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Autoclaved Cellular Concrete (ACC) Masonry with Vertical Hollows Confined with Disperse Reinforced Concrete

Răzvan Andrei Iernutan[a,]*, Florin Babota[a]

[a]15 Constantin Daicoviciu Street,400020 Cluj-Napoca, Romania

Abstract

Buildings that incorporate masonry structure in countries with high seismic values are restrained by the norms in terms of force, to be used as plain masonry taking into account their fragile behaviour under alternating actions. In order to improve the masonry behaviour under seismic actions, an association of plain masonry with reinforced concrete was made to reach confined masonry with columns and belts, reinforced core masonry, or reinforced void masonry, etc. Consequently the research began on the autoclaved cellular concrete (ACC) masonry behaviour in the case of buildings erected in seismic areas and was focused upon the analysis of autoclaved cellular concrete (ACC) masonry with vertical hollows confined with disperse reinforced concrete when applied in low rise masonry buildings and which are situated in low seismic areas. The research was also justified by the fact that gas formed concrete exhibits several benefits as compared to brick masonry, namely: better thermal insulation, less manual work, reduced weight and implicitly lower seismic loads. The association of autoclaved cellular concrete (ACC) with disperse reinforced concrete in the case of confined masonry leads also to the removal of formwork and of reinforcement cutting. In this context the research is mainly concerned with the behaviour of autoclaved cellular concrete (ACC) masonry confined with columns and belts of steel fibre disperse reinforced concrete, both from theoretical and experimental viewpoint.

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Keywords: autoclaved cellular concrete (ACC) masonry; disperse reinforced concrete; vertical hollows; conventional confination of masonry; modulus of elasticity.

* Corresponding author. Tel.: +40-722-274878.
E-mail address: razvan.iernutan@ccm.utcluj.ro

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1. Introduction

A detailed description of aerated concrete in terms of physical, chemical, mechanical and functional was done by Narayanan&Ramamurthy [1]. Costa et al. [2] studied the seismic performance of autoclaved aerated concrete (ACC) masonry from experimental testing of the in-plane capacity of walls to building response simulation. Studies were also done regarding the ergonomic evaluation of masons laying concrete masonry units and autoclaved aerated concrete [3].

The design code for masonry structures CR6 – 2006 and P100/1 – 2006 chapter 8 did not allow the use of autoclaved aerated concrete (ACC) in structural walls and nonstructural walls (including filling panels not in action with the frames) for the 1st and 2nd classes of importance structures because the compression strength (f_b) of masonry elements was required to be minimum 7,5 N/mm^2, while autoclaved aerated concrete (ACC) elements had only 5 N/mm^2. In such context, the research performed aimed at making a theoretical and experimental analysis of a new type of autoclaved aerated concrete (ACC) masonry (Fig. 1).

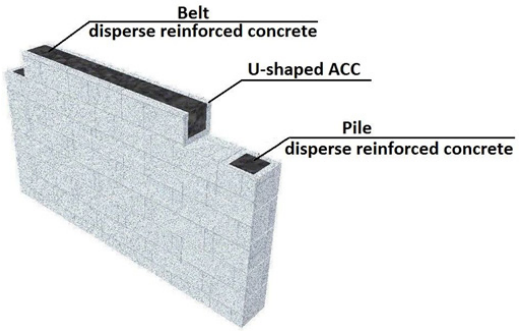

Fig. 1. Autoclaved aerated concrete (ACC) confined with disperse reinforced concrete piles

The research wants to find alternative solutions to the conventional reinforcement of the masonry in areas of low seismicity, namely the confination with concrete piles and belts, specified in the Romanian standards in force, by replacing concrete piles with vertical voids with ACC masonry filled with metal fiber disperse reinforced concrete. The presence of the composite materials allowed the development of technologies for both strengthening and raising new constructions. The selection of the type of fibre is made in accordance to the influence it has upon the composite material properties. It is well-known that unreinforced concrete undergoes a breaking failure and it turns to a ductile behaviour if fibres are added. The association of the masonry with the disperse reinforced concrete, when confined with disperse reinforced concrete piles or belts may increase masonry ductility and consequently avoid a breaking failure under seismic actions.

2. The experimental program regarding unreinforced ACC masonry elements and modules confined with disperse reinforced concrete

In order to highlight the behaviour of disperse reinforced concrete confined ACC masonry the author designed an experimental program to study:

- the mechanical strengths for ACC, and disperse reinforced concrete;
- the modulus of elasticity of ACC;
- the resistance to compression for the simple masonry module and confined with disperse reinforced concrete;
- the resistance to shear for the simple masonry module and confined with disperse reinforced concrete;
- the resistance to bending normal to the module plane for the simple masonry module and confined with disperse reinforced concrete;
- the σ-ε curves for the simple and confined masonry;