Accepted Manuscript

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Nadège Reboul, Amir Si Larbi, Emmanuel Ferrier

PII: S1359-8368(17)30920-4

DOI: 10.1016/j.compositesb.2017.11.002

Reference: JCOMB 5364

To appear in: *Composites Part B*

Received Date: 14 March 2017

Revised Date: 6 September 2017

Accepted Date: 2 November 2017

Please cite this article as: Reboul Nadè, Si Larbi A, Ferrier E, Two-way bending behaviour of hollow concrete block masonry walls reinforced by composite materials, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.11.002.

Two-way bending behaviour of hollow concrete block masonry walls reinforced by composite materials

REBOUL Nadège[1], SI LARBI Amir[2], FERRIER Emmanuel[3]

[1] *LMC2, Université Claude Bernard Lyon 1, IUT Lyon 1, 82 boulevard Niels Bohr, 69100 Villeurbanne, France, nadege.reboul@univ-lyon1.fr*

[2] *Univ Lyon, Ecole Nationale d'Ingénieurs de Saint-Etienne (ENISE), Laboratoire de Tribologie et de Dynamique des Systèmes (LTDS), UMR 5513, 58 rue Jean Parot, 42023 Saint-Etienne Cedex 2, amir.si-larbi@enise.fr*

[3] *LMC2, Université Claude Bernard Lyon 1, IUT Lyon 1, 82 bd Niels Bohr, 69100 Villeurbanne, France, emmanuel.ferrier@univ-lyon1.fr*

ABSTRACT:

This paper presents an experimental study devoted to investigating the effectiveness of externally bonded composites to improve the out-of-plane behaviour of masonry walls. Two strengthening materials were used that were chosen deliberately from more environmentally friendly composites: a flax fibre reinforced polymer and a glass textile reinforced cementitious matrix. Five masonry walls were tested under two-way bending: one reference, three reinforced and one repaired. Special attention was paid to the anchorage of the strengthening bands to the masonry. The performance of each strengthening configuration was estimated by considering the out-of-plane load capacity, ductility, energy dissipation and crack pattern. It appears that all of the tested specimens, whatever the strengthening materials, developed a substantial increase (from 20% to 30%) in their out-of-plane load capacity and exhibited ductility and displacement capacity. The transversal anchor systems proved to be effective (and readily achievable). From the results obtained in this study, it is concluded that the multiple matrix cracks in the glass textile-reinforced mortar allow a more extensive stress redistribution that makes this material a promising solution for the out-of-plane strengthening of masonry walls. An analytical approach, based on a cross-section analysis, is introduced to calculate the load-carrying capacity of the strengthened walls and a satisfactory agreement is obtained between experimental and theoretical results.

KEY WORDS: Masonry, Strengthening, FRP, TRC, Out-of-plane loading