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Experimental characterization of AAC masonry in shear: effect of block density, mortar and test setup

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Abstract

The paper discusses the results of an experimental program devoted to the characterization of AAC masonry in shear, by studying the effect of different key parameters: test setup, block density, and mortar type. As for ordinary masonry assemblages, shear parameters of AAC masonry can be determined from either shear tests on triplets or diagonal compression tests. However, the extension of these methodologies to AAC blocks with low densities is not so straightforward and highlights some critical issues. To evaluate the influence of block density (and block strength) on the shear parameters and on the observed modes of failure, masonry triplets and diagonal compression specimens were performed for AAC blocks characterized by two different densities (300 and 480 kg/m^3). Moreover, for the higher density class, tests were repeated by also varying the mortar type. Although most of Standard codes mainly relates the shear resistance of thin-layer masonry to the block material, the obtained results highlight that also the mortar type and the surface treatment before mortar application may have a not negligible influence on the final behavior.

Keywords

AAC, shear, density, triplets, diagonal compression, AAM mortar, experimental tests

1 Introduction

In masonry structures, bond between blocks and mortar plays a crucial role in ensuring a good in-plane and out-of-plane wall behaviour, especially under seismic actions [1-3]. Bond strength is in turn related to the initial shear strength (adhesion) and to the friction coefficient, and depends also on the normal stresses acting on the wall, according to the well-known Mohr-Coulomb criterion. In Europe, the experimental characterization of masonry in shear is usually performed according EN 1052-3 Standard [4], which allows following two different procedures. In both cases, a triplet test framework is recommended, with and without the application of lateral compression. In the first case, the test only provides the initial shear strength of the masonry, under zero compressive load; while the second procedure also allows the determination of the friction coefficient, through a linear regression of the results obtained by varying the value of lateral compression. While these experimental procedures have been deeply verified in the past for small-size solid masonry units (typically clay bricks), their extension to other types of masonry, like AAC, although routinely performed by Manufactures' laboratories, is not so straightforward. The test setup suffers indeed of some drawbacks, whose effects may be amplified in the case of larger and, in some cases, less resistant blocks (i.e., blocks with lower density). First of all, it has been observed in [3] that the lever arm of applied loads causes the appearance of bending in the mortar joints, and therefore the distribution of normal stresses along the joints themselves is not uniform. Furthermore, stress concentrations may arise near the corners of steel plates (adopted in the test setup for guaranteeing load redistribution and for constraint application), and therefore this can alter the evenness of stresses at the ends of mortar joints and sometimes may also lead to crushing of AAC blocks. Finally, when prestressing is applied, further problems may arise, related to the difficulties in keeping the lateral compression load constant during the test [5].

In some European countries, like Italy, National Standards (e.g., [6]) also allow the experimental determination of the shear strength of masonry assemblages through diagonal compression tests carried out according to ASTM E519/519M [7]. In that case, masonry shear strength is determined through the application of a vertical compression load on a square masonry specimen inclined at 45° with respect to the horizontal direction, so causing a diagonal tension failure. For AAC masonry, this test usually leads to the formation of a crack along the specimen diagonal between the applied loads, rather than on a plane parallel to bed joints. Therefore, the equation suggested by ASTM E519/E519M appears to be conservative in determining the shear stress acting along bed joints, as highlighted in [8].

This work discusses the results of an experimental program devoted to the characterization of AAC masonry in shear. Besides comparing the two above-described test procedures, in order to highlight their limits in case of AAC blocks, the experimental program also aimed at investigating the influence of material density and mortar type on shear strength and failure mode. Manufactures usually provide the initial shear strength of masonry in their technical sheets only for structural blocks (i.e., with higher densities, around 500- 600 kg/m^3); however, the knowledge of this parameter is important also in case of lighter, non-structural blocks, that are often used for the realization of infills in framed buildings. Indeed, the knowledge of strength, stiffness, and failure mode of infills is often required when evaluating the seismic response of framed buildings, according to the principles of performance-based earthquake engineering [9]. Finally, since AAC masonry is realized with thin mortar layers, it is generally accepted that mortar does not affect masonry strength, also according to Eurocode 6 [10] provisions. However, experimental results demonstrate that mortar composition and the preliminary surface treatment of the blocks may have a not negligible influence on the final results.

