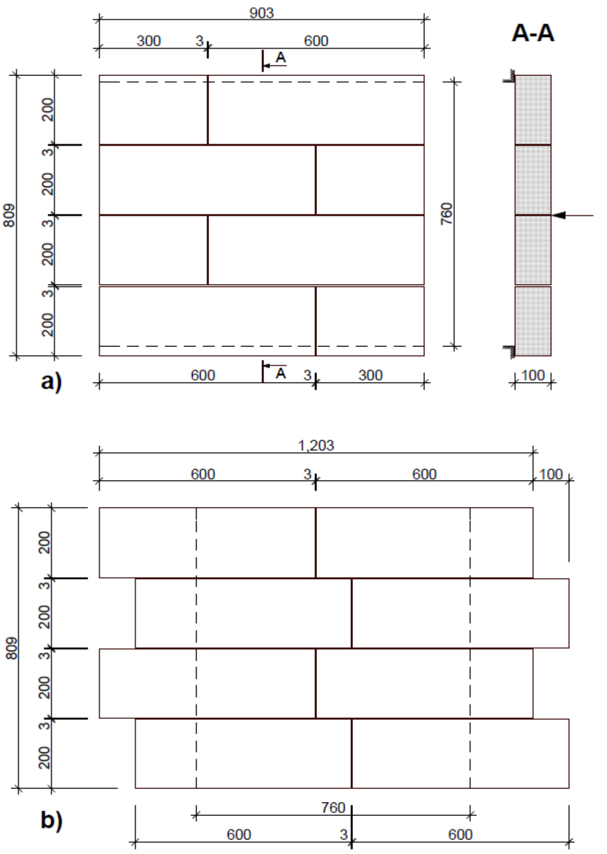


Fig. 1. Shape of test masonry specimens:
a) with plane of failure parallel to the bed joints;
b) with plane of failure perpendicular to the bed joints

Completed blockwork specimens were left for hardening for a week. Before the experiment there were drilled two holes in masonry elements to mount steel plate with rings for applying uniformly distributed load along central cross-section of element (marked by arrow on Fig.1, a), A-A). The specimens were tested in horizontal position as one-span beams loaded in the middle of span with clear length of span equal 760 mm. The location of supports' edges is also shown on Fig.1, a) and b) by dashed lines. Loading was applied by hanging of previously weighted loads and was carried up with steps of approx. 10 kg. On every stage delays were made for 1-2 min. The common view of experimental stand is shown on Fig. 2.

Specimens were loaded until theirs failure and maximum value of load was used to calculate flexural strength of masonry. After main experiments on flexural strength three cubes of 100 mm edge were sawn from blocks that were not damaged to obtain aerated concrete physical properties. They were weighed to check declared density grade of blocks and compressed to check declared compressive strength. Another three blocks were bent until fracture using a three point flexural test technique to estimate flexural strength of aerated concrete.

Fig. 2. Common view of experimental stand

## Conclusion

Modern Ukrainian design code for cellular concrete blockwork construction [1] sets even more narrow requirements then [2] and [3]. We suppose such strict statements caused by not only relatively low strength of cellular concretes but also few and fragmented scientific researches on the topic of flexural strength of cellular concrete block masonry. This paper is devoted to the beginning of experimental studies in the field of flexural strength of aerated concrete thin-bed blockwork estimation. Aim, research tasks, programme of experiment and methodology in details are presented.

## References

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