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LOAD BEARING TEST OF WALL FROM HOLLOW GLASS BLOCKS USING VITRALOCK INSTALLATION SYSTEM

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Abstract: *Hollow glass blocks are used in building for more than century. Originally, they were used in industrial buildings but soon new applications quickly followed. They gained popularity in modern architecture of 1920 – 1930 and again in 1960s. The hollow glass blocks were always combined with reinforced concrete leading to traditional installation method. Ever growing popularity leads to demand of new, easier and faster installation methods. The performance of these new systems needs to be verified to develop reliable design models and application rules.*

Keywords: Hollow glass blocks, Dry installation system, Experimental verification.

1. Introduction

Traditional installation is of glass blocks is carried out using cement mortar in similar way the walls from ceramic bricks are made. The installation can be facilitated by using plastic spacers, however, it still requires experience of the workers and precise planning. For this reason, alternative methods are developed which allow installation without mortar or adhesives. Vitralock by Seves is the promising method as it allows fast assembling without special tools and skills.

Vitralock is dry installation system consisting of two plastic pieces, the spacer and the connector (Fig. 1), which make the assembling of the walls very easy. The connector is locked into the spacers forming a rectangular grid, see Fig. 2. The glass blocks are simply placed into openings o the grid. When necessary, the wall can be reinforced by steel bars placed in the spacers.

Fig. 1: The elements of the Vitralock system.

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2. Preparation of the test

Purpose of the test was to obtain the response of interior partition wall exposed to horizontal load. The wall was assembled in the laboratory using 12 rows, each containing 14 glass block. The dimensions of the wall were 2.81 m (width) a 2.42 m (height), see Fig. 3 and Fig. 4. The wall was fixed to a timber frame made from 50 × 80 mm sections, each plastic spacer on the perimeter was connected by 4 screws 4 × 35 mm, see Fig. 2.

Fig. 2: The Vitralock system during the wall assembly.

The wall was reinforced by steel bars diameter 5 mm located on both surfaces. The system allows arranging the bars in either vertical or horizontal directions, therefore the loaded side was reinforced by bars in vertical direction and the non-loaded side by bars in horizontal direction. The bars were anchored to the timber frame by the plastic spacers.

The wall was firmly connected to the ceiling by three sets of wooden wedges, see Fig. 3. The joints were filled by grout for ceramic tiles. The wall was assembled in the same way it would be used in real building.

Fig. 3: The completed wall prior to filling of the joints (left) and during the test (right).

3. Execution of the test

The wall was loaded by horizontal load at height 900 mm above the floor, see Fig. 3. The load was created by hydraulic jack and distributed by steel beams to 4 points in the middle of the glass blocks (marked as 5, 6, 8 and 9 in Fig. 4).

Horizontal deformations at 10 locations were measured during the test, see Fig. 4 for the location of the transducers.

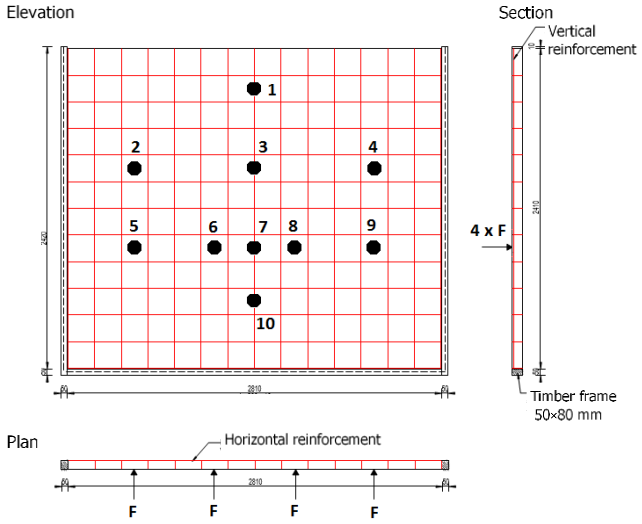

Fig. 4: Dimensions of the wall and location of the transducers.

The load was applied manually in 22 cycles. The loading was controlled by horizontal deformation at the point number 7. As soon as the required deformation was reached, the wall was left for 1 minute and then unloaded. The magnitude of the deformation increased over the load cycles, see Fig. 5.