2 Materials

2.1 AAC blocks

In the performed experimental program, 600 mm x 250 mm x 240 mm commercial AAC blocks produced by an Italian Manufacturer were used. Two different nominal densities were considered, namely ρ_1 = 300 kg/m^3 and ρ_2 = 480 kg/m^3, respectively corresponding to non-structural blocks (for infills) with high thermal insulation performances, and to structural blocks to be used in non-seismic areas. Basically, the difference in material density was obtained through the addition of a different amount of aluminium powder, working as expanding agent, in the green cake during the manufacturing process.
A preliminary mechanical characterization of AAC material was performed in the initial stage of the research, whose results are discussed in [11, 12]. Table 1 summarizes block density, compressive and flexural tensile strength, as well as elastic modulus, which were determined on many specimens conditioned at a moisture content of 6±2% according to relevant Standards [13-16]. Compressive tests were also repeated on a limited number of cubes belonging to the same AAC supply used for the assembly of triplets and masonry panels for diagonal compression (2 specimens formed by 3 cubes with an edge length of 100 mm, for each examined density). The average compressive strengths obtained on these last specimens were comparable with those reported in Table 1, being respectively equal to 1.80 MPa in case of density ρ_1 = 300 kg/m^3, and 4.13 MPa for ρ_2 = 480 kg/m^3. The moisture content of AAC blocks at the time of testing was also verified on 3cubes extracted from triplets and 3 from masonry panels for diagonal compression tests, and it resulted equal to 2.80% and 2.76 %, respectively.

Table 1 Mechanical characterization of adopted AAC blocks [11, 12]

Property	**ρ_1=300 kg/m^3**	**ρ_2=480 kg/m^3**
Density	295 kg/m^3	506 kg/m^3
Compressive strength	1.93 MPa	3.94 MPa
Flexural tensile strength	0.65 MPa	1.13 MPa
Elastic modulus	800 MPa	1566 MPa

Testing masonry specimens realized with large size blocks is not so straightforward, due to common limitations of testing equipment in most laboratories. For this reason, it was decided to cut the blocks before specimen assembly, in order to reduce their final dimensions. As regards tests on triplets, Raj et al. [1] suggested to use scaled AAC units with size 250 mm x 100 mm x 50 mm, being so similar to the dimensions of standard clay bricks. However, since the height of standard AAC block is larger than 200 mm, the same EN 1052-3 Standard [4] allows the use of specimens with reduced dimensions, according to the scheme of Figure 1. Therefore, this approach has been preferred herein for the realization of triplets, by assuming l_s=300 mm, h_1 = 200 mm and h_2= (h_1 + t_{bj}) / 2 = 100 mm, by considering negligible the mortar thickness t_{bj}. A sketch of the cuts performed on the commercial blocks is depicted in Figure 2; units 1 and 3 were subsequently re-assembled according to the scheme of Figure 1. Before the application of the mortar layer, block surfaces were properly cleaned by means of an electric blower.

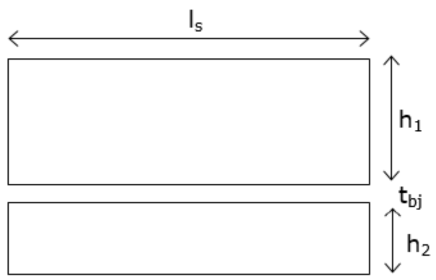
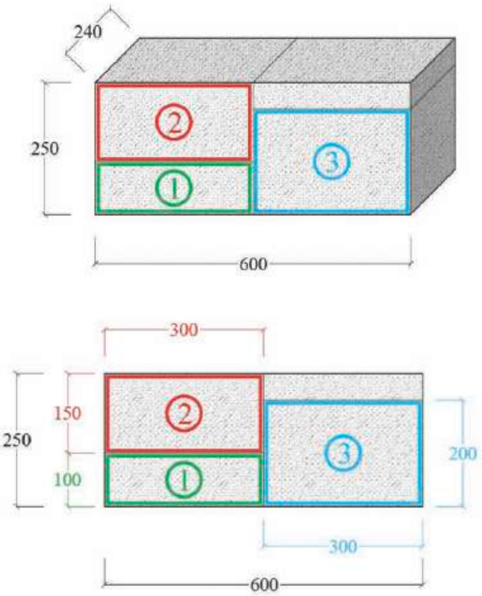


Figure 1 Specimen dimensions, according to the scheme "type 2" of EN 1052-3 [4].

As regards diagonal compression tests, ASTM E519/519M Standard [7] prescribes to adopt square specimens with an edge length equal to 1200 mm, having the same thickness as the blocks to be investigated (in this case, 240 mm). Due to the limitations of testing equipment, the results discussed in this work are referred to scaled specimens, with a scale ratio 1:2 with respect to ASTM

E519/519M recommendations. The specimens were therefore assembled by using AAC blocks with halved dimensions, respectively equal to 300 mm x 125 mm x 120 mm.



(a)

(b)

Figure 2 Cutting scheme adopted for specimen assembly, according to Figure 1: (a) axonometric view; (b) frontal view. Dimensions in mm.

2.2 Mortar for joint filling

Two types of mortars were used for the determination of AAC masonry shear strength:

- a commercial Pre-Mixed Thin Layer Mortar (PM-TLM), based on hydraulic binders and siliceous aggregates with maximum grain size of 0.6mm, and a declared compressive strength equal to 5 MPa;
- an alternative non-commercial Alkali Activated Thin Layer Mortar (AA-TLM), with similar mechanical performances as the pre-mixed one, developed for research purposes in laboratory. Even if alkali activated binders and mortars are not yet widespread as commercial products for the building sector, they represent an interesting "green" alternative with a view to reducing the use of Portland cement and its high carbon footprint [17,18].

For the commercial PM-TLM, a water dosage ranging between 23% - 25% (approximately 5,75 ÷ 6,25 l/bag) was adopted, according to the indications reported on the technical sheets. AA-TLM was characterized by a "one-part" formulation, obtained with metakaolin and white cement as precursors, and with potassium silicate and calcium hydroxide, both in powder form, as alkali activators. Siliceous sand was added to the admixture with a binder/aggregate ratio = 1/2, together with natural additives for the improvement of adhesion to the substrate and for water retention. For AA-TLM, a water dosage of 29% - 31 % was adopted, so to achieve a satisfactory workability.

Before shear test execution on masonry assemblages, some mortar specimens were collected for the determination of mortar consistence at the fresh state, and for the determination of mechanical strengths at the hardened state (after 28 days), according to relevant Standards [19, 20]. Consistence was determined through flow-table tests according to EN 1015-3, 1999/A2 [19], and it was expressed as the average of the diameters of the mortar disc measured in two perpendicular directions. Flexural strength was determined according to EN 1015-11 [20] through three-point bending tests on 3 prismatic specimens for each casting, with dimensions equal to 40 mm x 40mm x 160 mm. After failure, the two remaining halves of each prism were tested in compression, by interposing 40 mm x 40 mm steel platens between the sample surfaces and the testing machine. The main results of these tests on mortar are summarized in Table 2. For both the considered mortars, the reported results are the average of the three different castings, as required for the characterization of masonry specimens.

Table 2 Consistence and mechanical properties of mortars adopted for joint filling.

Property	PM-TLM (M5 mortar)	AA-TLM
Consistence	175.9 mm	156.6 mm
Flexural strength	1.52 MPa	0.96 MPa
Compressive strength	5.00 MPa	6.50 MPa

For AA-TLM, adhesion to the support at 28 days was also experimentally evaluated, according to EN 1015-12 [21]. To this end, a 5-mm thick mortar layer was applied to an AAC block with density ρ_2 = 480 kg/m^3. Detaching plates with 50 mm diameter and 25 mm thickness were glued to the mortar surface by means of epoxy resin. A pull-off tester was then used to apply a tensile load to the plates, and adhesive strength was calculated as the maximum tensile strength caused by the detaching load perpendicular to mortar surface (Figure 3). An average adhesive strength of 0.48 MPa was found, which is acceptable for the purpose, even if lower than that declared for the commercial PM-TLM.

Figure 3 Experimental setup for the determination of mortar adhesive strength at 28 days.

3 Determination of masonry shear strength through shear tests on triplets

3.1 General description of the adopted test setup

After their assembly, triplets were subjected to a uniformly distributed mass of about 30 kg, corresponding to an average vertical stress of 2.08×10^{-3} MPa. Triplets were covered with a polyethylene sheet for the first three days after their assembly, and then were cured at laboratory conditions until test execution.

The adopted shear test setup is shown in Figures 4 and 5. As can be seen, the specimens were subjected to a four-point loading scheme, according to the procedure "A" suggested in EN 1052-3 [4]. According to this procedure, a lateral confinement load was applied to the specimen by means of a hydraulic jack. The lateral load was applied before the beginning of the shear test, and was kept constant for all its duration. According to the above-mentioned Standard, tests were repeated for three different pre-compression loads, by considering a minimum of 3 specimens for each pre-compression level.