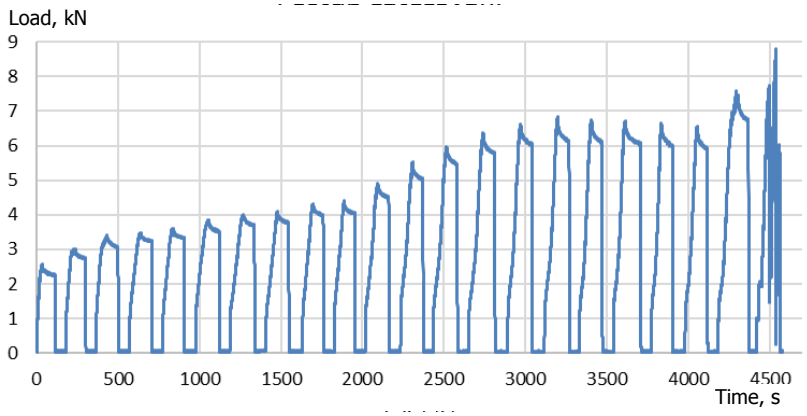

Fig. 5: Load procedure.

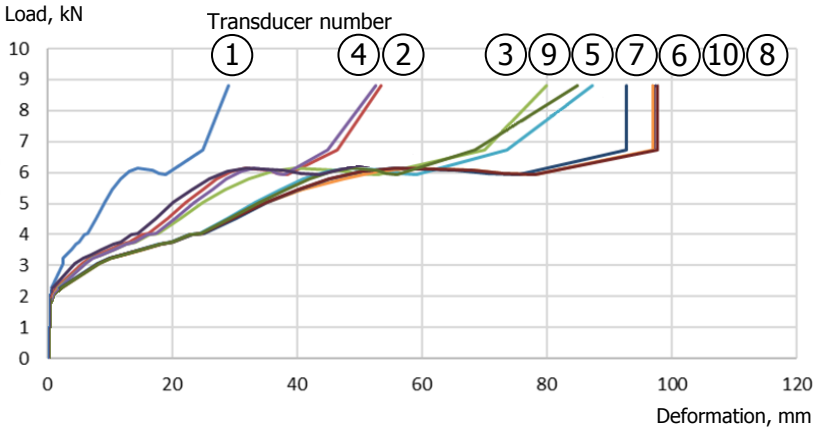

Fig. 6: Load - deformation diagram for the measured points.

The behaviour of the wall is linear for small deformations. Assuming the limit for horizontal deformation is

$$\delta_{lim} = L / 200 = 2410 / 200 = 12.0\ mm, \qquad (1)$$

the load to reach the limiting deformation is 3.58 kN.

Fig. 7: Cracks in the joint.

At the deformation approx. 10 mm first crack in the joint appeared which grew in the following load cycles, see Fig. 7. As the load increase, highly non-linear behaviour and significant permanent deformation was measured after unloading of each cycle, see Fig. 8. This is caused by plastic deformation of the spacers and slip of the reinforcement at the anchoring. However, the wall was able to resist the maximum load 8.8 kN which resulted in horizontal deformation of 93 mm when the hollow block was pushed out of the Vitralock grid.

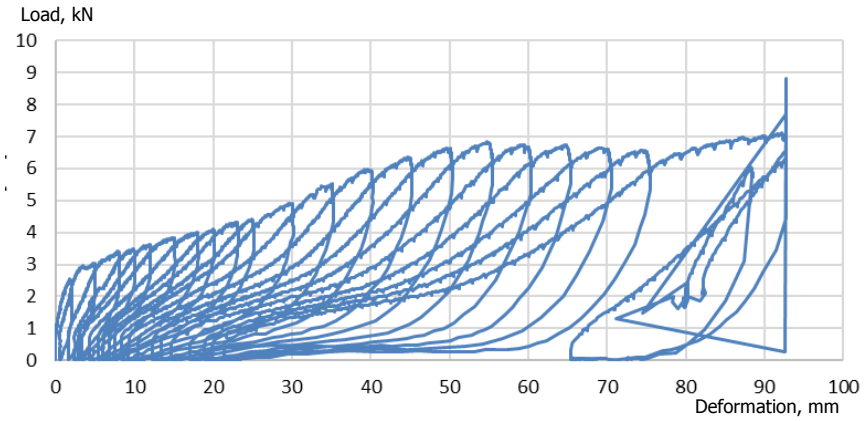

Fig. 8: Load - deformation diagram for the point 7.

4. Conclusions

Load-bearing test of wall made from hollow glass bricks using Vitralock system was tested to horizontal load. The experiment shows linear behaviour at loads which are expected in "everyday situation". Cracks in the joints appear with increasing load but they have no influence on the performance of the wall and represent only an aesthetic problem. When cracks should be avoided (in bathrooms, etc.) elastic sealing material should be used for joints.

Highly non-linear behaviour was observed at later stages when also permanent deformations were encountered. However, the wall was able to resist the applied load. Failure of the wall was observed at horizontal deformation 93 mm (i.e. L / 26) when the hollow brick was pushed out of the Vitralock grid.

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