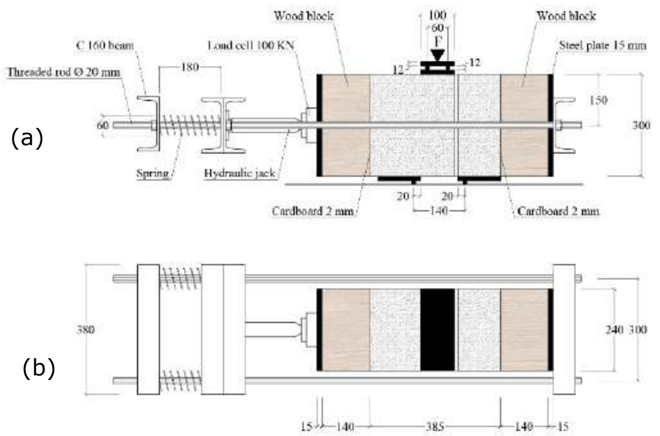


Figure 4 Sketch of the adopted experimental setup: (a) side view; (b) top view (dimensions in mm).

Figure 5 General view of the adopted setup.

EN 1052-3 [4] specifies two different triplets of values for the lateral load, depending on the compressive strength of the blocks (i.e., higher or lower than 10 MPa). However, in Section 8.4, the same Standard allows to further reduce the suggested values of lateral loads in order to avoid undesirable modes of failure, such as shear failure of the blocks, or crushing/splitting in the blocks (see Figure 6, failure modes A.3 and A.4). Since the strength of the blocks analysed in this work is much lower than 10 MPa, it was chosen to reduce the precompression load to the following values: (a) in case of PM-TLM, it was assumed f_{P1} = 0.05 MPa, f_{P2} = 0.075 MPa, f_{P3} = 0.1 MPa for blocks with density ρ_1, and f_{P1} = 0.05 MPa, f_{P2} = 0.1 MPa, f_{P3} = 0.15 MPa for blocks with density ρ_2; (b) in case of AA-TLM it was assumed f_{P1} = 0.05 MPa, f_{P2} = 0.075 MPa, f_{P3} = 0.1 MPa also for blocks with density ρ_2.

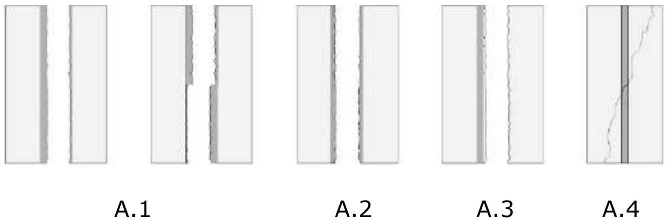


Figure 6 Possible failure modes, according to [4]: A.1 shear failure on one or two faces of the joint; A.2 shear failure in the mortar; A.3 shear failure in the block; A.4 crushing or splitting in the block.

Based on the experimental results, the shear strength of each specimen and the corresponding applied lateral stress were respectively calculated as:

$$f_{voi} = \frac{F_{i,max}}{2A_i} \quad (1)$$

$$f_{pi} = \frac{F_{pi}}{A_i} \quad (2)$$

being $F_{i,max}$ the ultimate load on a single masonry sample, F_{pi} the applied lateral load, and A_i the cross-sectional area of masonry sample parallel to bed joints. The so calculated (f_{pi}, f_{voi}) values were then plotted together, and a linear regression of the results was performed. The mean value of initial shear strength f_{v0} corresponds to the intersection between the regression line and the vertical axis, and the characteristic value can be calculated as $f_{v0k} = 0.8 f_{v0}$ according to EN 1052-3 [4]. The slope of the linear regression provides instead the friction angle, whose characteristic value can be in turned evaluated as $\tan\alpha_k = 0.8 \tan\alpha$.

3.2 Experimental results on triplets with PM-TLM and blocks with different densities

The main results of the tests on triplets assembled with commercial M5 PM-TLM are plotted in Figures 7 and 8 for the two investigated block densities. For each lateral load level, the results obtained on 5 triplets are reported in the graphs.

The corresponding obtained failure modes belongs to typologies A.1 and A.2 according to Figure 6, and are reported in Figure 9. However, it should be remarked that a higher number of specimens was tested, but some of the experimental results were discarded because associated to undesirable failure modes.

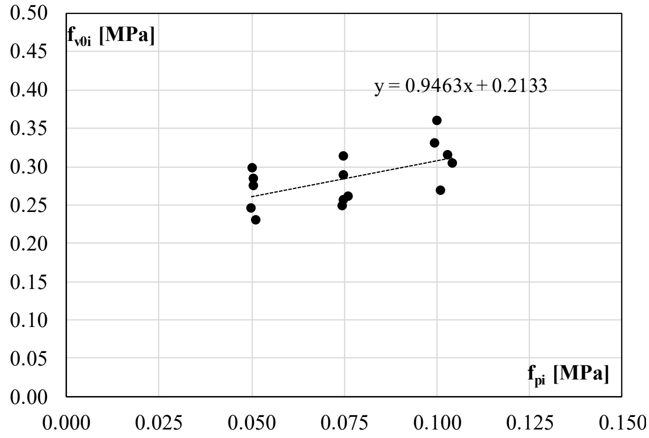


Figure 7 Experimental results of triplet tests on masonry specimens in case of block density ρ_1 = 300 kg/m^3 and PM-TLM.

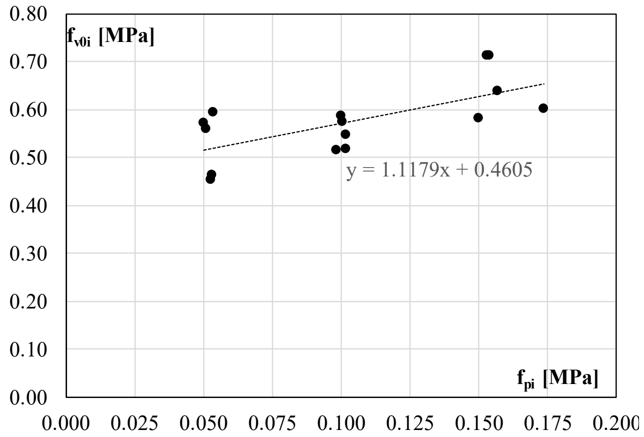


Figure 8 Experimental results of triplet tests on masonry specimens in case of block density ρ_2 = 480 kg/m^3 and PM-TLM.

Figure 9 Shear failure in the joint, triplets assembled with PM-TLM.

Failures mode A.4 was indeed detected especially in case of blocks with density ρ_1 (whose strength is much lower than that of the mortar), which failed for crushing or splitting/bending of the AAC block, according to Figure 10.

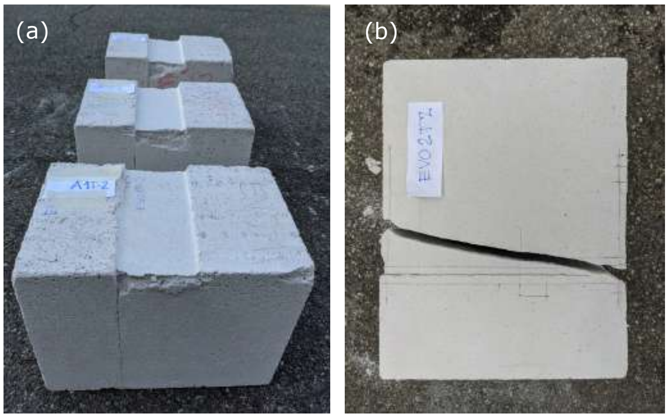


Figure 10 (a) Crushing and (b) splitting/bending failure in AAC blocks, triplets assembled with PM-TLM.

The characteristic values of initial shear strength f_{vk0} and friction coefficient α_k, as derived from the linear regression of the experimental data, are summarized in Table 3 for the two investigated densities.

Table 3 Characteristic values of initial shear strength and friction coefficient, for triplets with mortar PM-TLM and AAC blocks with different densities.

Nominal block density	f_{vok} (MPa)	α_k (°)
ρ_1=300 kg/m^3	0.17	35
ρ_2=480 kg/m^3	0.37	38

3.3 Experimental results on triplets with AA-TLM and blocks with density ρ_2

The same tests were also repeated on triplets assembled with AA-TLM and AAC blocks with density ρ_2. In this case, it was decided to also investigate the possible influence of the preliminary surface treatment of AAC blocks on the final results.

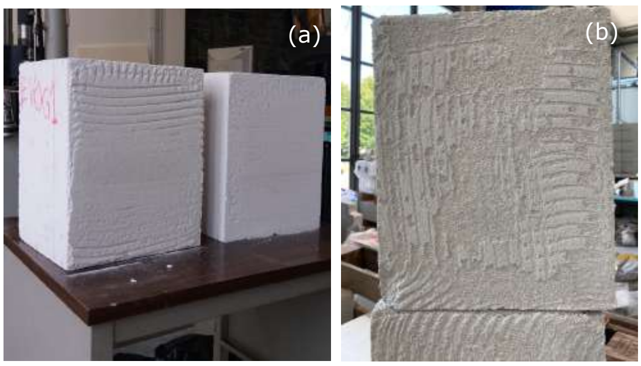


Figure 11 Shear failure in the joint, triplets assembled with AA-TLM (a) without and (b) with preliminary surface cleaning with an electric air blowing.

Therefore, two different series of triplets were prepared:

in the first series, the mortar was applied on the joint surface, just after the cutting of the blocks; while in the second one, block surfaces were preliminary cleaned with compressed air, so to remove dust deriving from cutting operations, and only then mortar was applied. To reduce the total number of tests, the first series consisted of 5 specimens for each lateral load level, while in the second series the specimens were reduced to 3 triplets (according to the Standard [4]) for each lateral load level. The testing setup and the followed procedure were the same already discussed in Section 3.1.

In the first case (without surface cleaning), the adhesion between the mortar and the blocks was very weak and mode A.1 failure was always detected, with a complete detachment of the mortar from one side of the joint, as shown in Figure 11a. On the contrary, in the case of preliminary surface cleaning, the experimental values of initial shear strength were higher, and the corresponding failure mode generally corresponded to mode A.2 of Figure 6 (see also Figure 11b).

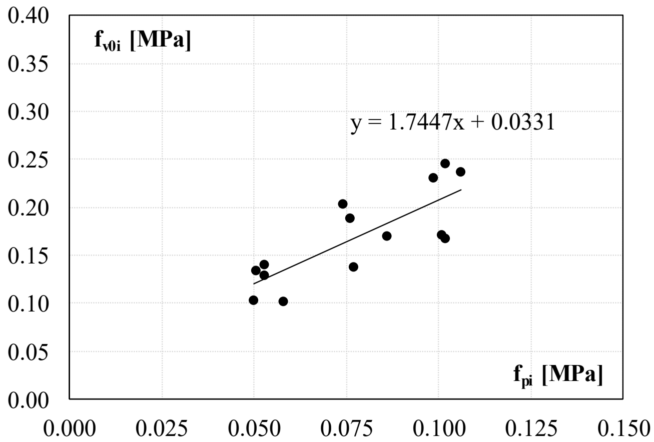


Figure 12 Experimental results of triplet tests on masonry specimens in case of block density ρ_2 = 480 kg/m^3 and AA-TLM, without preliminary surface cleaning of the blocks.

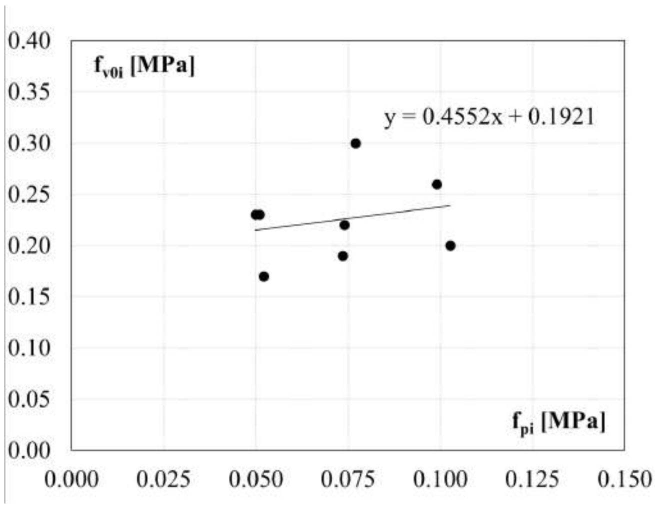


Figure 13 Experimental results of triplet tests on masonry specimens in case of block density ρ_2 = 480 kg/m^3 and AA-TLM, with preliminary surface cleaning of the blocks.

The main experimental results are reported in the graphs of Figures 12 and 13, and are summarized in terms of characteristic values of shear parameters (i.e., initial shear strength and friction angle) in Table 4. It can be observed that f_{vk0} in case of AA-TLM is slightly less than half of the corresponding value measured for PM-TLM triplets, despite the similar compressive strength of the two mortars; however, this results can be justified by the lower adhesive stregth of AA-TLM, as discussed in Section 2.2.

Table 4 Characteristic values of initial shear strength and friction coefficient, for triplets with mortar AA-TLM, AAC blocks with density ρ_2 and different preliminary surface cleaning.

Preliminary surface cleaning	f_{vok} **(MPa)**	α_k **(°)**
NO	0.03	48
YES	0.15	20

The obtained results highlight that the initial shear strength depends on block density, as well as on the characteristics of the adopted mortar, although Eurocode 6 [10] suggests the adoption of a unique value f_{vk0} = 0.3 MPa for TLM masonry. The experimental friction angles are generally higher than the value suggested by the Eurocode, as also found in other works published in the literature (e.g., [22,23]). Moreover, it seems that also the surface treatment of the blocks (before mortar application) exerts a not negligible influence on the results, since the presence of AAC dust deriving from cutting operations shoot down mortar adhesion.

4 Determination of masonry shear strength through diagonal compression tests

4.1 General description of the adopted test setup

The dependency of masonry shear strength from block density and mortar type was also investigated through the execution of diagonal compression tests, according to ASTM E519/519M Standard [7]. As already discussed, due to laboratory limitations, it was decided to perform the tests on scaled specimens (with scale ratio 1:2). Therefore, two scaled steel loading shoes to be interposed between the specimen and the testing machine were designed and realized on purpose (Figure 14). According to ASTM E519/519M, the specimen should be placed in a plumb position in a bed of gypsum capping material in the lower loading shoe. However, the same Standard specifies that, in some cases, a premature splitting failure due to compression may take place at the triangular points of the bearing. Since this failure should be avoided, the Standard allows the use of triangular confinement plates clamped or welded to the open ends of the loading shoes, and the filling of the spaces between the specimen itself and the plates with capping material (Annex A1.3, [7]). In traditional masonry made of clay bricks or concrete blocks, the splitting failure at triangular corners of the specimen usually takes place when higher loads are required to produce diagonal tensile failure; however, in case of AAC masonry, crushing of the corners is also due to the low compressive strength of the material itself (Figure 14). For this reason, the loading shoes were modified according to Figure 15.

Figure 14 Scaled loading shoe; splitting failure of the corner.

Figure 15 Closed loading shoes, filled with capping material.

Figure 16 General view of the experimental setup adopted for diagonal compression tests.

A general view of the experimental setup is shown in Figure 16. As can be seen, some of the specimens were also equipped with two Linear Variable Displacement Transducers (LVDTs), which were applied on the two opposite faces of the specimen along its diagonals, with a nominal distance between the bases equal to 200 mm. According to ASTM E519/519M [7], the shear strength is calculated by dividing the components of the acting load parallel to the specimen edges by the net area of the section A_n, according to the relation:

$$f_{v0} = \frac{0.707\,P}{A_n}, \tag{3}$$

where P is the ultimate load on the masonry sample and:

$$A_n = \frac{w+h}{2} \cdot t \cdot n\,, \tag{4}$$

being w and h the width and the height of the specimen, t the thickness of the specimen, and n the percentage of the unit's gross area that is solid (in this work, n = 1).

Equation (3) derives from the assumption that the diagonal compression applied to the specimen induces the appearance of a uniform shear stress, and therefore the same Equation (3) provides the shear cohesion f_{v0}, which is in turn equal to masonry tensile strength, f_t. However, it should be reminded that the results provided by diagonal compression tests can be interpreted also in a different way, since, according to some Authors and Standards [22, 24, 25], induced stresses are not homogeneous within the specimen. According to this second interpretation, the failure would be caused by the attainment, in the central part of the panel, of a limit value of the principal tensile stress, corresponding to the tensile strength of masonry associated to diagonal cracking. According to RILEM Standard [25], this tensile strength can be calculated as:

$$f_t = \frac{0.5\,P}{A_n}\,. \tag{5}$$

4.2 Experimental results on masonry panels with PM-TLM and blocks with different densities

The obtained results for masonry panels assembled by using PM-TLM are reported in Table 5, as a function of block density. It was chosen to test 3 specimens for the block density ρ_1, and 6 specimens for the higher density ρ_2. Even if the results appear quite scattered, it can be observed that shear strength increases with block density, as already detected also from triplet tests. In case of blocks with density ρ_1, Table 5 also reports the masonry shear modulus G, evaluated as:

$$G = \frac{f_v}{\gamma} \tag{6}$$

being:

$$\gamma = \varepsilon_c + |\varepsilon_t| \tag{7}$$

where ε_c is the axial strain in compression (measured by LVDTs in the vertical direction) and ε_t is the axial strain in tension (measured by LVDT along the horizontal direction).

As reported in the literature, failure was caused by the formation of a main crack along the specimen diagonal between the applied loads. As shown in Figure 17a, this crack mainly interested AAC blocks (especially in case of the lower material density), but in some cases also a stepwise diagonal crack pattern was observed, which interested both the blocks and the mortar joints (Figure 17b).

Table 5 Shear strength for AAC masonry panels with mortar PM-TLM and blocks with different densities.

Nominal block density	f_{v0} **(MPa)**	$f_{v0,mean}$ **(MPa)**	*G* **(MPa)**	G_{mean} **(MPa)**
	0.29		226.7	
ρ_1=300 kg/m^3	0.23	0.23	237.9	222.9
	0.17		204.0	
	0.17		-	
	0.49		-	
	0.30		-	
ρ_2=480 kg/m^3		0.30		-
	0.17		-	
	0.44		-	
	0.25		-	

Figure 17 Crack pattern at failure: (a) diagonal crack in the blocks; (b) stepwise diagonal crack pattern in the blocks and in the mortar joints.

4.3 Experimental results on masonry panels with AA-TLM and blocks with density ρ_2

Subsequently, the tests were repeated on masonry panels obtained by assemblying the AAC block with higher density (ρ_2 = 480 kg/m^3) and AA-TLM. The obtained results are summarized in Table 6 in terms of shear strength f_{v0} (calculated according Equation 3) and shear modulus *G*. If comparing the results with the corresponding ones reported in Table 5 (for the same block density), it can be seen that also in case of diagonal compression tests the shear strength obtained for masonry with AA-TLM is lower than that associated to PM-TLM. The dected failure mode was a stepwise diagonal crack pattern, mainly interesting mortar joints, as can be seen in Figure 18.

Table 6 Shear strength for AAC masonry panels with mortar AA-TLM and blocks with density ρ_2.

f_{v0} **(MPa)**	$f_{v0,mean}$ **(MPa)**	*G* **(MPa)**	G_{mean} **(MPa)**
0.21		280.8	
0.18		305.8	
	0.18		307.9
0.19		460.7	
0.13		184.3	

Figure 18 Stepwise diagonal crack pattern in mortar joints.

5 Conclusions

This work reports the results of an experimental program devoted to the characterization of AAC masonry in shear. The influence of some key parameters, such as test setup, block density and mortar type, is studied. The following conclusions can be drafted:

- Independently from the adopted test setup (triplets or diagonal compression tests), masonry shear strength depends on block density, and is generally lower in case of lighter blocks.
- Independently from the adopted test setup (triplets or diagonal compression tests), masonry shear strength is also influenced by mortar type. Masonry specimens assembled with AA-TLM exhibited a lower shear strength than in case of PM-TLM, despite the similar compressive strength of the two mortars and the identical thickness of the joints. This is probably due to the lower adhesive strength of AA-TLM, which is in turn related to the specific additives used in the admixture.
- The results appear to be also dependent from the preliminary surface treatment/cleaning of AAC

blocks because the possible presence of AAC dust (due to cutting operations) shoot down mortar adhesion and therefore masonry strength.

- The dependence of masonry shear strength from block density and mortar type is so far not considered in Eurocode 6 [10], which suggests a unique value of initial shear strength f_{v0k} = 0.3 for TLM masonry. This value is not always on the safe side, as demonstrated by the experimental results relative to masonry obtained with lighter blocks, or with AA-TLM mortar.
- In case of shear tests on triplets performed with the application of a lateral precompression load, experimental evidence suggests reducing the precompression levels declared by EN 1052-3, so to avoid unwanted failure modes involving AAC blocks.
- The results obtained from the two investigated testing procedures (triplet tests and diagonal compression tests) are not completely overlapping, also due to the different interpretations of the results obtained from diagonal compression tests available in the literature. Tests on triplets are associated to a shear-sliding failure, that is usually considered as the typical failure mode for new masonry assemblages by Standard codes, while diagonal compression tests are characterized by the spreading of a shear diagonal cracking, which is more typical of existing buildings. As discussed in [26], this crack pattern can be also detected in existing AAC masonry subjected to seismic loads. That being stated, the two test procedures evidence similar trends in shear strength variation (that is, lower shear strength in case of density ρ_1 and/or AA-TLM). Moreover, given the same masonry components, the obtained values of shear strength are comparable to each other: f_{vk0} = 0.17 MPa, 0.37 MPa and 0.15 MPa from triplets, against f_{v0} = 0.23 MPa, 0.30 MPa and 0.18 MPa from diagonal compression, respectively in case of AAC density ρ_1 and PM-TLM, AAC density ρ_2 and PM-TLM, AAC density ρ_2 and AA-TLM.

The results of this study have revealed many questions that can hopefully be answered with further investigations.

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